CHAPTER 5

# An Introduction to Flexible, On-Demand Warehousing: E-Space

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## Introduction

A highly flexible, agile supply chain has become a key requirement for many businesses to remain competitive (Kumar, Shankar & Yadav 2008). In today's multi-channel, fast-paced and highly demanding marketplace, both manufacturers and retailers must be able to produce and deliver products faster than ever before. It is no longer just about minimising supply chain costs. Increasingly, the speed of supply chain is the key differentiator when it comes to making a sale or losing out to the competition.

With most of the world's products manufactured in a different country, or even on a different continent, to the one where they are eventually sold, guaranteeing a quick delivery is no mean feat. And if, as expected, trade barriers and tariffs continue to develop, then delivering across borders will only become more difficult in the future (King 2018).

The only way for companies to achieve the short lead times demanded by today's consumers is to store products in large, centrally located warehouses.

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This is how most supply chains currently work: products are manufactured on one side of the world, they are then shipped to a central warehouse for storage, where they sit and wait, until finally they are delivered to the end customer.

Although this supply chain model has served many companies well for the last 20 years, the rapid acceleration of consumer expectation for immediate delivery (largely driven by increasing online purchasing) has drastically outpaced the speed at which supply chains have adapted. In short, customer demand for speed has increased tenfold, whereas the speed delivered by global supply chains has yet to change.

The most common way companies have sought to meet this consumer demand for faster deliveries is not by completely changing the supply chain but rather by adding more inventory in more warehouses. The result is an explosion of inventory across supply chains, with billions of products sitting idle in warehouses, costing money and losing value.

The effect of this increase in inventories can be seen in the rapid increase in the number of warehouses built: in the USA alone there is over 9.1 billion square feet of warehousing space (the equivalent of more than 200,000 football pitches), with over 1 billion square feet of warehousing added in in the last 10 years alone (CBRE 2018). However, the cost of these warehouses pales into significance when one considers the value of the products stored inside them – estimates put this figure at over $1.2 trillion (Federal Reserve 2018).

With such a high value of inventory held in supply chains, why haven't they adapted to keep up with the increasing demand for fast delivery? One reason is that the contract logistics market is anything but adaptable. Logistics service providers (LSPs) cling stubbornly to outdated business models; they are stuck and slow to innovate (Cui, Shong-Lee & Hertz 2009). Furthermore, LSPs demand long-term warehousing contracts, volume commitments and accurate forecasts to lock their customers into fixed supply chains. As one supply chain manager explained, 'warehousing remains the last fixed element in the supply chain'.

In this chapter, we will discuss the reasons why the existing contract logistics model is not suitable for the fast-moving, adaptive supply chains of today. The chapter begins with a brief introduction to how the contract logistics industry currently works, before introducing a new model, hereafter referred to as E-Space, which we believe will turn the existing contract logistics model upside down. In doing so, E-Space will free up manufacturers and retails to implement the flexible, fast and agile supply chains that we as consumers demand.

Our vision for this new world does not stop there. It is not just contract logistics that is holding back the transition to more flexible supply chains; manufacturing also remains stubbornly slow to adapt to the new world. We conclude the chapter by proposing that once the slow, fixed nature of the contract logistics model is disrupted, that of manufacturing will not be far behind.

## The Warehousing Industry Today

The commercial need to transport products from point of origin to point of consumption has existed as long as there have been products (Wilkinson et al. 2009). However, the rapid rate of globalisation over the last 30 years has meant that supply chains have become elongated and complex. Most shippers (organisations that produce or sell products) have elected to outsource their logistics operations to LSPs, rather than invest in their own planes, boats, trucks or warehouses. The idea of providing warehousing as a service started to develop as an industry in the late 1980s (Sheffi 1990). Since then, the warehousing industry as a whole has experienced tremendous growth, exemplified by the establishment of multinational LSPs such as DHL, UPS and FedEx. Today, the outsourced warehousing industry, commonly referred to as the contract logistics industry, is worth over $200 billon (BCG 2016).

The logistics industry really took off when the world went global and demand for outsourced logistics surged. Manufacturing moved to low-labour-cost countries; the rise in consumerism created more demand in more markets; international transportation grew at double-digit annual growth rates; and technological advances meant that products could be managed across continents. But setting up a new warehouse is not as simple as it may first seem. As described in Figure 5.1, it usually involves nine steps and takes from six to nine months. A timeline of more than two years is not uncommon if the warehouse must be built from scratch.

The first step is in the supply chain design, which involves identifying the need for a new warehouse (or multiple warehouses) to improve the supply chain. The next step is to select the size and location for the warehouse(s). Warehouse location selection usually begins with a centre of gravity study. This study is a mathematical modelling of the best possible location for a warehouse based on product supply and demand. The calculation for the location of a facility or facilities will determine the coordinates of the best location(s). A typical example of the outputs from a centre of gravity study where either one or two locations are desired is shown in Figure 5.2.

Typically, once a shipper can estimate the new warehouse location and approximate size, they will send out a request for information (RFI) to find existing options in that market. This allows LSPs to respond with their availability and options. This process can be problematic, as if the volumes are very large then LSPs will struggle to provide enough space. If volumes are too small, LSPs may choose not to respond at all to the RFI, as the potential returns are not worth the required time investment to sign a contract.

In most cases, a number of potential suppliers are identified, allowing the shipper to create a request for quotation (RFQ), which is essentially a request for the exact cost of implementing and operating that warehouse. The RFQ process in itself can be extremely slow, as shippers need to define their exact

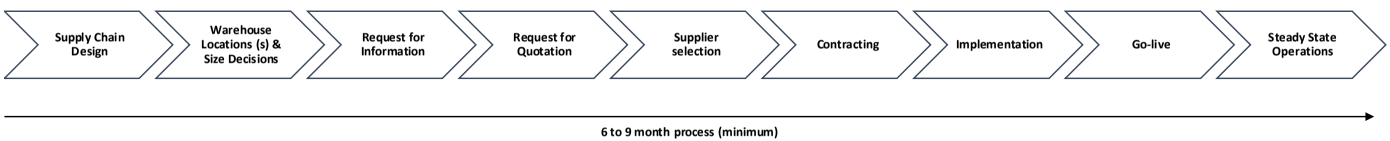


**Figure 5.1:** Steps needed to set up a new warehouse.

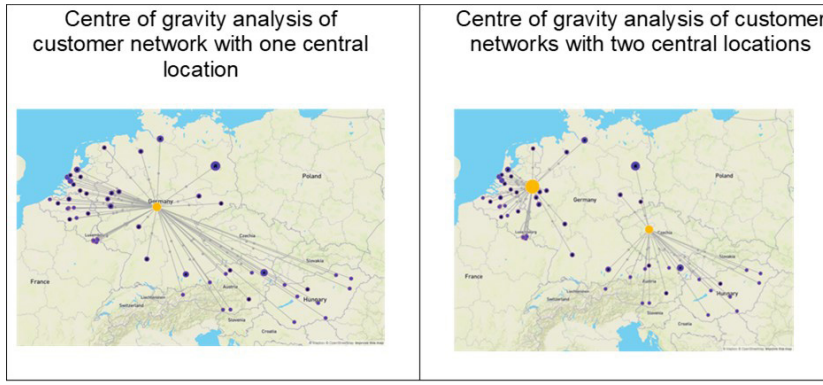


**Figure 5.2:** Centre of gravity analysis to select number and location of warehouses.

business requirements (volumes, number of orders, order profiles, types of products to be stored, any specific system requirements). Both short-term and long-term requirements must be mapped. This information is essential for the LSP to provide a quote.

It is at the RFQ stage that the process becomes difficult, and therefore slows down. Shippers are asked to predict their volumes and order profiling over the next three to five years, which most would agree is an impossible task. But LSPs will not commit to renting and operating a new warehouse without guaranteed volumes and revenue; they refuse to accept any exposure or risk. Predicting the future space and labour requirements of any business is a guessing game, and often the LSP relies on a long list of assumptions to calculate their quotation. With each LSP applying different assumptions and calculation methods to calculate their pricing, the next step in Figure 5.1, the supplier selection step, can prove notoriously difficult.

As soon as the pricing model has been agreed, a quote provided, and the customer is ready to sign on the dotted line, then surely it should be smooth sailing from there on in? Sadly not. It is not uncommon for contracts between LSPs and customers to run into hundreds of pages, as the nuances of scope of services, liabilities and service levels are carefully defined. The contract seeks to cover as many possible variations in business outcome as possible; it is usually a case of: if you can imagine it happening, then it needs to go in the contract.

Finally, though, all the contracting is complete, everything is signed, and the implementation phase can begin. Typically, implementation takes between eight and 12 weeks to complete. While there are occasional exceptions, and some implementations are possible in a week, the majority take longer, especially if new hardware must be ordered, staff trained, or new warehouse management systems (WMSs) established and integrated with existing systems.

When we sum up all of these timelines (up to three months for the pricing, another month or more for contracting, and up to three months for

implementation), it is not at all surprising that customers complain about the glacial speed of LSPs. The time between the shippers' decision to establish a new logistics operation and the first customer order leaving the warehouse frequently exceeds six months. In these six months, both parties are focused solely on the basics of the contract; there is no mention of innovation or process improvement, let alone how the LSP can help its customers achieve their strategic objectives. The bureaucratic contracting process leaves little time for anything else.

It is only after implementation that both the shipper and LSP can really see if the original assumptions (used for all the pricing and contracting phase) were correct. Unsurprisingly, the assumptions often turn out to be incorrect, and so the negotiations continue throughout the life of the contract; the bureaucracy of adjusting prices and contracts continues until the shipper has the energy for a change.

## A New Approach: E-Space

How can flexibility, agility and innovation be introduced into the warehousing industry? To answer this question, we only need to look to the other major sources of disruption in the global business environment. Digitalisation seems to be the key when it comes to improving speed and efficiency. This applies equally to shopping (Amazon), taxi cars (Uber) and tourism (Airbnb). Airbnb works by allowing property owners (suppliers) to advertise their free space to people visiting that area (customers). Space is then booked and paid for through the platform. This process is fast, efficient and low risk.

So why not apply an Airbnb-type solution to warehousing? The result would be an E-Space model that would allow manufacturers and retailers (shippers) to rent short-term warehousing space from building owners and landlords (suppliers) in the same way that holidaymakers rent space in people's homes (Wilson & Huckle 2018). If suppliers could advertise available space via an E-Space platform, and customers could see and then book that space in real time, then the amount of unused space in the overall warehousing network would reduce, and customers could quickly find and book flexible space.

Initially, this seems like a simple solution, but selling warehousing is not quite as simple as creating an online market place and sitting back as the business floods in. Digitalising a long, complex process will not automatically make things faster. Thereby, in order for an E-Space model to work for warehousing, the process itself must be readdressed. A digital warehousing marketplace would provide visibility on where to find empty space, but, if LSPs cannot simplify their pricing in order to sell that space, the utility of any E-Space platform would be extremely limited. Pricing for basic warehousing space must therefore be immediately available, along with an indication of handling costs, so that potential customers can calculate and compare possible options.

**Table 5.1:** Requirements of an E-Space model.

| | |
|---|---|
| Pricing | Immediate pricing available on the platform for the space. Indicative pricing for handling costs must also be provided. |
| Contracting | A simple contracting process that allows customers, suppliers and LSPs to quickly agree on prices and contracting terms. |
| System | A fast, online warehouse management system that can be operational in hours, not weeks or months. |
| Transportation | Integrated transport rates and systems, which allow customers to book and pay for not just the warehouse but also all activities up to and including the customer delivery and any returns. |

A further challenge that remains, even with a warehousing marketplace, is the duration of implementation. Even if customers are able to find warehousing space, and contract with the owner quickly, the process of setting up a new warehouse still would take weeks or even months. Implementing a warehouse management system and integrating with customer ordering systems is a slow process. To truly act as a flexible system, E-Space needs to improve the speed of implementation. The E-Space business model must also address the challenge of transportation to and from the warehouse. Customers will need total visibility on transport cost and availability before directing inventory to new warehouses, and they need that information before they can even select a new warehouse location. Without this visibility, the trade-offs between one warehouse location and another will remain unknown.

Moreover, customers now expect full traceability on their products throughout the supply chain. The most sensible approach here would be to integrate transportation with the E-Space business model; this saves customers having to contract with a multitude of different transport providers in numerous different warehouse locations. In summary, the E-Space business model needs to provide more than a simple market place between warehousing customers and suppliers; it must remodel the existing warehousing process into something agile, fast and flexible. The key stages of this process are detailed in Table 5.1.

## Implications of E-Space for Supply Chains

What would happen to supply chains if companies could use an E-Space platform to store inventory close to customer demand in any available warehouse, instead of the warehouse selected three years previously? Look again at the centre of gravity analysis provided in Figure 5.2. What if, rather than trying to find one central location and committing to a three-year contract, manufacturers and retailers could make use of multiple warehouses, store goods in warehouse A today and warehouse B tomorrow, without any long-term contracting, and

**Figure 5.3:** A complex, nonsensical transport flow in a supply chain from China to Ireland.

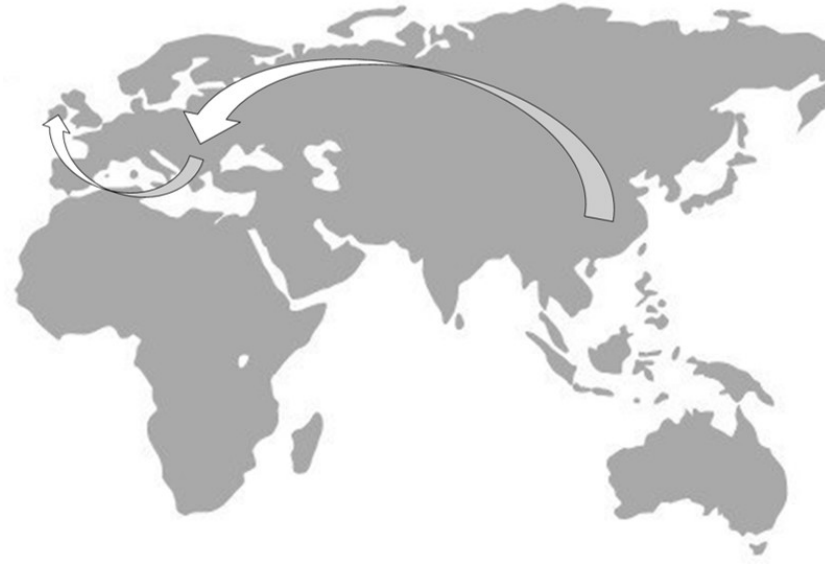

**Figure 5.4:** An E-Space-facilitated supply chain with transport from China to Ireland through central Europe.

depending on product flow and customer locations? What would be the impact on the logistics world? What would E-Space mean for supply chains in general, as well as inventory levels and final-mile transportation?

The possibilities introduced by the E-Space model could turn global supply chains upside down, in particular the contract logistics industry. Instead of a slow, over-contracted and change-resistant industry, logistics could become a fast-paced, agile and flexible environment. Customers would be able to make decisions on warehousing in real time, and we would see far greater movement of products from locations with lower demand to those with higher demand.

When it comes to inventory management, the impact of E-Space could be enormous. The current lock-in system of today, where warehousing customers sign long-term contracts for space, makes it almost inevitable that the warehouse will become full of inventory. Warehouses are a bit like suitcases or spare rooms: the bigger they are, the more you find to fill them. And, of course, if you are already paying for warehouse space because you are locked into a fixed-term contract, it would seem like an overall cost advantage to manufacture in bulk and store excess products in a warehouse. This seems to make sense, but take it further and it means that companies over-produce (because they have space), store too many products, and then leave them there indefinitely. LSPs regularly stock products for years, even decades, because their customer refuses to bite the bullet and scrap unwanted goods, even if it is clear to all involved that those goods will never be sold.

The fixed nature of contract logistics also has negative implications on transport cost. Because warehouses are fixed points in the supply chain, transportation of goods must be organised around them. This often results in nonsensical transport flows (Figure 5.3), where products move from the port or airport of entry to a centrally located warehouse, before moving back along the same road to deliver to customers who live next to that port or airport.

If organisations could store products across small warehouses close to local demand, rather than large, central warehouses in the middle of nowhere, then transport effort and cost could be greatly reduced (Figure 5.4). This would lead to a clear benefit for supply chains in general but also the wider environment and the many road networks struggling under traffic congestion.

## Implications of the E-Space Model for Users

Even when the technology is there, an industry that has worked one way for 20 years is not going to change overnight. But change it will. In this section we provide insight from three different stakeholders that will be affected by the transition from contract logistics to E-Space:

1. **Suppliers** (landlords and real estate)

The implications of an E-Space model for suppliers are major. Through an E-Space platform, they will gain access to vast network of customers who will

specifically be looking for warehousing space. Suppliers will be able to sell empty space for short periods of time, charging a premium for flexibility and last-minute contracting. The warehousing market will open up into a free market, where price will be derived purely from market demand. Suppliers will easily be able to hedge risk by operating for a larger number of smaller customers instead of depending on one or two large customers.

2. **Customers** (shippers)
The warehousing market as it is today leads to massive amounts of waste in the supply chain. This waste can be product waste (many products disappear into rigid, elongated supply chains) or space waste. Below is a typical example of how customers currently end up with unwanted warehousing space:

| What the customer needs: | What the LSP offers: | What the customer gets: |
|---|---|---|
| 10,000 square metres, January–November<br><br>15,000 square metres, December | A fixed contract of 15,000 square metres January–December | A monthly invoice for 5,000 unused square metres for 11 months of the year |

An entire supply chain cannot be changed overnight, but the E-Space approach has massive implications for customers. If customers decide to use an E-Space platform, it may be for either strategic or tactical supply chain decision, as well as a combination of both. Strategically, customers could redesign their entire warehousing and delivery strategies to be as flexible as possible while still maintaining quality standards. For example, matching product warehousing to customer demand in real time would ensure that products are always correctly placed to supply customers, without any excess space and the associated costs. Tactically, customers could solve problems such as peak season excess inventory by temporarily employing the E-Space model to seek out additional space at critical times.

| What the customer needs: | What E-Space offers: | What the customer gets: |
|---|---|---|
| 10,000 square metres, January–November<br><br>15,000 square metres, December | Flexible space throughout the year to match demand on a month-by-month basis | No unused warehousing space, locations that match up with demand, and the ability to make changes when needed |

Additional implications for customers include access to a vast network of suppliers, reduced commitment to long-term contracts and much less pressure to predict their future demand.

3. **Warehouse operators** (LSPs)
Regardless of what happens in the E-Space sphere, there will always be a need for vast warehouses in the middle of the desert to store toilet paper, toothpaste and the student staple dried noodles with a 70-year shelf-life, so the contract logistics model is not going to disappear completely. But, for perishable products, or those that become obsolete very quickly (e.g. fast-changing technologies), then a simple E-Space model could well replace the traditional LSP when it comes to sourcing warehousing space.

The LSP must then find other ways to add value in the supply chain. This will often involve warehouse management, as this is something that the majority of suppliers prefer to outsource. LSPs also need to find ways to add value to the products themselves, for example through packaging, labelling or even more advanced manufacturing services such as assembly or testing.

4. **Consumer** (end customer)
There are also implications of the E-Space model for the end customer, who will find their products arriving more quickly than ever before. The carbon footprint of products purchased online may reduce as their journeys become more direct, so there is an argument for increasing sustainability of supply chains. Prices will also be impacted as product manufacturers and retailers no longer need to pay for excess inventory, a cost that is inevitably passed to the end customer.

## Industry Perspective: On-Demand Warehousing (JLL)

Warehouses are critical components in virtually all supply chains. However, while the latter are increasingly being challenged to be more agile and responsive to changes in customer demand, warehouses are fixed assets which offer their users only limited flexibility at best. They are fixed in terms of location and often have limited potential to flex capacity.

Users (businesses and other organisations) that have a need for additional warehouse capacity have traditionally had three options: to own or lease an additional facility and operate it themselves; to own or lease a facility and outsource the operation to an LSP; or to outsource the facility and operation to an LSP on either a dedicated or a shared/multi-user basis. Whichever option is chosen, sourcing an appropriate solution often takes months and involves a long-term commitment (such as a lease or a contract with an LSP) typically measured in years, although short-term contracts are available for shared/multi-user contracts. These timescales are fundamentally at odds with the ability to respond quickly to changes in customer demand or to service customers in ever-shorter time frames, which the growth of e-commerce especially has highlighted.

Given these dynamics, it is unsurprising that the markets for both warehouse real estate and warehouse/logistics services are being disrupted by technology platform providers, such as Stockbooking in France and FLEXE in the US, that seek to connect users of warehouse space with providers of warehousing and services. These platforms enable users to source warehousing and services on-demand from a large network of approved suppliers on a 'pay as you go' basis without long-term commitments – a model that JLL refers to as 'warehouse as a service' (WaaS). These providers could be LSPs or other non-LSP occupiers who have spare capacity within their warehouses.

These types of platforms have existed for years in the road freight industry, enabling cargo owners to source transport capacity as and when required, via online 'freight exchanges', but they are relatively new in the market for warehouse real estate and warehouse/logistics services. While all these platforms digitally connect users with suppliers, different network providers offer different services. For example, in France, Stockbooking says that: 'Storage spaces and logistics services offered will depend exclusively on the offer of the selected partner.' In the US, the FLEXE offer includes access to the FLEXE technology platform, a cloud-based WMS that warehouse providers use to manage FLEXE projects, and which users utilise to manage and track inventory, orders and shipments. The FLEXE offer also provides users with access to a team of dedicated logistics coordinators to manage their day-to-day needs across their network of FLEXE facilities.

Although the on-demand market is fully digitised by the different platform providers, it is not, in aggregate, transparent. As a result, it is not possible to provide an indication of the scale of user demand satisfied by on-demand warehouse solutions in the same way that it is possible to scale the demand for traditional warehouse solutions by quantifying how much warehouse space has been transacted via the traditional options of owning, leasing or outsourcing. Therefore, at present, the significance of on-demand warehousing in terms of its impact on the overall demand for warehouse space cannot be assessed. This is not likely to change any time soon unless all the different platform providers report statistics on their business volumes in terms of warehouse space (or capacity) transacted.

Although it is not possible to measure this market, we think there are good reasons to believe it will grow in the years to come. For warehouse users requiring additional capacity, the model offers access to a huge market of suppliers and the opportunity to add (or subtract) additional warehouse capacity when and where required. Some users may choose to use on-demand warehousing and services to supplement a core network of facilities that they own, lease or outsource on a long-term basis, while others could potentially move to a wholly on-demand solution. For those supplying capacity, it offers access to a huge market of end users and the opportunity to secure additional revenues through utilising spare capacity. In addition, for landlords (as opposed to warehouse suppliers that are also occupiers) the on-demand model may provide an

alternative way to market a property, especially if that property is having difficulty attracting interest from users on a traditional long-term basis.

Clearly, the on-demand solution will not suit all warehouse users, in the same way that a traditional outsourced solution does not suit all businesses. Very many businesses will continue to want to have their own long-term facilities, especially where they also make large investments in automation and robots. In addition, without a stock of warehouses occupied on a long-term basis by LSPs or others it would not be possible for the technology platform providers to offer the on-demand service to others.

If, as we expect, on-demand warehousing expands as a way of sourcing both warehouse real estate and warehouse/logistics services, this will clearly be disruptive for the existing markets. Real estate brokers who traditionally market warehouse properties on behalf of users or landlords or act for users in sourcing appropriate buildings (or sites) are likely to adapt with their own digital marketplaces to provide more flexible solutions, and LSPs who traditionally offer dedicated or shared user services are likely to add on-demand services to their offering by creating digital platforms that embrace their existing warehouse stock.

The logic of the on-demand model is that users can provide more efficient and responsive logistics services to customers from a stock of warehouse buildings that are more fully utilised than would otherwise be the case. If this proves to be the case, then on-demand warehousing could make supply chains more sustainable as well as more flexible. This potential win–win outcome means that everyone with an interest in real estate or logistics should follow developments in-demand warehousing closely.

## Limitations of the E-Space Model

The biggest challenge facing the E-Space model will be convincing the customer market to accept a modal shift in how they acquire warehousing space. While the current process is lengthy and inefficient, this is what customers are used to. If another option offers the same service in only a fraction of the time, suspicion will naturally arise that the service is inferior in some way, and therefore not to be trusted. Market confidence comes from experience – we trust what we know. This is the major challenge for any new business model that dramatically changes how markets operate. We know the success stories – Uber, Airbnb, Expedia, to name but a few – but for every success story there are many thousands of failures where the market did not accept a proposed change.

For warehousing customers, using an E-Space platform requires placing trust in a network of unknown suppliers. While a warehouse provider may offer the right amount of space in the right location at the right price, if the provider is an unknown company or even a private individual, then warehousing customers will be wary about signing a contract with this provider. And rightly so – if you need to store products essential for the continuation of your

business, then you want to be certain that the person responsible for them is to be trusted. Insurance policies or legal battles are no use when your entire product line has been lost or destroyed through careless handling; your end customers will simply find a new supplier and your business is perhaps irreparably damaged.

How to control quality of service is therefore another major challenge for the E-Space model; if an E-Space platform offers a network of warehousing suppliers, it must offer some method of quality control. Established, long-running and trustworthy suppliers must be able to demonstrate their competence in some way that the customer can easily understand. New suppliers must also be able to compete in the warehousing market space in order to promote fair competition. Photographs are the simplest way for a customer to see exactly what they are buying; video links are even better, as are 360-degree tours of a building.

E-Space platforms could also offer supplier certification systems: visiting and auditing warehousing suppliers to ensure service provision is up to standard. Generally, the more detail that a warehousing supplier can provide about the space, the more confidence the customer will feel placing their products there. A user rating system is also a common way for previous customers to share their experiences, which over time builds a picture of the level of service on offer. As warehousing is highly KPI-driven, ongoing monitoring and evaluation is relatively easy to envisage, whereby warehouse providers could share their service KPIs (without revealing customer details) and therefore provide a clear overview of their warehousing capabilities.

Another potential challenge to the E-Space model is product liability: what happens when things go wrong? Storing large volumes of valuable goods in one place inevitably leads to the risk of something becoming lost or damaged. In the regular warehousing model, there is one customer (the owner of products) and one supplier (the owner of space). It can be that the supplier has been outsourced by an LSP, but in that instance the LSP is the supplier, at least as far as the customer is concerned. In an E-Space model there is an additional supplier in play: the platform provider. This increases the complexity of the customer/supplier relationship and leads to additional questions about relationship ownership and also liability.

If the platform provider is purely a middleman linking the customer with the warehousing supplier, with no guarantee of quality, no relationship with either party, and no investment in the success or failure of the warehousing transaction, then it is very easy for the platform provider to accept no liability whatsoever for anything that happens in the warehouse. If, however, the platform provider does want to guarantee quality or to retain customers, then it has an obligation to ensure that standards are maintained and to provide assistance if they are not. This leads to a complex question about the extent of liability E-Space platform providers should be willing or able to accept, and this question is an issue for the entire model.

The final challenge we address in this chapter is that, should platform providers simply act as a middleman linking customer with warehousing supplier,

what is to stop those parties from bypassing its system in any and all future transactions? If the platform merely introduces two parties and enables them to do business together, taking a small cut of that business, then should those parties decide to do business in future they will communicate directly and cut out the middleman. The platform must add value to the business transaction either through guarantees of quality, risk mitigation, more competitive pricing or some other method. How to add value is a challenge already faced by many existing E-Space providers.

## Taking the Flexible Approach Even Further

What are the further implications of an E-Space approach to supply chains? If manufacturers and retailers can quickly and easily decide where to place products, with guaranteed transportation links and final delivery assurances, then this will open up a huge range of opportunities to move value up and down the supply chain, to decentralise non-critical processes, and to take advantage of the local market that your end customers call home. In this final section we explore just a few of the possibilities opened up by the E-Space model of supply chain.

### *Pop-Up Factories*

No doubt most of us are now familiar with the 'pop-up' concept, where businesses open in a new location for a very limited period of time in order to showcase their products and services or to serve a particular market (e.g. festivals, holidays). We frequently see pop-up restaurants and pop-up stores. What we do not often see are pop-up factories, although Nokia's 'factory in a box' is a step in that direction. E-Space could change that. If manufacturers can use an E-Space model to find the right location to store goods, what is to stop them from using the model to find the right location to produce them? If flexible space is all they need, and E-Space provides that, then why shouldn't manufacturers source production space via an E-Space model? Manufacturing processes can easily be located either directly where the raw materials are available or where the end customer needs the product. Pop-up factories would provide ideal temporary locations for one-off production or short-term contracts. Manufacturers could bring their own machines and employees, needing only the space and the transportation links to run their businesses from anywhere in the world.

### *Distributed Manufacturing*

A natural next step from pop-up manufacturing locations is a strategy of decentralised or distributed manufacturing (Wilson 2017). E-Space is a major

enabler of this kind of strategy, as it encourages the idea of relocating products and services close to the end user. The main benefits of distributed manufacturing include reduced lead times, minimal costs of storage, easier customisation and personalisation, and reduced waste. Final products are stored in the component stage, assembled to order and then shipped.

Obviously, the benefits of centralised manufacturing are lost with this approach: economies of scale and cheap labour become less available, at least in the final stages of production. Quality control becomes harder with a distributed model, although today's production controlling technologies facilitate a much easier monitoring of decentralised processes. Pricing, regulations, staff training and many other factors are also more complicated with a distributed manufacturing approach, but these are all solvable and are arguably outweighed by the benefits of such an approach.

### *Local Sourcing*

Linked to the model of distributed manufacturing is the option of local sourcing. If manufacturing can go local, so can procurement, and E-Space could further enable manufacturers to switch to local procurement strategies to reduce their overall environmental footprints. Local sourcing strategies find raw materials in the local, regional or national market where production or fulfilment will take place. For example, if the company Bags Ltd needs to produce in Spain and sells to customers in Spain, then the sourcing strategy with the lowest environmental impact would be to source the raw materials and components for their bags directly in Spain.

There are many challenges associated with local sourcing when it comes to duplicating production and product quality worldwide; obviously, raw materials differ according to where they have been sourced. Managing consistency is critical across different markets if manufacturers want to produce and sell the same products in different markets using locally sourced materials. On the other hand, why do we need everything to always be the same? Would it matter if consumer products in Spain had a slightly different texture or colour to those in Argentina? Arguably, for many products, local variation due to the differences between locally sourced raw materials would be a source of value rather than a problem.

### *Circular Economy*

A final implication of E-Space is that it facilitates a more circular supply chain by making it easier for organisations to recover products (circular economy). Local locations close to the end customer will make it much returns processes much easier for manufacturers and retailers; returned goods can be quickly assessed for faults in the local warehouse, and then either resold back in to

the market if no fault is found, or stripped back into components for reuse or recycling. This means that far fewer waste will be generated at the end of product life, which is the main aim of a circular model of supply chain. Valuable products or components are recovered and not lost in to landfill (or worse). E-Space can bring organisations closer to their end customers and help them to maintain better control over the full product life cycle.

## Conclusion

Supply chains have a long way to go before they are fully able to satisfy the growing demand for flexibility and agility now coming from the consumer and customer market. Warehousing is still dominated by long-term, fixed contracts. Market players are well established, and everyone knows and understands the system. The industry will not change overnight. However, E-Space is actually already happening. Several flexible warehousing platforms have launched over recent years both in the United States and in Europe. These platforms offer a marketplace of flexible warehousing space through a network of suppliers.

Customer demand for these platforms is still relatively low as awareness of this new business model is still limited. But it is only a matter of time until E-Space platforms become as normal as flight booking, hotels, and transport platforms. As customers start to realise the benefits of updating their warehousing strategies to a flexible, agile model, then we will see a major shift in the market away from the long-term warehousing contracts towards the E-Space model.

E-Space will not work for everyone; if products show very stable demand along with low levels of obsolescence, then it is currently difficult to see the need for flexibility in warehousing. Especially if this flexibility comes at a premium. Mass-produced products with long shelf-lives such as kitchen roll and soap show no current need for agile warehousing strategies – they must simply always be available and volume requirements are easy to predict. But for products with flexible demand, which may be seasonal or related to current trends, or high levels of obsolescence, such as technology, then E-Space is an optimal approach to warehousing strategy. Decisions about where to place products and when are critical to the success of such products. No one will order Christmas trees if they arrive on 26 December. And no one will pay a premium for a mobile phone once the latest model has been released. Delivering product quickly can be make or break for an organisation, and this is highly dependent upon logistics.

There are a number of other challenges facing the new approach: legal and financial questions remain, and, as for the business model itself, how best to approach the establishment of an E-Space platform would need at least another dedicated chapter. The change will not happen overnight, but slowly the modus operandi will shift, which will have major and far-reaching implications for supply chain and production strategies. The inevitable conclusion is that E-Space spells the end of contract logistics as we know it.

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