



**HAL**  
open science

**”The digitisation of warehousing work. Innovations, employment and job quality in French, German and Dutch retail logistics companies”**

Karen Jaehrling, Jérôme Gautié, Maarten Keune, Bas A.S. Koene, Coralie Perez

► **To cite this version:**

Karen Jaehrling, Jérôme Gautié, Maarten Keune, Bas A.S. Koene, Coralie Perez. ”The digitisation of warehousing work. Innovations, employment and job quality in French, German and Dutch retail logistics companies”. 2018. halshs-01884127

**HAL Id: halshs-01884127**

**<https://shs.hal.science/halshs-01884127>**

Preprint submitted on 15 Jun 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# CHAPTER 7 – The digitisation of warehousing work. Innovations, employment and job quality in French, German and Dutch retail logistics companies

Karen Jaehrling, Jérôme Gautié, Maarten Keune, Bas Koene and Coralie Perez

- 1 Introduction: the embeddedness of disruptive innovations.....281**
- 2 Economic trends embedding innovation dynamics: changes in the retail supply chain .....282**
  - 2.1 Retail logistics transformation and ‘lean logistics’ .....282
  - 2.2 Marketisation and the role of (third party) logistics service providers .....283
- 3 Key innovation dynamics.....285**
  - 3.1 E-commerce: the ‘e-tailing revolution’ .....285
  - 3.2 Automation and digitisation .....287
- 4 Innovation strategies at company level – an overview .....289**
  - 4.1 Selection criteria and key characteristics of case study companies.....289
  - 4.2 Business and innovation strategies at the company level – a short description of 6 cases 292
- 5 Innovation-job quality linkages at company level.....294**
  - 5.1 Innovation models, employee involvement and labour relations .....294
  - 5.2 Process innovations: automation: fewer manual jobs, less physical strain?.....298
  - 5.3 Organisational innovations: Temporal and functional flexibility .....308
  - 5.4 Co-incident or co-evolution: changes in remuneration .....316
- 6 Conclusions.....318**
- 7 References.....322**
- 8 List of Case Study Reports and Industry Profiles .....325**
- 9 Annex – Summaries of Case Studies.....326**

## 1 Introduction: the embeddedness of disruptive innovations

The storage and distribution of goods has been the target of fundamental changes in the past which can be linked to two major trends: on the one hand a more longstanding ‘supply chain revolution’ aimed at reducing inventory costs and supply chain response time; and on the other hand the emergence of new distribution channels through e-commerce. The innovations adopted by logistics providers in order to address these challenges have numerous and in some cases profound implications for employment levels, work organisation and job quality. While they also affect the job profiles of management jobs and to some extent create new opportunities for more highly skilled employees, the bulk of employment in these companies is in manual routine jobs in the area of goods reception and storage, order picking, packing and shipping goods to the ‘points of sale’ (stores) or to the final customer. These occupations will be the focus of our analysis; it is also these jobs where the current innovation dynamics yield (or are expected to yield) the most disruptive effects.

In terms of employment levels, the mid to long-term expectation is one of extensive automation, making many of these jobs redundant and fundamentally changing the employment structure in the retail warehouses. According to the study by Frey and Osborne, most workers in transportation and logistics are likely to be substituted by computer capital in an initial wave of ‘computerisation’. “As computerised cars are already being developed and the declining cost of sensors makes augmenting vehicles with advanced sensors increasingly cost-effective, the automation of transportation and logistics occupations is in line with the technological developments documented in the literature.” (Frey and Osborne, 2013: 41). In fact, while the use of robots and other ‘autonomous’, sensor-based technologies is still rather limited in retail warehouses, a broad range of fully and semi-automated warehousing technologies that substitute for manual tasks has been increasingly deployed in retail warehouses over the last two decades.

However, as other authors have stressed, tasks are not to be equated with jobs. While for some of the tasks manpower may be substituted by machines, the extent to which jobs will be destroyed depends on the task profiles of occupations and on their adaption to the changed technological environment (e.g. Autor, 2015; Arntz et al., 2016). Moreover, the study by Frey and Osborne focuses on technical feasibility and neglects the economic viability of technological solutions. Thus, the development of low-skill service sector jobs, such as those, in retail warehouses depends not only on the ‘susceptibility’ of tasks to computerisation, but also on companies’ decisions on the extent to which they invest in automation and how they adapt job profiles and work organisation. Besides profitability assessments, these company decisions are in turn influenced by a range of external factors, such as *labour supply levels and structure* (including changes due to e.g. demographic change or immigration) and most notably *institutional constraints*, such as strong employment protection or employee participation rights. These constraints may make companies choose less disruptive innovation models by imposing limits on companies’ ability and willingness to make jobs redundant and by encouraging them instead to implement technological solutions at a slower pace, or choose technologies that are compatible with maintaining employment levels, make better use of employees’ skills or even require upskilling – thus to choose alternative modernisation paths that might be equally economically viable and socially sustainable.

By comparing companies in different institutional and labour market contexts, which are however exposed to similar technological and market pressures, we aim to investigate, firstly, *if* companies do differ with regard to innovations (extent, pace, the way they are implemented); secondly, *why* they do or do not differ – e.g. how this is related to organisational patterns of conflict resolution; and thirdly, what is the cumulative *effect* on job quality, employment levels and inclusiveness.

We thereby seek to embed innovation dynamics analytically in the wider economic and institutional context. Many evaluations of the impact of digitalisation on jobs in the logistics industry focus on the potential implications of new technologies, even though mostly in a non-deterministic manner, pointing to choices for human resources strategies (see e.g. Delfmann et al., 2017; Ittermann et al., 2016). In ‘real world companies’, however, these changes take place in conjunction with other economic trends and institutional constraints, such as the marketisation of the logistics function, that shape the extent and pace of innovations and exert their own impact on job quality. We are interested in these ‘real world’ dynamics, in order to assess not only the *potential* but also the *likely* implications of innovations in the current economic and institutional environment; and in order to weigh the effects of innovations against overall changes in job quality, employment levels and inclusiveness.

The focus of our research is on companies or business entities whose core business is to operate warehouses and provide transportation services to retail companies. Research was carried out in France, the Netherlands and Germany, resulting in six case study reports in total that constitute the main basis for the findings presented in this chapter. The analysis also draws on three national industry reports (Jaehrling, 2016, Gaborieau and Gautié, 2016; Koene et al., 2016) written prior to the case studies, based on statistics, documents, literature and expert interviews. While the institutional framework in these three countries differs slightly (see below), the companies are currently exposed to similar market pressures and innovation dynamics. In order to understand the interactions between innovations and job quality in our qualitative company sample, it is necessary to shed some light on this broader environment in which innovation processes take place at the company level. Therefore the first section below (2) deals with the relevant market trends in which innovation processes are embedded. The next section (3) describes the key innovation dynamics in the industry to which the companies in our sample have to respond in one way or the other. The following section gives an overview of the key characteristics and innovation strategies in the companies in our sample (4), after which we turn to an analysis of the interactions between innovations, job quality and employment at the company level (5).

## 2 Economic trends embedding innovation dynamics: changes in the retail supply chain

### 2.1 Retail logistics transformation and ‘lean logistics’

The term retail logistics, as used in the literature, usually refers to the management and operation of the distribution of goods on their journey from a manufacturer to a retailer and further on to the final customer (*‘distribution logistics’*), as well as the *‘reverse logistics’* tasks that encompass taking care of waste, recyclable goods, reusable bottles/packages, and returned goods. Since the 1980s, the retail supply chain has seen a profound transformation that shifted control over these tasks from manufacturers to retailers (Sparks, 1998; Fernie, 2001; Hamilton et al., 2011). Buying and distribution became “a headquarters function in retailing” (Fernie and Sparks, 2004: 16), and retailers transformed from “passive recipients of products, allocated to stores by manufacturers in anticipation of demand” to “active designers and controllers of product supply in reaction to known customer demand”. (Fernie and Sparks, 2004: 6). In a first step, pioneered in Europe by some large British grocery retailers, retailers started to centralise their store deliveries by channelling an increasing proportion of their supplies through their own distribution centres (DCs), instead of relying on direct deliveries from manufacturers to the stores (Sparks, 1998; Fernie and Sparks, 2014). Thus the business entities that are the focus of this chapter, national and regional distribution centres, emerged as a result of this retail logistics transformation. The effect was a significant reduction in lead times and stock holdings. For instance,

at the beginning of the 1990s, inventory levels at the British food retail chain TESCO had decreased to just about 25% of the levels in 1980 (Sparks 2014: 155).

From the 1990s onwards, additional measures were implemented with the overall goal of further reducing inventory costs and ‘time-compress’ the logistics processes, in accordance with the ‘lean’ principles that were extended to the distribution chain from the late 1990s onwards (Jones et al., 1997; Womack and Jones, 2005). By implementing just-in-time (JIT) principles, retailers for instance began to demand more frequent deliveries of smaller quantities, both in primary distribution (factories to DCs) and in secondary distribution (DCs to shops). In order to rationalise primary distribution, retailers also started to take control over transport flows from suppliers to the DCs (see Sparks, 2014 on Tesco/UK; Prümper, 2002 on Metro/GER) and increasingly sought to integrate their primary and secondary distribution networks in order to optimise vehicle utilisation. Concepts like Quick Response (QR), Efficient Consumer Response (ECR) and Collaborative Forecasting, Planning and Replenishment (CFPR) sought to foster closer collaboration and information exchange between suppliers and retailers in order to avoid over-stock or out-of-stock situations and support the overall transformation from a supply-driven to a demand-driven supply chain. Basic technologies for this software-based integration of the supply chain is Electronic Data Interchange (EDI) and Standard Barcodes such as the European Article Number (EAN). The changes in the supply chain up and downstream of DCs also impacted on the ‘intralogistics’ processes within warehouses. For instance, the adoption of JIT principles has increased the share of products being ‘cross-docked’, i.e. moved directly from inbound to outbound trailers without being stored in DCs, thereby minimizing the costly inventory function of DCs, including labour intensive tasks such as storing, retrieving and picking goods (Rodrigue et al., 2017: 230ff). Additionally, the processes involved in the inventory function, i.e. within regular DCs, have been rationalised as well, strongly supported by automation. This primarily involves the use of computer-operated storing, sorting and picking technologies, and the introduction of warehouse management systems (WMS) to keep track of location and product flows in the warehouse.

The profound and partly disruptive ‘computerisation’ or ‘digitisation’ of warehouse work thus started in the late 1990s, as part of a more general ‘retail logistics transformation’ that was strongly informed by, or at least conformed to, ‘lean’ principles. While the ‘lean’ concept is not restricted to the overall goal of reducing costs, and has also come to compete with other concepts such as the ‘agile’ supply chain, the focus on efficiency gains has been quite dominant (Ferne and Sparks, 2004: 10). The retail logistics transformation depicted above is far from complete, as many of the above mentioned concepts and instruments have been adopted only partially and slowly by retailers (see e.g. Fernie 2014 on ECR concepts); consequently, they continue to make up a good deal of the current technological and organisational changes in DCs. In the same vein, core features of the lean model of the supply chain – the primary focus on low costs, the goal of minimising inventory, and efforts to “reduce lead time as long as it doesn’t increase costs” (Harrison et al., 1999, quoted in Fernie and Sparks, 2004: 10) – continue to impact on current innovation dynamics at company level. Thus the trend towards e-commerce, which is often regarded as creating the need for a more flexible and ‘agile’ supply chain, does not simply replace the lean management concept but rather overlaps with it and continues to orchestrate innovations and job quality (see Wright and Lund, 2006; Newsome et al., 2013).

## 2.2 Marketisation and the role of (third party) logistics service providers

The business entities that are the focus of this chapter, national or regional DCs, were the outcome of a process that shifted control over logistics processes to retailing firms, the new “channel captains” (Ferne and Sparks, 2004: 6). This does not necessarily mean, however, that these entities are owned and operated by retail companies. In fact the retail logistics transformation also opened up new market

opportunities for independent logistics service providers. The strong growth of the transport and logistics sector in many European countries result in part from the trend towards outsourcing the logistics function formerly provided in-house by manufacturing and service sector firms to independent ‘third party logistics (3PL)’ providers. In the retail industry, however, this trend seems to be less pronounced than in other segments of the economy. A survey among British retailers in the mid-1990s revealed that outsourcing was of “marginal significance” and that retail managers seemed to be little inclined to change that, as they wished to maintain control over the logistics function (Ferne 2014: 52). By contrast, transport was more likely to be outsourced than warehousing services. Today, 3PL providers are certainly not ‘marginal’ any longer in the retail logistics industry, not least as their use is facilitated by substantial progresses in the software-based integration of the supply chain. Still, available statistics and surveys for our three countries largely confirm that outsourcing is more frequent for transport than for goods storage and handling and has not yet become the dominant practice for the distribution centres of large retail chains (see Jaehrling, 2016; Gaborieau and Gautié, 2016).

Nonetheless, the as yet limited level of outsourcing does not mean that the relationships between retailers and many of their (in-house) logistics service providers has remained untouched by the general trend towards marketisation. The vertical disintegration of the firm through outsourcing is but one form of marketisation – broadly defined as an intensification of price-based competition at the level of transactions (Greer and Doellgast, 2017: 195f). Other measures used by retail companies, such as the treatment of internal logistics departments as cost centres or the transformation of logistics departments into legally independent subsidiaries owned by the retail company, can be considered as alternative forms of marketisation, as this increases transparency over costs and comparability to other service providers on the market. Even though the longstanding relationship between in-house or quasi in-house DCs and their ‘owner-client’ might shelter them somewhat from the threat of being replaced easily by other, cheaper (or better) logistics providers, the existence and dynamic growth of the 3PL segment is bound to put cost pressure on in-house providers. As Ferne (2014: 52) notes of British grocery retailers who kept their logistics service in-house, “clearly retailers not only wished to maintain control over the logistics function but feel that their staff could provide customer service at lower costs”. The pressure on prices is likely to be high particularly in settings where sectoral or company collective agreements for in-house providers offer higher pay levels than those for logistics service providers – and this is typically the case in our three countries under study. Moreover, price-competition is not only nurtured by pull-factors (pay gaps), but also by push factors, since price-competition in the retail industry has increased due to the expansion of discounters such as Aldi and Lidl across Europe, and also due to e-commerce (higher price transparency, lower barriers to market entry, new global players such as Amazon). Overall, therefore, in addition to the ‘lean’ principle, the trend towards marketisation puts additional pressure on warehousing costs, and contributes to a structurally asymmetrical relationship between retailers and their logistics service providers.

In principle however, current trends in the retail logistics environment also offer logistics service providers opportunities to step up their position in the supply chain, or at least to avoid too strong a dependency on one or a few large retailers. As the effective and efficient management of logistics tasks is increasingly viewed as crucial to retailers’ business successes, they are more dependent than before on reliable and well-functioning relationships with their logistics providers. The greater internationalisation of sourcing and distribution in retail, and the increasing integration of the primary and secondary distribution networks add to the volume and complexity of the logistics tasks and offer opportunities for logistics service providers to “capitalize on these market opportunities” (Ferne, 2014: 54). Finally, logistics companies can also seek to diversify their clients, by offering their logistics infrastructure and expertise in warehousing and transport services to other retailers, possibly with a more diverse product range.

The growth of e-commerce (see below) is a particularly important factor impacting on supply chain relationships. Firstly, e-commerce enables manufacturers to sell their products directly to the customer, thereby reducing the role of retailers (and their DCs). At the same time, manufacturers selling their products on their own have become potential clients of logistics companies operating DCs. Secondly, e-commerce is linked to the market entry of a large number of online retailers that do not have a long history of in-house logistics and thus ‘sunk costs’ that might keep them from contracting out the logistics tasks (Fernie, 2014: 51). Finally, as Xing et al. (2016) argue, most traditional retailers also have little or no home delivery experience and need to develop new logistical solutions. Buying external expertise and avoiding too high capital investments in the new logistics infrastructure can therefore motivate retailers to contract out the logistics tasks for their online sales, E-commerce is thus fostering outsourcing, and at the same time facilitating the DCs’ strategy of expanding their customer base. Still, there are also a number of risks and costs to be considered for retailers (Xing et al. 2016: 338f). This might help to explain why, even if outsourcing is more common for the e-fulfilment processes (Xing et al. 2016), there is no straightforward tendency among retailers to ‘buy’ the logistics services, as evidenced not least by the large network of company-owned DCs operated by Amazon (MWPVL 2017). By contrast, Morrisons, one of the four largest supermarket chains in the UK, decided in 2014 to contract out its logistics services for online purchases to its competitor Ocado, a large online-only supermarket, which operates a nationwide network of depots. To make things even more complex, since 2016 the same depots have been used to deliver Morrisons’ groceries (which is acting as a wholesaler here) to Amazon customers, as this is the solution chosen by Amazon in the roll-out of Amazon Fresh in the UK.<sup>65</sup> This example very well illustrates the strategic choices available both to retailers and their logistics service providers. Also, new competitors from the group of postal companies and parcel carriers (such as DHL) have entered the business of providing warehousing services and are at the same time potential cooperation partners for retailers and logistics companies, for instance when it comes to last-mile delivery.

At any rate, both for external and in-house providers, e-commerce has brought with it new logistics tasks and requirements and is forcing logistics service providers to innovate, as will be discussed in the next section.

### 3 Key innovation dynamics

#### 3.1 E-commerce: the ‘e-tailing revolution’

From a logistics perspective, the ‘e-tailing revolution’ (Fernie et al., 2014) has profound implications, most importantly because it requires retailers to set up ‘business to consumer’ (B2C) distribution channels, where individual items are shipped from the retailer directly to the final consumer – in contrast to the traditional ‘business to business’ (B2B) channel, where goods are shipped in larger quantities from distribution centres to the points of sale (shops). Some products (books, music, video games) have even become available in digital format and can be downloaded directly from the retailer’s or publisher’s shop, thereby completely replacing the tasks carried out by distribution centres and reducing demand for these services. Overall however, the increasing share of online shopping is boosting the demand for logistics facilities and services dedicated to online purchases and imposing important **changes on the physical distribution network**.

Two main fulfilment models can be distinguished (Fernie and Sparks, 2014): the *store-based model*, where online orders are assembled in local stores and then either collected by consumers (‘click and

---

<sup>65</sup> ‘Amazon starts UK fresh food delivery’, The Guardian, 9 June 2016

collect') or delivered to their home; and the *dedicated order model*, where online orders are assembled in distribution centres and then directly shipped to the final customer. The first model makes use of existing distribution networks, as purchased items pass through traditional DCs to shops, whereas the second model requires specific facilities where the merchandise can be stored and picked at the item level. Most of these facilities have so far been built as separate e-fulfilment centres, run by either retailers or logistics service providers (Jones Lang Lasalle, 2013; Fernie et al., 2014). Traditional mail order companies, as well as retailers selling large appliances, already operated this kind of facilities, whereas they are completely new to the food segment. Here, they are often labelled 'dark stores', as the interior resembles conventional supermarkets rather than warehouses. Besides this new type of distribution centre, other types of logistics facilities are becoming more important: in the dedicated order model, a large proportion of sales is channelled through the parcel hubs and sorting centres of large postal companies and parcel carriers, such as UPS or DHL. One very important challenge in both modes is the so called 'last mile' to the final customer. In order to avoid the costs and inconveniences of failed home deliveries (due to the absence of customers), retailers and parcel carriers have experimented with a number of 'unattended delivery systems' (Fernie et al., 2014), including e.g. putting up lockers or operating collection points located near residential locations, or in much frequented places that require little additional travel for consumers, such as train stations (e.g. Weltevrede, 2008 for the Dutch B2C market), or the car parks of hypermarkets, a model much used by French grocery retail chains (Gaborieau and Gautié, 2016). The customer convenience and the costs associated with these 'last mile' delivery systems are viewed as key factors for both the attractiveness and cost-effectiveness of online shopping. Finally, the e-tailing revolution has also boosted demand for reverse logistics services, as retailers in the non-food segment in particular have to handle a large flow of returned goods; this includes the retrieval, checking, repackaging and redistribution of the returned merchandise (Fernie and Grant, 2015).

Apart from boosting demand for logistics services and changing the physical distribution network, e-commerce has also further increased **pressures to reduce lead times**<sup>66</sup>, albeit for different reasons: While in the 'lean' paradigm, reducing lead times was primarily pursued as a means to reduce inventory levels and save costs, in an e-commerce environment reducing delivery times is pursued as a means to attract customers and thus expand market shares, even if this comes at the price of considerable costs. This is much more in line with the 'agile' model of the supply chain which prioritises speed and flexibility over costs (Harrison et al. 1999). In this respect, Amazon can clearly be termed an innovation leader. It is offering same-day delivery (Amazon Prime) in many large European cities (currently in the UK, Germany, France and Italy) and has even begun to offer same-hour delivery (Amazon Prime Now) for a small selection of items in some of the largest metropolitan areas (Berlin, Munich, Paris). With the roll out of 'Amazon Fresh' in the UK (2016) and Germany (2017), the e-commerce player has begun to expand its high speed delivery service to the perishable grocery products segment. Amazon's foray into the grocery sector was seen as a serious threat to established players in both countries and has already triggered reactions, such as the recent decision by Tesco in the UK to expand its own same day delivery services across the UK.<sup>67</sup>

The trend to ever shorter delivery times is a response to the expectations of online shoppers, who have come to develop an 'any time, any place' mentality (Fernie et al., 2014: 221). However, quick delivery is but one of many customer expectations, and as surveys among online shoppers reveal, other

<sup>66</sup> The term lead time in the logistics context denotes the "time it takes for an order to be fulfilled, which includes preparation, packing and delivery to a designed location" (Rodrigue et al., 2017: 231)

<sup>67</sup> 'Tesco to extend same-day online delivery service across UK - Service will cover more than 99% of UK households, says supermarket as fears grow over Amazon's foray into groceries market', The Guardian, Monday 24 July 2017.



features such as the option to choose a specific delivery date may be even more important (Xing et al. 2016: 343). Thus logistics service providers, whether in-house or external, have to make important strategic choices about which expectations to prioritise and how to balance the different goals and expectations, most notably time, costs and quality of the logistics services. Besides ‘delivery speed’, there are also increased requirements to adapt logistics processes more flexibly to stronger fluctuations in demand (see 5.3).

### 3.2 Automation and digitisation

As explained above, the automation of intralogistics processes was triggered by the retail logistics transformation. However, e-commerce has pushed the need for automation even further, notably because of the strongly increased volumes of individual items to be shipped directly to the end customer and the correspondingly high throughput requirements (ten Hompel and Schmidt, 2007: 16). There is not (yet), however, a uniform trend towards fully automated warehouses; rather, the pace, extent and type of automation depend on a number of factors, including the characteristics of the stock handled in warehouses (e.g. size, weight, standardised/non-standardised package, diversity of stock). Across countries, it has become common, among business experts and those working in the retail logistics industry, to make a distinction between three types of warehouses, according to their degree of automation: *conventional*, *semi-automated* and *automated* warehouses.<sup>68</sup>

*Conventional warehouses:* Tasks are mostly performed manually, supported by forklifts and other electric vehicles on which the pallets with picked items are mounted. Pickers work with different order picking technologies (see ten Hompel and Schmidt, 2007: 30ff). ‘Paper picking’ – where operators pick items based on computer generated lists – has increasingly been replaced by the use of barcode or RF scanning devices; followed since the second half of the 1990s by ‘pick-by-voice’ and ‘pick-by-light’ and most recently ‘pick-by-vision’ (data glasses). Pick-by-voice seems currently to be the most widespread technology, at least in the food segment. Pickers wear headsets and communicate orally with a software system to receive and confirm picking tasks; basic requirements are a Warehouse Management System and check digits placed on a label positioned at each pick location.

*Semi-automated and automated warehouses:* A clear-cut distinction between the two terms is rarely explicitly given, but a common core meaning of ‘semi-automated’ is that only part of the different process steps in a warehouse are automated and a high proportion is still performed manually. Thus technologies may include man-aboard vehicles which move horizontally and vertically in the aisles between high racks, but the item is still picked by a human operator. Other technological solutions involve so called ‘goods-to-person’ systems, where un-manned vehicles, conveying systems or carousels move goods to a point where they are collected by human operators – as opposed to the ‘person-to-goods’ systems in the conventional warehouses where pickers walk or drive through the warehouse and collect the items. In some instances, the term semi-automated is also used to refer to warehouses that combine fully automated solutions for certain process steps (e.g. Automated Storing and Retrieval Systems (AS/RS)) with conventional solutions for other steps such as picking. By implication, fully automated warehouses involve technologies that operate with a minimum of manual labour and where more or less all tasks, including the most labour-intensive tasks of picking and packing, are replaced by a large interconnected system of machines based on conveyor systems and carousels. Examples include the ‘Order Picking Machine’ by WITRON (<https://www.youtube.com/watch?v=DNyFyFJ6CWk>).

<sup>68</sup> But see ten Hompel and Schmidt (2007: 20-45) for a more detailed and accurate account of the wider array of technological solutions for receiving, storing, retrieval, sorting, picking and packing items.

To varying degrees these systems help to significantly raise productivity in warehouses by reducing error rates and/or increasing picking efficiency. To date, however, fully automated and even semi-automated warehouses are far from being the rule in current retail DCs; they are more widespread in certain non-food segments (pharmaceuticals, media), but less so in the food segment. This is despite the fact that *“The business case for automation in Europe has always been stronger than in North America because of land constraints, higher labor costs and labor availability issues”* which makes it easier to justify the investment into automation economically (MWPVL 20xx). However, fierce price competition in the retail sector and the trend towards marketisation in logistics might be a factor that slows down the automation process in Europe, because a concern for long-term cost savings (by substituting for manual labour) has to be balanced by companies against the high investment costs required in the short term. Moreover, factors often invoked as disadvantages of automated systems, apart from their high investment costs, is their lack of flexibility in the face of a strongly varying quantity and type of products, due to varying consumer demands, seasonal products, the high diversification of products and ever shorter product life cycles.<sup>69</sup>

One important element in the current debate on the digitisation of the economy and the corresponding technological and organisational changes for logistics processes (e.g. ten Hompel and Kerner, 2015; Zijm et al., 2016; Kersten et al., 2017; Heistermann et al., 2017) is robots and other sensor-based autonomous and decentralised coordinated modules (such as the warehouse robots developed by KIVA for Amazon). These are considered better suited to catering to the much increased demands for flexible and individualised order processing. However, their use in European retail DCs is very limited so far, including in the DCs in our sample. This is probably due not least to the rather recent and ongoing technical progress here. Moreover, where companies have only recently invested in the type of large-scale automation with firmly installed equipment described above, they are unlikely to be among the first to switch to these alternative technological solutions. Still, they are likely to be incorporated into European DCs over the mid-term as well. Their interaction with job quality and employment levels, however, can to date be studied *empirically* on a very narrow basis only. The technological developments described above (‘conventional’, semi-/fully automated solutions) are thus of greater relevance to recent and ongoing innovation processes at company level and will therefore be a major issue in our empirical analysis.

Finally, another very important trend is the progress in information technology (e.g. ‘track-and-trace’, advanced WMS and Enterprise Resource Planning (ERP) systems), which enables firms to control and monitor the flow of goods both within and across different segments of the supply chain ever more closely through the collection and exchange of real-time data and the use of predictive analytics based on ‘big data’ (although this is still in its infancy in the retail industry (Kersten et al., 2017)). Along with other factors, this increases the interdependency between processes in distribution centres, retailers, transport companies and suppliers and has implications in particular for the internal resource planning (5.3), as we shall see.

---

<sup>69</sup> An example illustrating the difficulties in implementing automated solutions in a food DC is the British supermarket chain Sainsbury (cf. Fernie and Sparks, 2014: 17ff).

## 4 Innovation strategies at company level – an overview

### 4.1 Selection criteria and key characteristics of case study companies

The following analysis draws on six case study reports.<sup>70</sup>

**FR-MEDIA** is the subsidiary of a large French retail chain selling cultural and electronic products. The case study covers a semi-automated DC servicing shops (DC1) and a separate DC which is dedicated to e-commerce (DC2). (Perez and Gautié, 2017)

**FR-FOOD** is the subsidiary of one of the top 10 large French food retailers; it operates around 30 distribution centres servicing supermarkets across France. The case study draws on interviews in several regional conventional and one semi-automated DC which started operation in the past 5 years. (Gautié and Perez, 2017).

**GER-FOOD** covers two DCs operated by two different subsidiaries owned by two of the top 10 large German food retailers. Both DCs under investigation are regional, conventional DCs, but the works councillor of DC2 provided information on another semi-automated DC in the region that started operation a few years ago (Jaehrling, 2017a).

**GER-FCMG** is the logistics division of a large German retail chain selling fast moving consumer goods. The case study focuses on one of the national, semi-automated DCs servicing shops across Germany (Jaehrling 2017b).

**GER-FASHION** is a subsidiary of a logistics holding which in turn is a subsidiary of an e-commerce retailer in the fashion segment. The case study focuses on two semi-automated DCs: one returns centre (DC1) and one national distribution centre (DC2) (Jaehrling, 2017c).

**NL-MEDIA** is an independent logistics provider that started its business in the books segment but has moved into additional product segments (other media products, healthcare and fashion) over the past years. The case study focuses on a national, semi-automated DCs that is servicing both shops and individual customers. (Keune and Koene, 2017).

The table below provides an overview of the main characteristics of the case study companies and the number of interviews carried out in each case. The interview data were complemented by secondary data such as press releases, company statistics and brochures retrieved from corporate websites and/or other internal documents made available by interviewees. Researchers also took part in a plant tour in at least one warehouse in each case study company, lasting between one and three hours. Moreover, the analysis draws on additional interviews with industry experts carried out as part of the case studies. These included representatives from business associations, trade unions, and academic experts based at universities and other institutions in applied research, or professionals in institutions devoted to occupational health and safety.

---

<sup>70</sup> A seventh case study report (NL-FOOD) could not be finalised, due to difficulties in getting access and the delay of scheduled interviews. A summary of this case is nevertheless added to the Annex.

Table 1: Characteristics of case study companies

Pseudonym	characteristics of company	number of employees in company and in DC	female employment	immigrant background	average age of employees	Number of interviews + number of DCs included in research
<b>GER-FASHION</b>	- Subsidiary of e-commerce holding - predominantly <b>B2C</b> - predominantly <b>fashion</b>	Company: > 2500 DC: 501 - 2500	High (> 60%)	Low (6%), increasing	increasing share of those aged 50+	13 interviews in 2 DCs (3 ER; 8 MA ; 1 TU; 2 EXP)**
<b>GER-FOOD</b>	- 2 subsidiaries of 2 different retail chains - predominantly <b>B2B</b> (shops) - predominantly <b>food</b>	Companies: 501 - 2500 DCs: 51 - 500	Low (10-20%)	n.a.	High (44 y picker; 49 y truck drivers in DC 1); increasing in DC2 / decreasing in DC1	7 interviews in 2 DCs (2 TU, 2 ER, 1 MA, 2 EXP)**
<b>GER-FMCG</b>	- Logistics department of retail chain - predominantly <b>B2B</b> (shops) - Fast moving consumer goods	Company: > 2500 DC: 501 - 2500	Low (10-15%)	n.a.	n.a.	3 interviews in 1 DC (1 ER; 1 TU, 1 MA)**
<b>FR-FOOD</b>	- Logistics department of retail chain - exclusively <b>B2B</b> - predominantly <b>food</b>	Company: > 2500 DCs: 51-500; 501-2500	Low (15% in one DC)	Low (2% in one DC)	High, (48 y in one DC); increasing	14 interviews in 6 DCs (5 E/ER; 3 E, 6 MA)**
<b>FR-MEDIA</b>	- Subsidiary of cultural and electronic products retail chain - B2C and B2B (shops)	Company: 501 - 2500 DC : 501 - 2500	Low, but increasing	High (>20 countries of origin)	High (~41 y)	5 interviews in 2 DCs (3 MA, 2 E/ER) **
<b>NL-MEDIA</b>	- Independent logistics company - Predominantly <b>B2B</b> , increasingly <b>B2C</b> - Shifting from serving one product segment (Media) to multiple segments	Company: 501 - 2500 DC : 501 - 2500	35%, increasing due to new segments (50% in fashion)	n.a.	Stable over period 2011-2015	9 interviews in 1 DC (7 MA, 1 ER, 1 TU)**

Source: Compilation based on case study reports (see list of reports in section 8 of this chapter)

\*\* MA = Management; TU = (external) Trade Union representative; ER (= elected employee representative); E = employee; EXP = External experts

In selecting the cases to be investigated, researchers took into consideration the broad industry trends and structures described above, and aimed to include companies covering different types of logistics processes that could be expected to make a difference with regard to innovation dynamics. The case selection therefore targeted companies servicing different *segments of the retail industry*, namely the food/drugstore goods and the non-food (fashion, media) segment. These two segments are characterised by different market shares for e-commerce, which has spread much faster in the non-food segments. In the food segment, on the other hand, it has for a long time been restricted to a limited range of products in the three countries under study. Moreover, the two segments also correspond to a well-established distinction between ‘fast moving consumer goods’ (food, drugstore goods) and ‘slow moving consumer goods’, which are characterised by differences in terms of profit margin, shelf life and turnover rate – key features impacting on warehousing processes. However, e-commerce and other trends are blurring the differences between the two segments, as exemplified by the strategy of setting up separate DCs for slow moving items within the same product segment.

Our company sample also reflects several broad trends in the industry. Our focus is mostly on **large logistics companies servicing large retail chains**. Thus the business entities in our sample employ at least 1000, some even more than 2500 employees, usually spread over several warehouses. This mirrors the trend towards strong market concentration across countries and goods segments. Large retail chains are dominant players in all three countries, in both food and many non-food segments. This is matched by the companies operating the distribution centres: these tend to be large business entities as well, often with a very few or just one retail chain as their (dominant) customer.

Another common feature is that, with the exception of one case (NL-MEDIA), all business entities in our sample are owned by retail chains, i.e. are **in-house or ‘quasi in-house’** (legally independent subsidiaries) entities. The trend towards fully outsourcing logistics services to 3PL providers is thus mirrored only to a limited extent by our company sample. Some of our companies do themselves outsource part of their warehousing operations, or even part of their DCs, but the bulk of work is performed by their own employees. Thus, by predominantly focusing on companies providing (quasi) in-house warehousing services for large and established retail chains, our cases can be considered as typical of a quantitatively important segment of the retail logistics industry; but in terms of generalizability it has to be borne in mind that we have only limited evidence on independent 3PL providers. As argued above, the marketisation of the logistics function has also helped to change the relationships between retailers and their in-house logistics providers; thus the differences might not be as significant as might be expected when judging by the formal organisational status.

A third common feature is linked to the large size of the companies. Unlike many small and medium-sized companies, the large companies in our sample are covered by the **full array of country-specific institutions governing the employment relationship**, at both company and industry level. This does not make these companies representative of the whole industry or country, as many companies operating in the same segment are not (any longer) covered by these institutions. However, it does mean that at least in our companies the institutional framework matters and might make a difference with regard to the innovation/job quality nexus – compared to companies not covered by these institutions. It should be stressed however, that the industrial relations systems of the three countries share many similarities, and recent trends tend to further minimise previous differences – as for instance a common trend both in countries like France (‘state-centred’ model of industrial relations) and in Germany and the Netherlands, (‘social partnership’ model) towards the decentralisation of collective bargaining, through the conclusion of company-level collective agreements and/or the inclusion of derogation clauses in national labour laws and in sectoral or cross-sectoral collective agreements (European Commission, 2015). In our context, the most important differences between France, on the one hand, and Germany and the Netherlands, on the other, relate to the greater

fragmentation of trade unions according to their political allegiance in France, which also translates into a more fragmented landscape of employee representatives at company level. Partly as a consequence, labour relations at the company level tend to be more adversarial in France, similar to other countries belonging to the ‘state-centred’ cluster (European Commission, 2009: 49).

Finally, in terms of **job quality**, all companies – with the exception of FR-FOOD – have a reputation for providing ‘better-than-average’ working conditions, compared to competitors in the industry. This judgement is based on both external documents and press reviews and a self-evaluation by the management and /or employee representatives we interviewed. The most visible indicator is that the companies are covered by collective agreements (even where this is no longer a standard for the industry, as in Germany and Netherlands) that provide for higher wage levels than in many DCs operated by 3PL providers.

The **employment structure** also has similar features and trends. Employment in food retail warehouses is largely male dominated, while this is not consistently the case in the non-food retail warehouses. A common feature across almost all cases is the relatively high average age of employees. Finally, with regard to employees with immigrant backgrounds, their share is substantial in several warehouses, but can be as low as 2% in other cases as well (FR-FOOD), due to specific local labour market and demographic situations (rural area). Overall, following the definition used in the QuInnE project, the segment of low-skilled jobs in retail warehouses can be classified as relatively ‘inclusive’, in the sense that these jobs are more accessible to members of social groups that are exposed to higher unemployment risks. In some of our cases, their share among employees has even increased in recent years, for reasons linked to innovation processes, as we will explain further below.

#### 4.2 Business and innovation strategies at the company level – a short description of 6 cases

Faced with the market structures and the innovation dynamics described above, the companies in our sample have made different strategic choices over the last 10-15 years. The table below gives an overview of the different dimensions of change identified above; a more contextualised description is provided by the short portraits in the Annex. Overall, all the companies have adopted a broad range of changes, including marketisation (use of 3PL, internal outsourcing) and changes to the physical distribution network that have accompanied the process innovations in warehouses (automation and the introduction of B2C distribution processes). In terms of product, or rather service innovations, they consisted mainly of faster and more flexible deliveries to consumers (both shops and individuals), but in some cases also an expansion of the services delivered to customers (see NL-MEDIA and GER-FASHION).