WAREHOUSE MANAGEMENT

A COMPLETE GUIDE TO IMPROVING EFFICIENCY AND MINIMIZING COST IN MODERN WAREHOUSE

By Gwynne Richards 2018

What is a warehouse?

> *A warehouse should be viewed as a temporary place to store inventory and as a buffer in supply chains.*
>
> *It serves as a static unit - in the main - matching product availability to consumer demand and as such has a primary aim which is to facilitate the movement of goods from suppliers to customers, meeting demand in a timely and cost-effective manner.* (Adapted from Van den Berg (2011))

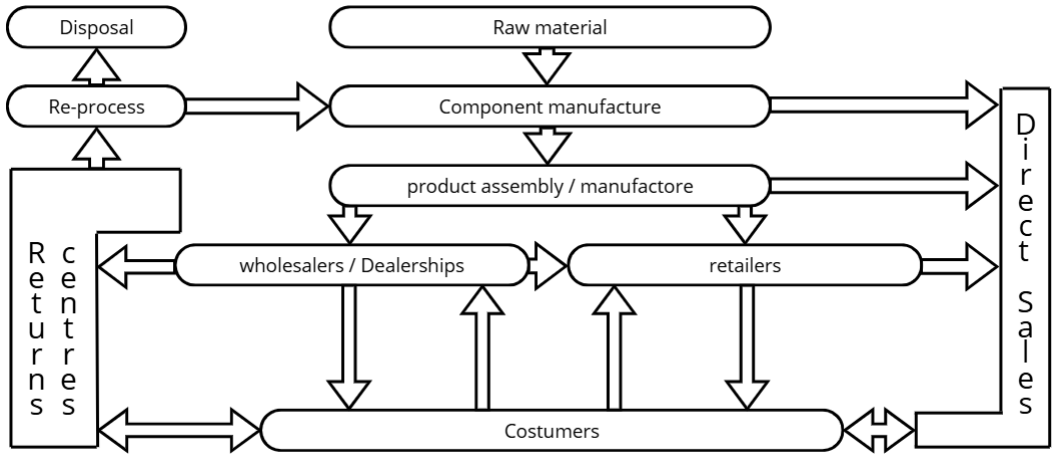
The introduction of sophisticated automation, robotics and advanced software systems into warehouse operations can potentially have an effect on logistics operations. These advances in technology are likely to lead to a significant reduction in staff and improved efficiency. Not all warehouse operations are likely to benefit from such advances or can afford large investments in technology. Automating a bad process might make it quicker but certainly doesn't make it more efficient.

Logistics is very much about trade-offs. Major trade-offs include:

- cost versus service
- storage capacity versus speed of put-away and retrieval
- speed versus accuracy
- lower inventory versus stock availability
- efficiency versus responsiveness
- volume purchases versus storage cost and availability; and
- transportation costs versus storage costs.

Good books are the warehouses of ideas. (H G WELLS)

Figure 1.1 Warehousing in the supply chain



Specific factors that need to be taken into account when deciding on a warehouse location:

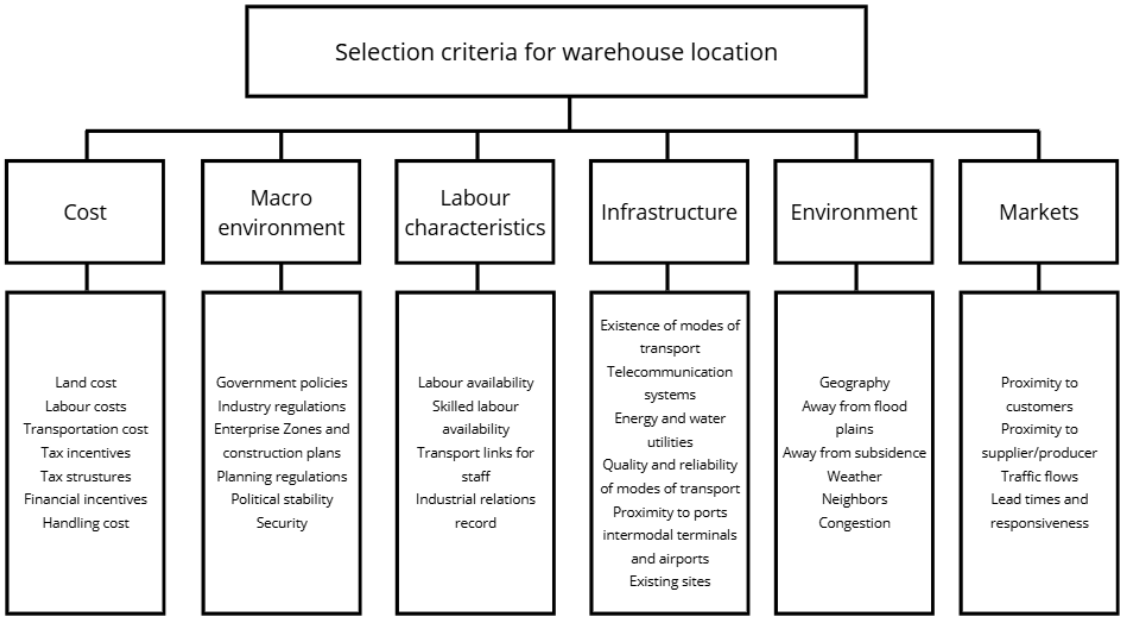
- cost of land, rent and rates
- access to transport networks
- proximity to multimodal hubs
- availability of affordable, skilled labour
- transport links for staff
- availability of funding, grants, etc
- availability of existing buildings
- availability and cost of utilities including telecoms
- availability of finance and resources
- goods traffic flows
- proximity to ports and airports

- location of suppliers and manufacturing points; and
- the potential neighbors (eg proximity to oil storage depots can be a negative factor as ASOS found out to their cost during the Buncefield oil disaster).

In a Savills (2013) survey, the top nine requirements for e-retailing operations in terms of location were as follows:

- land/rent/lease costs
- access to affordable labour
- expansion space available
- close proximity to parcel hub
- close to motorway network
- central location (covering all United Kingdom); close proximity to consumers; government incentive; and
- close proximity to higher skilled labour.

Figure 1.6 Factors determining the location of warehouse



SOURCE *Adapted and reprinted from Expert Systems with Applications, Multi-criteria warehouse location selection using Choquet integral, Tufan Demirel, Nihan fetin Demirel, Cengiz Kahraman, May 2010, with permission from Elsevier*

Role of the warehouse manager

> *Managers today have to do more with less, and get better results from limited resources, more than ever before... A manager's job is to provide the environment where individuals are internally motivated to do the very best job possible, in the very best spirit possible, to make the very best contribution possible.* (BRIAN TRACY)

Job description

- the provision of a responsive and cost-efficient warehouse that is aligned with the current and long-term requirements of the global business strategy
- responsibility for the leadership and direction of the warehouse team
- to ensure that the warehouse is capable of delivering the volume requirements of the business
- to drive continuous improvement in the cost-efficiency of the operations
- to set the long-term vision for the warehouse in line with the strategic plan and to ensure that future volumes and customer service requirements can be met;
- to safeguard the human and physical assets employed in the warehouse
- the management of projects and introduction of new initiatives
- to maintain strong relationships with suppliers; and
- the development and management of industrial relations within the warehouse environment

The six basic principles of warehouse management:

- accuracy
- cost control
- cleanliness
- efficiency
- safety; and
- security

Figure 2.1 Warehouse trade-offs

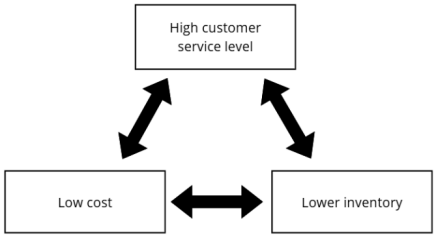
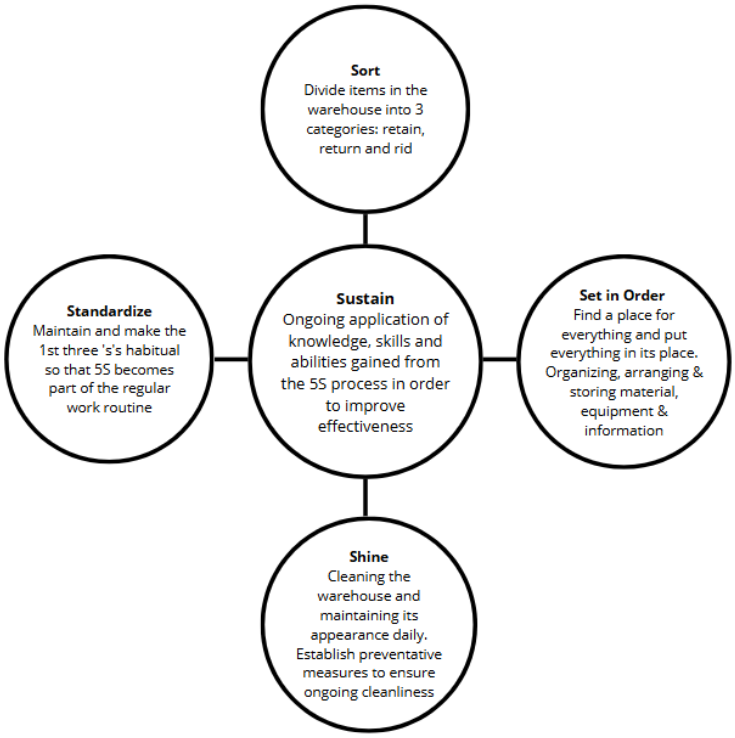


Figure 2.3 Warehouse challenges (adapted from Dematic Corporation 2009)

Challenge	Operational Requirements
Cost reduction	Increase productivity, improve utilization of space, staff and equipment
Achieve the Perfect Order	Improve productivity, increase accuracy, improve handling and invest in systems
Shorter order lead times	Improve processes and increase productivity
Sales via multiple channels and increase in smaller orders	Improve picking strategies such as bilk picking and greater use of technology
Fluctuation in demand	Flexible working hours and improved forecasting
Proliferation of SKU	Improved use of equipment such as carousels, A frames and flow racks
Labour cost and availability	Staff retention through excellent working condition, flexible hours, training and improved productivity
Increasing cost of energy and environmental challenges	Manage energy more efficiently, better use of waste
Data accuracy and speed of transfer	Introduce Warehouse management system and real-time data transfer

Figure 2.5 SS Methodology in the warehouse



Workforce management challenges:

- identifying, attracting and retaining good supervisors, first line managers and team leaders
- attracting and retaining employees
- an ageing and constantly changing workforce, including the introduction of international staff
- identifying training needs
- the need to provide safe, comfortable working conditions
- employment contract negotiations
- introduction of incentive schemes
- compliance with employment and health and safety legislation
- staff discipline; and
- security issues

Ackerman (2000), effective supervisors and managers. Should have nine critical attributes:

1. Excellent communication skills
2. An ability to delegate effectively
3. Motivational skills
4. Problem-solving skills
5. Flexibility
6. A comprehensive knowledge of company processes and procedures
7. Ability to train others
8. Be customer oriented
9. Teamwork skills

- ability to work in a group
- ability to build relationships
- ability to cope under pressure
- negotiating skills
- ability to cooperate
- coordination and allocation of tasks
- influencing skills
- ability to compromise where necessary; and
- ability to make decisions.

Almost all quality improvement comes via simplification of design... layout, processes, and procedures. (TOM PETERS)

Figure 3.2 Warehouse processes

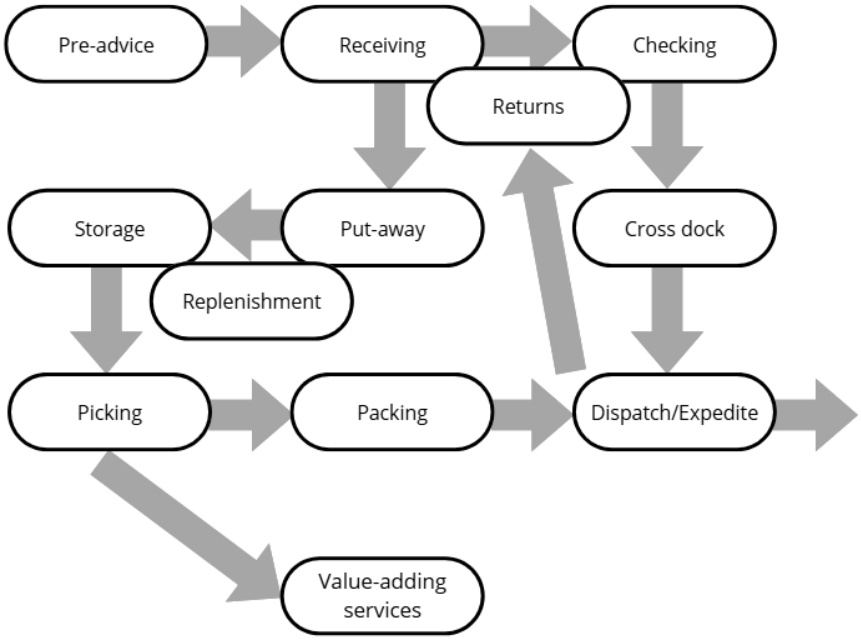
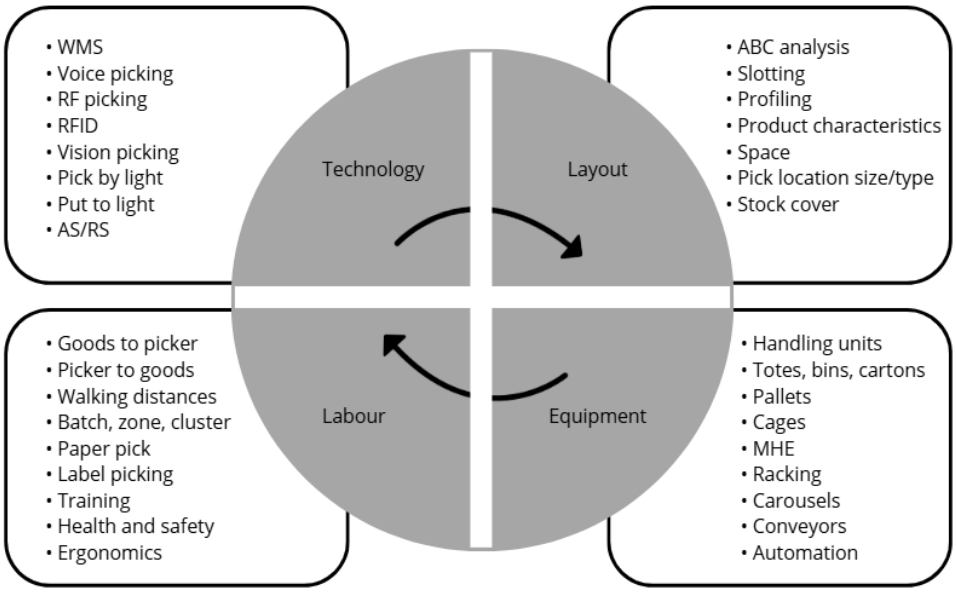


Figure 4.1 Picking interrelationships



'Ten Commandments of picking'

- Design for flexibility and scalability - things change - build for today, design for the future.
- Keep pickers picking... not waiting or undertaking other tasks such as carton erection, packing, labelling, etc.
- Minimize travel.
- Minimize product touches. If you have expert pickers you shouldn't need to check their work.
- Never let pickers arrive at an empty location.
- Measure, measure, measure (productivity and accuracy but also product dimensions).
- Pick logically, slot intelligently.
- Pick accurately - get it right first time.
- Continue to learn and explore.
- Advocate continuous improvement.

Provide:

- good lighting
- ergonomic equipment
- equipment aids (scanners, voice, RFID, vision)
- assistance with heavy items
- placement of product - easy-to-reach shelf locations; and
- clear and unambiguous labels

Figure 5.1 Picking strategies and equipment

Picker	Orders	Handling equipment	Storage methods	Picking operations	Hardware & software
• Picker to goods • Goods to picker • Automated picking • Robotics	• Picker to order • Cluster picking • Batch picking • Zone picking • Wave picking • Compact picking •Order Distribution system	• Pallet jacks • Powered pallet trucks • Cage/trolley • Forklift trucks • Order pickers • Conveyors • AS/RS and Mini-load systems • Ergonomic work stations • Robots	• Bulk/floor storage • Conventional racking • Very narrow aisle racking • Carton flow racks • Shelving • Mobile storage • Carousels • Horizontal • Vertical • A Frames • Automated storage systems	• Paper pick • Pick by label • Scanning • Vision picking • Voice picking • RFID • Automatic • Scanning • Pick to light • Put to light	•WMS • wcs • Slotting software • Barcode scanners • Hand-held • Wearable • RFID scanners • Voice units • Vision glasses

Goods to picker

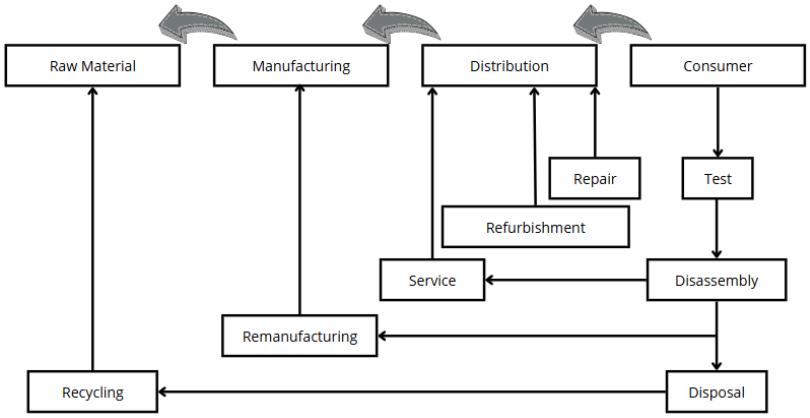
- Eliminate picker travel time, use less labour
- Omit the dedicated pick face
- Reduce system footprint
- Product security
- Ergonomic workstations
- Speed in order selection
- Accuracy
- Decoupled workstations
- High-utilization workstations
- Sequencing
- Order profile
- Efficiently accommodates SKU growth.

There are many different picking strategies that can be utilized within a warehouse operation. Each one will depend on the nature of the product, the velocity of throughout and the company budget.

Table 7.1 Stock classification

Classification	Description	% of stock items
A	Fast-moving stock	20%
B	Medium-moving items	35%
C1	Slow-moving items	
C2	Very slow-moving but required for cover	
O	Obsolete or non-moving stock	45%
S	Special or ene-off purchases	
X	Non-stock or non-standard ítems	

Figure 7.1 The returns cycle (courtesy of University of Huddersfield)



Reverse logistics is:

- level of returns
- available space
- available expertise
- cost
- control and efficacy
- capacity and capability of third parties; and
- lead time from return to available to ship.

Returns management requires:

- decision-making process before product is physically returned
- the use of returns authorization notes
- ongoing measurement of product return cycle time
- training of employees in returns handling
- cross training of staff in warehouse operations and reverse logistics
- use of software to monitor and evaluate product returns
- time slots allocated for receipt of returns
- two-stage approach for returns handling - initial processing to identify quick wins followed by in-depth examination
- use of detailed product return process maps
- availability of packaging material to re-box products

- undertake regular audits; and
- achievement of higher recovery rates (> 80 per cent).

Advantages after introducing three telescopic booms into the operation.

- safer working conditions
- cleaner working area with better visibility
- separation of forklifts and operators
- improved ergonomics: no more rolling of the types, no more lifting of the types
- improved quality of the types
- fewer claims, having introduced a counting and video system on the conveyor; and
- improved productivity:

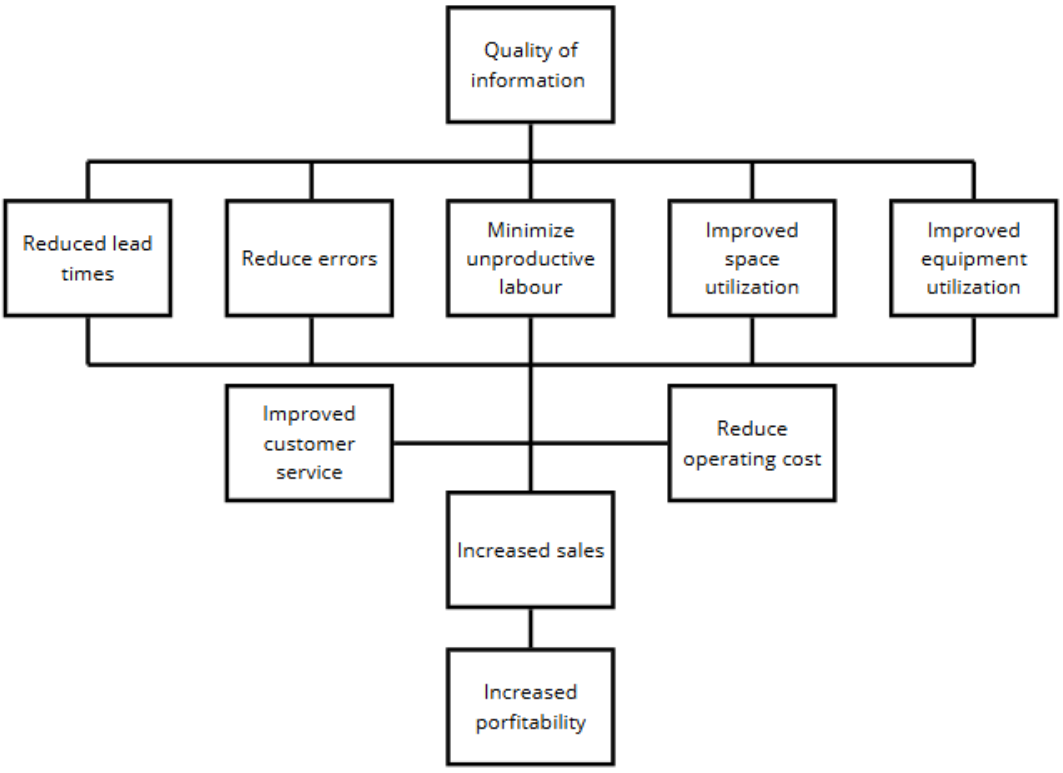
Trade isn't about goods. Trade is about information. Goods sit in the warehouse until information moves them. (C J CHERRYH)

Warehouse management systems

Potential benefits of having a WMS

- real-time stock visibility and traceability
- improved productivity
- accurate stock records
- reduction in miss-picks
- automatic replenishment; reductions in returns
- accurate reporting
- improved responsiveness
- remote data visibility
- improved customer service and
- minimized paperwork

Figure 8.1 Advantages of Quality Information (used with permission of Tompkins Associates)



Selecting the right WMS

- Form a project team
- Define, record, review and improve current processes. Don't automate redundant or poor processes
- Create a list of key functions required of the new system
- Incorporate any future growth plans in your specification
- List the benefits to your company of a WMS
- Research and approach a select number of vendors and select a small number with experience of providing solutions for your market sector

- Visit reference sites to look at operational effectiveness and discuss the benefits the WMS system has brought about since implementation
- Produce a return on investment (ROI) report

What to look for in a system

- Ability to interface with other systems
- Modular and scalable
- Accessible
- Ease of operation
- Standard system
- Meets specific needs
- Capable of supporting warehouse best practice
- Reporting capabilities
- Restrooms

Software as a service

- lower cost of entry
- reduced start-up costs
- smaller learning curve which means quicker adoption across your workforce
- scalability and easy accessibility
- instant upgrades
- user-driven innovation; and
- ability to turn on and off as required, eg to run a temporary warehouse operation

The key to successful purchase and implementation is:

- preparation and allocating sufficient time and resources to the project
- getting your processes right before introducing the system
- producing a base level so that the full benefits of the system can be compared
- getting the buy-in and involvement of senior management and warehouse staff
- choosing the most appropriate supplier; and
- ensuring that all staff are trained to an acceptable level

Warehouse layout: Main floor- space areas

- receiving area
- quarantine and inspection area
- reserve storage area
- value-adding services area
- packing area
- dispatch area
- cross-dock area
- empty pallet and packaging storage area
- MHE charging areas
- equipment storage
- Warehouse offices; and
- Restrooms

Figure 9.5 U-flow warehouse (courtesy of University of Huddersfield)

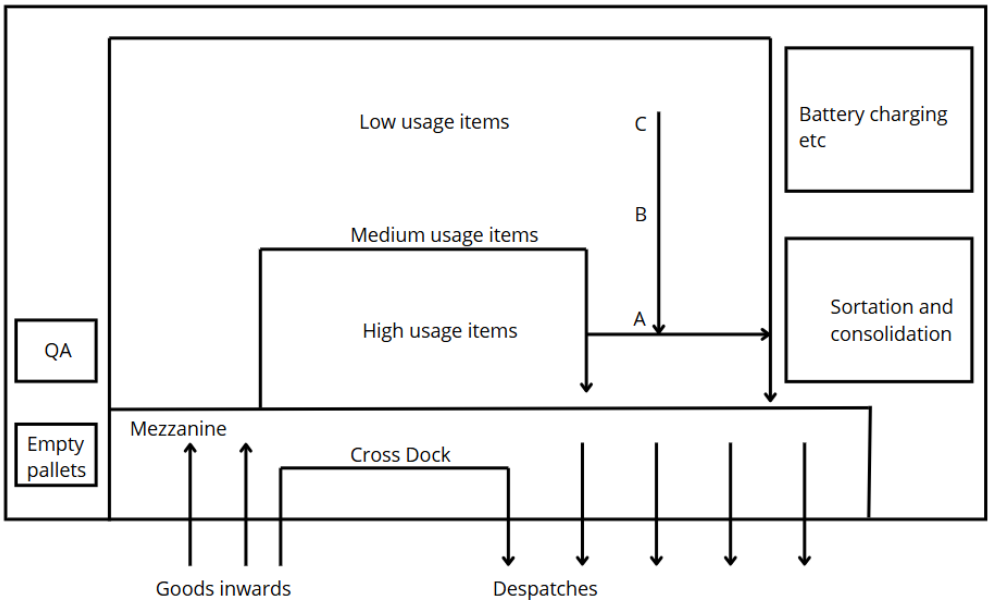
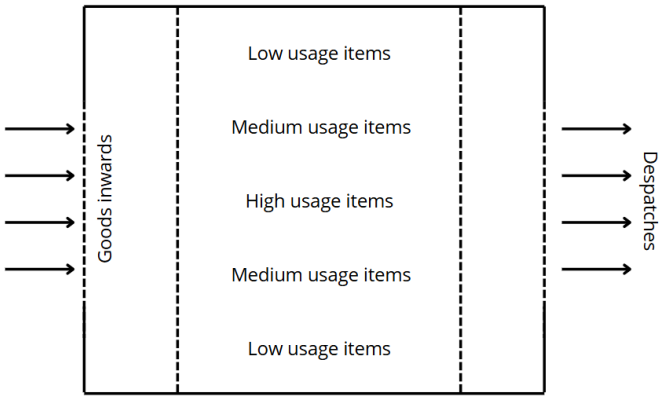


Figure 9.6 Through-flow warehouse (courtesy of University of Huddersfield)



Shortage of space:

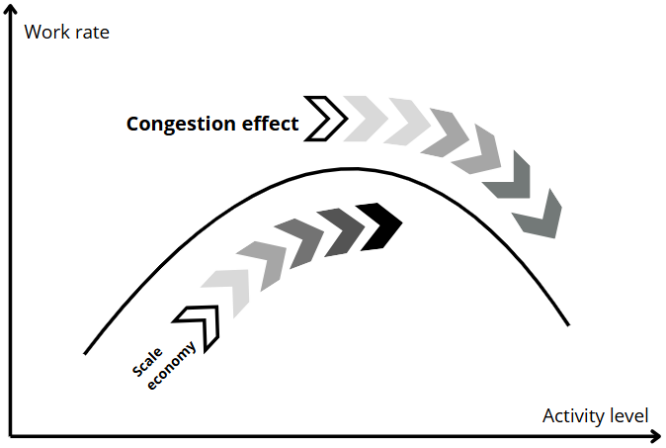
- expanding the warehouse
- renting additional space; and
- creating more space within the existing premises.

Designing or re-designing a warehouse:

- F - Flow (a natural flow of movement through the warehouse)
- I - Throughput (manage peaks and troughs)
- A - Accessibility (to all products)
- C - Compliance (Building regulations and the environment)
- C - Compatibility (of products)
- E - Ergonomics (Staff wellbeing)
- S - Safety (of staff and products); and
- S - Space (full use of cubic capacity).

Resourcing a warehouse

Figure 11.2 Growth factors influencing work rates



Considering start up scenarios or the introduction of significant numbers of new employees, when productivity may build progressively to target:

- fatigue and de-motivation
- congestion
- layout
- re-fuelling trucks; and
- new staff.

Every dollar of cost (or expense) that is cut falls directly to the bottom line. This makes sense because it is true. (ANONYMOUS)

The warehouse costs tend to be made up as follows:

- Labour: 45-50 per cent
- Building: 25 per cent
- Building services including utilities: 15 per cent
- Equipment: 10-15 per cent
- IT: 5-10 per cent

Figure 12.1 Simple Warehouse cost tree

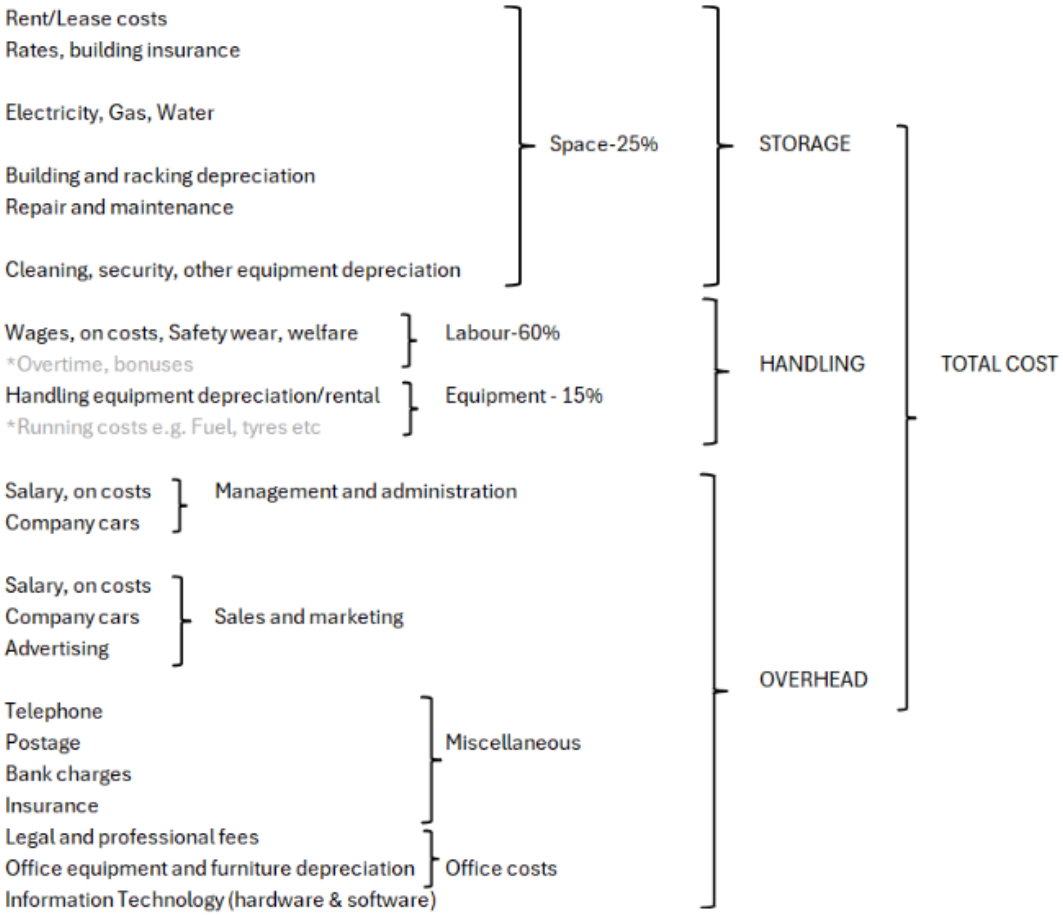
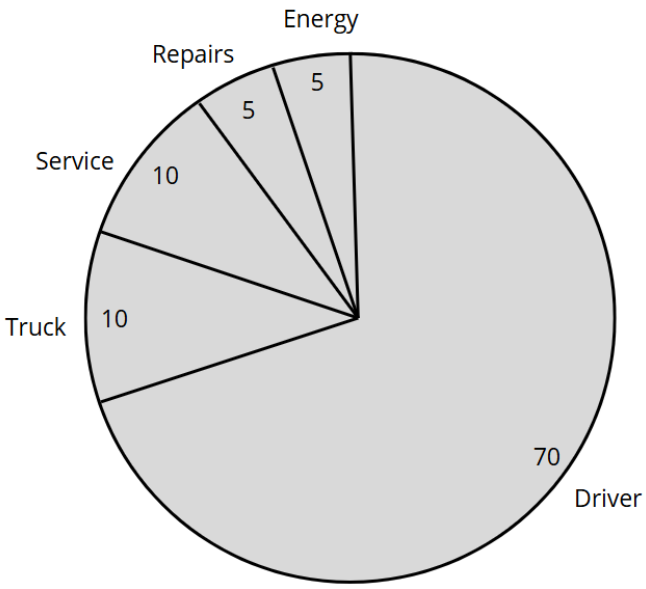


Figure 12.2 Breakdown of the cost of ownership - FLT (courtesy of Toyota)



The cost build-up will be as follows:

- Labour
  - time collection of order
  - travel time to each location
  - pick time at each location
  - travel time to dispatch area; labelling and packing time; checking time (if necessary)
  - loading time
- Equipment - time
  - use of powered pallet truck
  - contribution to voice technology for example
- Other
  - packing and labelling materials; supervisory and administration costs; overhead
  - profit.

Once calculated and divided by the number of cases per order we should end up with a cost per unit outhandled.

> *What you do not measure, you cannot control.* (TOM PETERS)

Ackerman (2003), we should be measuring four areas within the warehouse:

- reliability
- flexibility
- cost; and
- asset utilization

Figure 13.1 Retailer and third-party KPIs (courtesy of Steve Whyman)

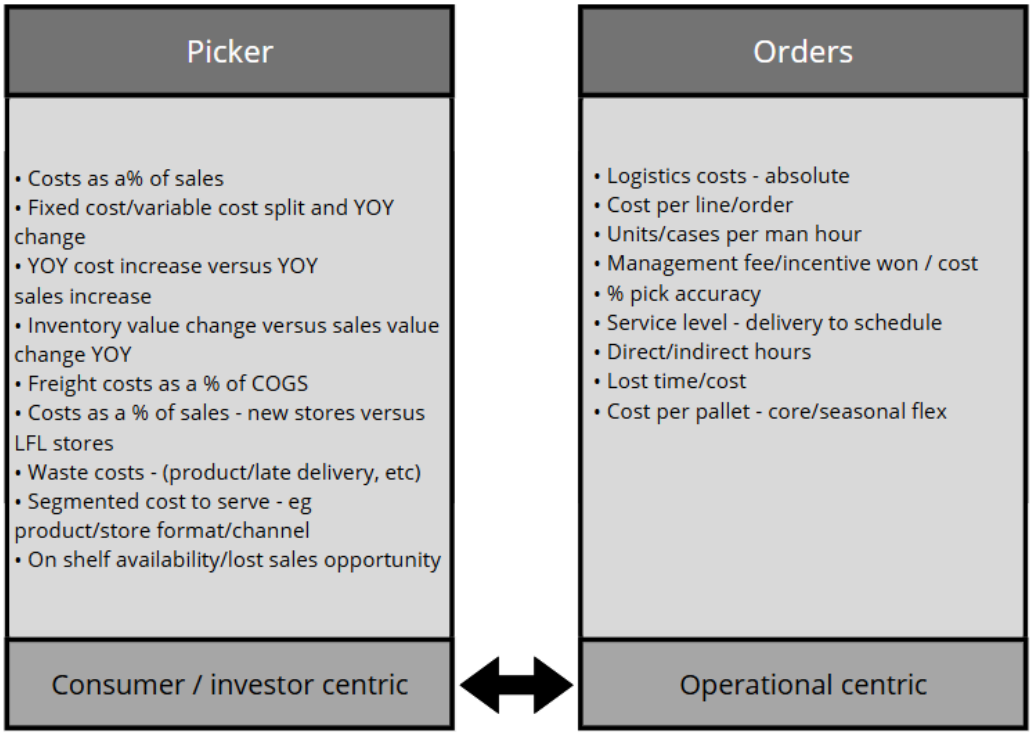


Table 13.2 Department metrics (courtesy of Vitasek 2010)

Departament	Target
Receiving	Reduce dock to stock time
Customer service	Reduce order process time
Picking	Improve pick accuracy
	Increase pick productivity

Table 13.5 Mondelez benchmarking mode

Country and Site UK: 3PL A			
Category			**Units**
Warehouse	**Operational metrics**	Cases despatched (total	Number
		Pallets despatched (total)	Number
		Case pick pallets despatched	%
		Total warehouse cost including overheads	£
	KPIs	Full pallet pick	%
		Cost per case despatched	£
		Cost per pallet despatched	£
Service	**KPIs**	Case fill (Log Ops responsible)	%
		On time in full (Log Ops responsible)	%
Transport IB	**Operational metrics**	Number of cases received	Number
		Number of pallets received	Number
		Number of loads received	Number
	KPIs	Vehicle utilization	%
Transport OB	**Operational metrics**	Number of cases despatched	Number
		Number of pallets despatched	Number
		Number of loads despatched	Number
	KPIs	Vehicle utilization	%
Inventory	**Operational metrics**	Total inventory value	Euro
		Total warehouse pallet capacity	Number
		Number of pallets in stock (month end)	Number
		Value of inventory written off (Log Ops responsibility)	Euro
	KPIs	Warehouse utilization	%
Safety	**KPIs**	LTIFR (global definition)	Number
		Total number accidents	Number
		Number of lost time accidents	Number
Quality	**Operational metrics**	Number of pallets on hold or in quarantine	Number
	KPIs	Cases damaged in transit	Number
		Cases damaged in warehouse	Number
		Transport security incidents reported	Number
Environment	**Operational metrics**	Electricity consumption	KWh
		Gas consumption	Cubic M
		Transport CO2 emissions	Tonnes
		Outbound CO2 per pallet shipped	Tonnes
		Electricity consumption per pallet shipped	KWh

IB=Inbound
OB=Outbound
LTIFR=Lost Time Injury Frequency Rates

in-house operations with that of their third-party logistics providers.

Figure 13.3 The balanced scorecard (Kaplan and Norton 1996)

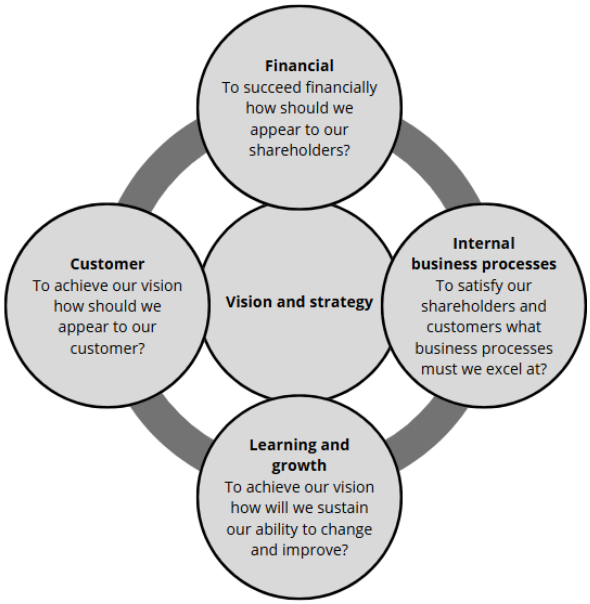


Figure 14.1 The outsourcing decision (Mcivor 2000)

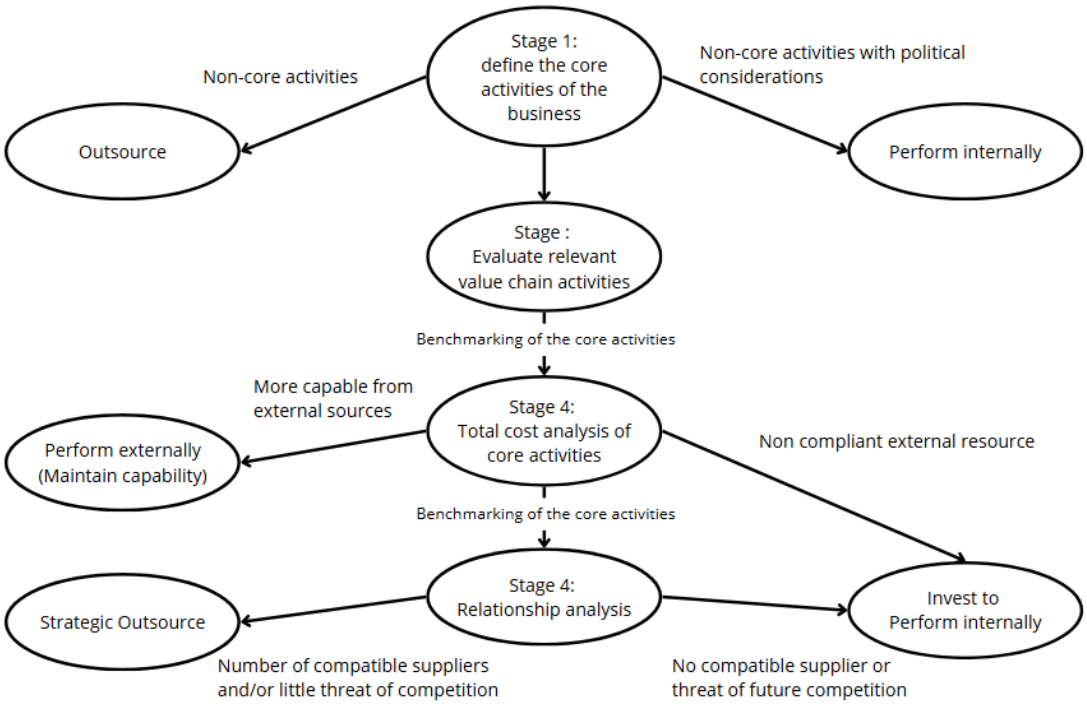


Figure 14.2 Outsourcing decision matrix (Vitasek 2010)

Potential value to the organization		Low	High
	High	Partnership outsourcing approach	Core activity. Do not outsource!
	Low	Transactional outsourcing	Decision based on financial considetations

Organizational Expertise

Table 14.1 Sourcing considerations

Four cornerstones	Primary sourcing considerations
1 Assess the current environment	Link to business objectives
	Requirements analysis
	External market analysis
	Cost analysis
	Supply market analysis
2 Analyze/select the supply solution	Determine overall category approach
	Incorporate Total Cost of Ownership concepts
	Assess the risk level
	Balance value between buyer/supplier
	Determine key category characteristics
3 Execution Planning	Develop a solicitation plan
	Identify supplier selection drivers
	Determine how to manage risk
	Select the preferred contract type
	Develop a pricing model approach
4 Manage and Refresh	Approach to supplier governance/relationship management
	Assess performance management process
	Assess resource levels to support success
	Develop a sound exit plan
	Assess continuous improvement expectations

SOURCE *Strategic Sourcing in the New Economy: Harnessing the Potential of Sourcing Business Models for Modern Procurement (2016)*

Figure 14.3 Outsourcing logistics process (courtesy of FT Group Sourcing 2009)

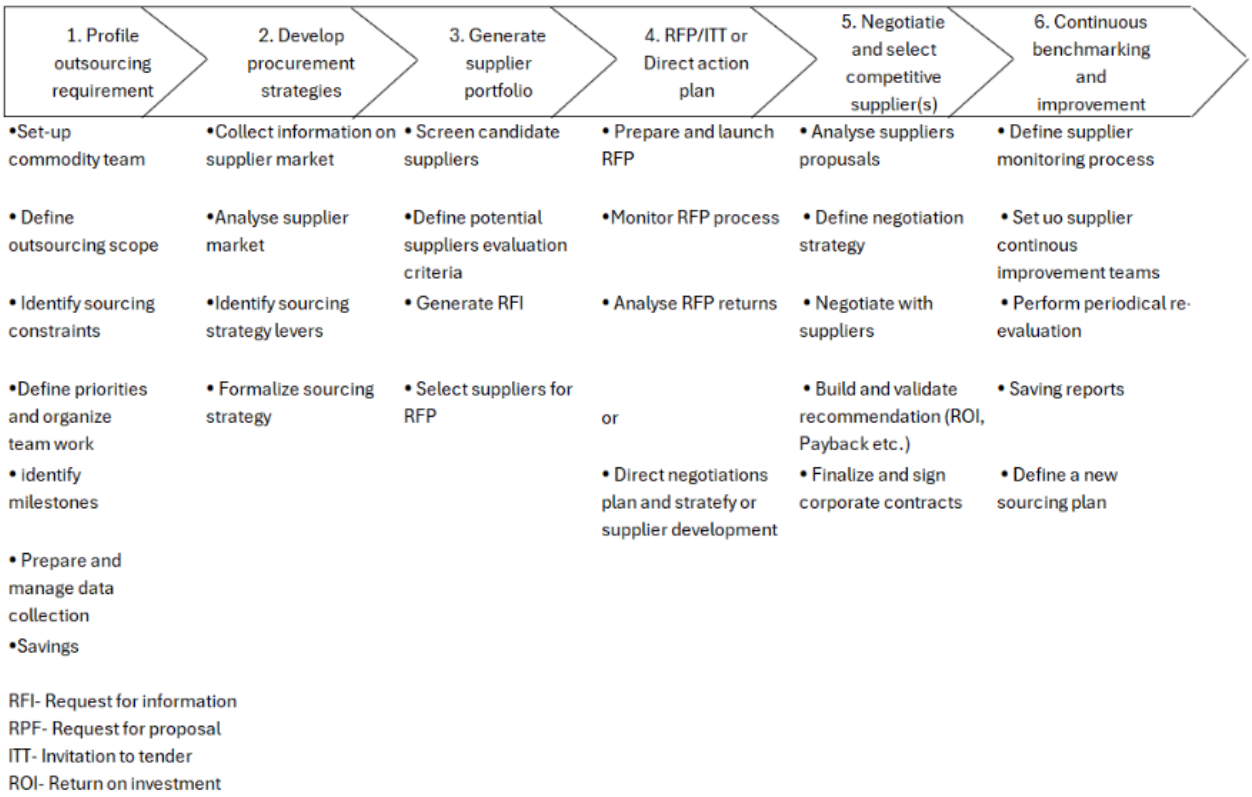


Figure 14.4 Outsourced relationships (courtesy of Steve Whyman)

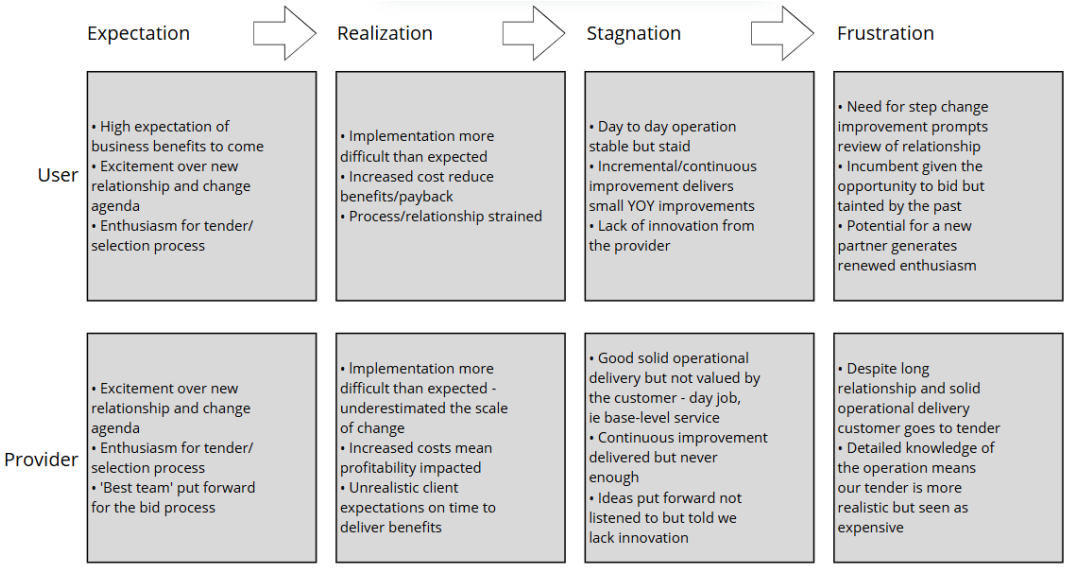


Figure 14.9 The five rules

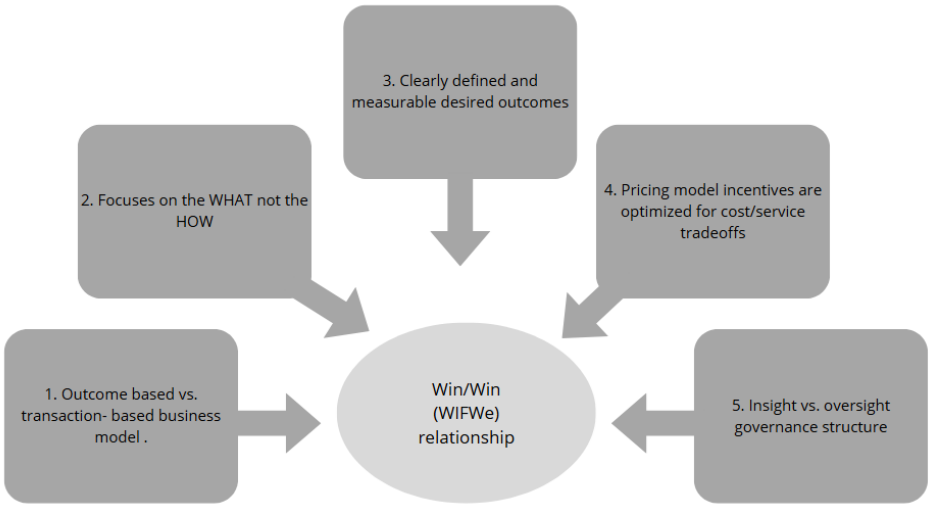
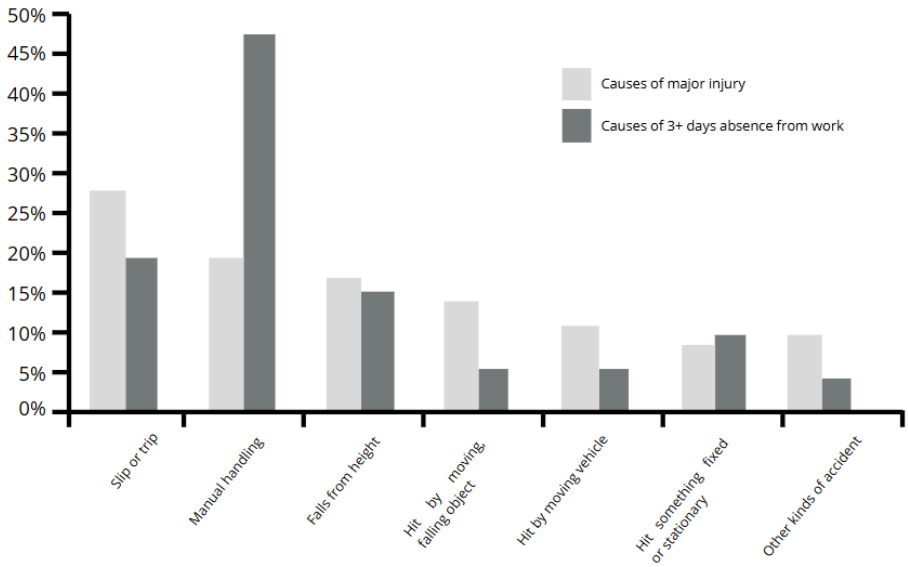


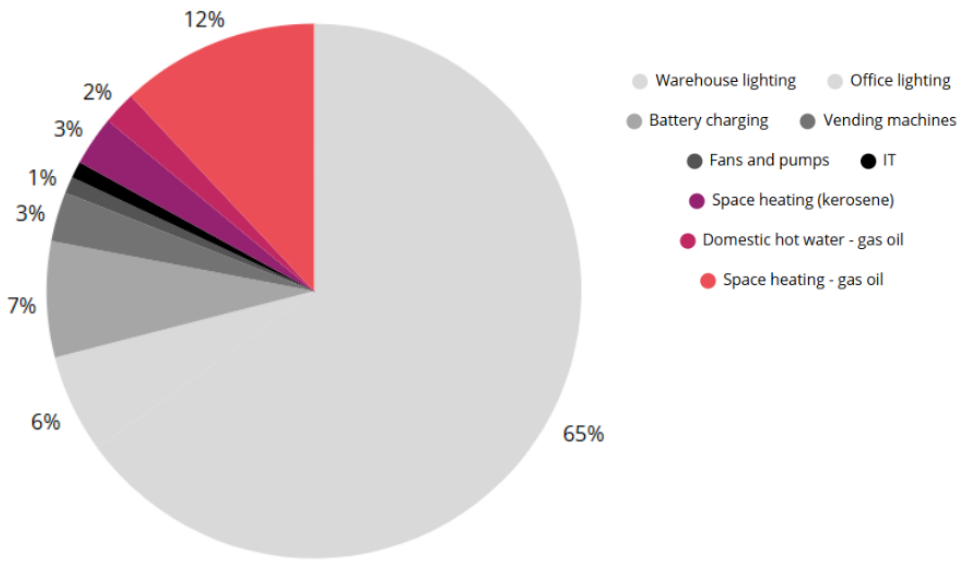
Figure 15.1 Main causes of injuries in the warehouse



Forklift trucks

Triple bottom line: people, planet and profit. (JOHN ELKINGTON)

Figure 16.1 Warehouse energy usage



The warehouse of the future

The best way to predict your future is to create it. (ABRAHAM LINCOLN)

Challenges:

- Smaller, more frequent orders
- Shorter order lead times
- Increase in personalization of items
- A greater proliferation of product lines or SKU
- A requirement for accurate information in real time
- The need to achieve the perfect order to ensure competitiveness
- A requirement for lower overall inventory and overall cost reduction
- An increase in the cost of land
- Increasing labour costs
- Ageing populations in many countries
- A shortage of skilled labour
- A shortage of management knowledge and expertise
- Security of products
- Traceability of items
- Cold chain storage and distribution
- A greater need for systems integration
- The growth in cloud-based systems data security
- Overall data security
- Local and global regulations and protectionism
- Sustainability demands - pressure for more environmentally friendly warehouses
- More buzz words such as Industry 4.0, M to M (Machine to Machine) and the Internet of Things!

Warehouses in highly developed countries will no doubt adopt the latest technology, automation is not for everyone, and warehouses will continue to hold stock and employ staff to receive, put away, pick and dispatch products.

One thing is certain: we cannot afford to stand still!!!