Warehouse Management

INSTITUTE FOR PROFESSIONAL AND EXECUTIVE DEVELOPMENT

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UNIT SPECIFICATION

EDUCATION FOR NOW & THE FUTURE

Designed in England,
United Kingdom

Unit Title

Warehouse Management

Credit value

The credit value for this unit is 30 30 credits equivalent to 300 hours of teaching and learning (10 hours is equivalent to 1 credit) Guided learning hours (GLH) = 50 hours GLH includes lectures, tutorials and supervised study. This may vary to suit the needs and requirements of the learner and/or the approved centre of study. Directed learning = 50 hours: This includes advance reading and preparation, group study, and undertaking research tasks. Self-managed learning = 200 hours: This includes completing assignments and working through the core and additional reading texts. It also includes personal research reading via other physical and/or electronic resources.

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Learning outcome Learner will:	Assessment criteria Learner can:
1.0 Understand the types and importance of warehouses; selection criteria for warehouse location and supply chain trends affecting warehouses.	1.1 Warehouse: It is a designated space, building or facility used for the efficient storage and handling of goods and materials that will be sold or distributed later. Its primary aim is to facilitate the movement of goods from suppliers to customers, helping meet demand in a timely and cost-effective manner. It should be a point of transhipment where goods received are despatched as quickly, effectively and efficiently as possible. A warehouse should be considered as a temporary place where inventory is stored, and as a buffer in supply chains. • The warehouse generally has the following basic processes: (-) Goods are received into the warehouse; (-) Orders are processed; (-) Replenishment takes place (i.e. the process of inventory moving from reserve storage to primary storage, then onto picking locations); (-) Some value-adding services are included; (-) Product despatch. 1.2 Types of warehouses and their uses: • Raw materials warehouses: These are used to store raw materials and components; which must be held in order to ensure continuous production. They are usually situated close to the point of extraction or close to the manufacturing point. • Finished goods storage warehouses: These are used to store products that are ready for sale; thereby providing a buffer or safety stock for companies. Buffer or safety stock enables companies build up inventory in preparation for new product launches, expected increases in demand and to deal with seasonality. • Postponement, customization or sub-assembly warehouses: Used to store products temporarily at different stages in production, these warehouses may also be used in the customization of products before final delivery to the customer. > Postponement and sub-assembly activities < may include: (-) Specific packaging or labelling changed or added (e.g. printing in different languages); (-) Computer assembly to

	include different graphic cards, memory chips, etc.; (-) Country specific items being added such as electrical plugs. • Consolidation and sequencing warehouses: Products are received into these warehouses from different sources and amalgamated for onward delivery to the customer or onto a production line. They also include retail stock consolidation warehouses where products from different suppliers are consolidated for onward delivery to stores. • Transhipment / Break-bulk centres: Products are received in large quantities from suppliers into these centres. They are then broken down into manageable quantities and then delivered to various locations. • Cross dock centres: Cross docking is a logistical strategy where products and materials are unloaded from inbound transportation (such as trucks), and then immediately moved onto outbound transportation with as little storage time as possible. It is a process of receiving products through an inbound dock and then transferring them across the dock to the outbound transportation dock. Cross docking leads to supply chain efficiency by improving speed and productivity. Cross dock centres make this operation possible. • Sortation centres: Goods are received into these centres from all over the country, sorted by zip code or postcode, consolidated and delivered overnight to their respective distribution areas for onward delivery. These facilities, for example, are used by letter, parcel and pallet distribution organizations. • Fulfilment centres: These are facilities (usually provided by third party organizations to online sellers) that warehouses and dispatches products sold online. Products that have been sold online are picked, packaged, labelled and sent out to the customer, by the fulfilment centre staff, as per the postage specification of the purchaser. Some larger online sellers and e-commerce giants have their own fulfilment centres. Some fulfilment centres also handle returns, kitting, labelling and offer cross-docking services. • Temperature controlled warehouses: The key function of a temperature controlled warehouse

	is to maintain the temperature of products at the level at which they were received. • Reverse logistics centres: Reverse logistics refers to the practices and processes set up for organising product returns from points-of-sales to the manufacturer or seller in order to repair, recycle or dispose of these items in the most cost-effective way. Various warehouses have been set up specifically to handle returned items. When customers return unwanted or defective items to stores, the items are consolidated and sent to the returns centre, where they are checked and either repackaged, repaired, recycled or disposed of. • Public sector warehouses: These facilities provide warehousing operations which support the public sector, armed forces and the third sector. 'Third sector organisations' is a term used to describe the range of organisations that are neither public sector nor private sector. It includes voluntary and community organisations (both registered charities and other organisations such as associations, self-help groups and community groups), social enterprises, mutuals and co-operatives. Natural disasters such as earthquakes, droughts and tsunamis have resulted in third sector organizations opening up warehouses in strategic locations worldwide, to ensure that they are closer to disaster areas and are therefore able to react quicker. Supplies for local government facilities such as schools and offices are also stored in other public sector warehouses. 1.3 Lean warehousing: This refers to the concept and practice of eliminating those warehouse processes and activities that are absorbing resources but are not creating any additional value. 1.3.1 Wastes that lean management seeks to eliminate in the warehouse include: • Transport - unnecessary movement of people, products, information and equipment such as empty running forklifts. • Inventory – storing parts, pieces, documentation ahead of requirements or the storage of obsolete items. • Motion – bending, turning, reaching, lifting. Ensure the fast moving items are in easy reach.

	• Waiting – bottlenecks at pick locations. • Over production – holding too much inventory. • Over processing – performing unnecessary steps such as re-labelling and checking. • Defects – time spent correcting errors such as miss-picks. • Skills – underutilizing capabilities, creativity and knowledge and delegating tasks with inadequate training. 1.3.2 The “5S” (Five S) concept that underpins lean thinking that can be applied to warehouse management: • The first S (Sort or Seiri or Clear out): concentrates on removing any unnecessary items from the work area. This can include obsolete and damaged stock, over stocks, defective equipment, broken pallets, waste packaging etc. It can also refer to unnecessary movement within the warehouse. An effective visual method to identify unneeded items is called "red tagging", which involves evaluating the necessity of each item in a work area and dealing with it appropriately. A red tag is placed on all items that are not important for operations or that are not in the proper location or quantity. Once the red tag items are identified, these items are then moved to a central holding area for subsequent disposal, recycling, or reassignment. Items in the warehouse should be divided into three categories; retain, return and rid. • The second S (Straighten or Seiton or Configure or Set in Order): focuses on efficient and effective placement of items, e.g. location labelling and putting frequently used items in easy to access locations. Directional signs in the warehouse are also part of this, as they will help reduce the amount of time taken to find items. A place should be found for everything and everything in the warehouse should be put in its place. Organize, arrange and store material, equipment and information. • The third S (Shine or Seiso or Clean): Once the clutter that has been clogging the work areas is eliminated and remaining items are organized; the next step is to thoroughly clean the work area. Daily follow-up cleaning is necessary to sustain this improvement. Working in a clean

	environment enables workers to notice malfunctions in equipment such as leaks, vibrations, breakages, and misalignments. These changes, if left unattended, could lead to equipment failure and loss of production. Preventative measures must be established to ensure ongoing cleanliness. Staff work better in a clean area; and clean warehouses tend to be more efficient. • The fourth S (Standardize or Seiketsu or Conform): refers to creating standards for each work area. Explain each process with the relevant staff and then produce, document and display best practice procedures within the warehouse. Make them simple to read and understand. • The fifth S (Sustain or Shitsuke or Custom): ensures continuous improvement. Staff must be encouraged not to return to the old ways of working, but to accept change and improve on the new ways of working. Regular checks and audits need to be carried out with the potential for reward on achieving high standards of work. There must be ongoing application of knowledge, skills and abilities gained from the 5S process in order to improve effectiveness. 1.4 Reasons for holding inventory or stock: • To serve as a buffer to manage uncertainty in supply such as lead times, quality and order fulfilment. • To purchase quantities that are economic. • To ensure continuous production runs with a complete set of components. • To stabilize manufacturing by using batch production. • To cope with unpredictable demand and the desire not to pass up a sales opportunity • To provide customer choice. • To take advantage of investment opportunities: Some products can increase in value the longer they are held in storage. These include some fine wine and spirits, precious metals and stones, antiques and fine art. Stock may therefore be held in anticipation of making a return in the future. 1.5 Problems associated with holding excessive amounts of inventory or stock: • Holding excessive levels of inventory ties up cash in the business.

	• Storage: The cost of warehouse space, warehouse staff and any particular storage conditions such as chilled or secure storage. • Management: The cost of management time in counting, finding, moving and inspecting. • Obsolescence: The risk that the product will become unsaleable if held for too long or because product enhancements are required. • Damage: The inventory has the potential to become unsaleable. • Theft: The removal of inventory. 1.6 Multiple criteria must be assessed, which include both quantitative and qualitative data, when selecting warehouse location. > > > Selection criteria for warehouse location include: • Cost: This includes land cost; labour costs; transportation costs; tax incentives and structures; handling costs; and financial incentives. • Macro environment: This includes government policies; industry regulations; enterprise zones and construction plans; planning regulations; political stability; and security. • Labour characteristics: These include labour availability (skilled and unskilled); transport links for staff; and industrial relations record. • Infrastructure: This includes telecommunication systems; energy and water utilities; quality and reliability of modes of transport; proximity to ports, intermodal terminals and airports; and existing sites. • Environment: which includes the geography; being away from flood plains and subsidence; the weather; neighbours; and congestion. • Markets: which include proximity to customers; proximity to suppliers/producers; traffic flows; lead times and responsiveness. > > > Specific factors that must be considered when deciding on warehouse location include: (-) 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; (-) Proximity to economic networks; (-) Location of suppliers and manufacturing points; (-) Potential neighbours. 1.7 Supply chain trends affecting warehouses: • There continues to be strong growth in e-commerce operations both in the business-to-business (B2B) and business-to-consumer (B2C) markets. Customers expect more in terms of value for money, faster order processing and lead times, efficient delivery, returns and after sales services. These customer expectations are greatly changing the way in which warehouses are built, managed and maintained. ^ This requires more fulfilment centres and returns processing facilities. Manufacturers and retailers continue to seek additional cost savings as markets become more and more competitive. As a result of increasing pressure on supply chains, warehouses are expected to become more automated, with many supply chain giants adopting the use of artificial intelligence to help improve productivity and efficiency. ^ Warehouses are expected to be more efficient and cost effective, with the likely closure of inflexible buildings and inefficient operations. ^ It is also expected that retailers will continue to take stock out of the supply chain, leading to increases in stockless depots, transhipment and consolidation centres and cross dock operations. ^ To help protect the environment, warehouses will be expected to reduce their carbon footprints. As they grow in size, warehouses will be expected to have their own means of power generation, be it solar or wind, and may also convert waste into power. ^ Greater collaboration within the supply chain will lead to greater consolidation and an increase in shared-user operations. This will potentially lead to a reduction in the number of smaller warehouses and the construction of purpose-built centres.

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Learning outcome Learner will:	Assessment criteria Learner can:
2.0 Understand the basic principles of warehouse management; the critical attributes of warehouse managers; warehouse managers' responsibilities and the challenges they face.	2.1 Basic principles of warehouse management: (-) Accuracy; (-) Cost control; (-) Cleanliness; (-) Efficiency; (-) Safety; and (-) Security. 2.2 Responsibilities of the warehouse manager: • Providing a responsive and cost efficient warehouse that is aligned with the current and long term requirements of the global business strategy. • Leading and directing the warehouse team. • Ensuring that the warehouse is capable of delivering the volume requirements of the business. • Setting the long term vision for the warehouse in line with strategic plans and ensuring that future volumes and customer service requirements can be met. • Safeguarding the human and physical assets employed in the warehouse. • Managing projects and introducing new initiatives. • Maintaining strong relationships with suppliers. • Developing and managing industrial relations within the warehouse. 2.3 Trade-offs warehouse managers are expected to recognize and balance include: • Increased throughput versus reduction in labour costs. (Warehouse throughput refers to the number of units that can be processed in a given period of time.) • Storage density versus quicker pallet extraction. • Manual versus costly automated processes. • Increased pick rates versus accuracy. • Inventory holding costs versus cost of stock outs. • Speed versus safety. (A trade-off is a kind of compromise that involves giving up something in return for getting something else.)

	2.4 Main pressures and challenges faced by warehouse managers: • Pressure to reduce operating costs: The supply chain is being targeted by companies as an area where costs can be greatly reduced. There is therefore increasing pressure on warehouse managers to reduce costs whilst increasing customer service at the same time. • Pressure to achieve the perfect order: A perfect order is an order that has been delivered to the customer on time, in full, in perfect condition and accompanied by the correct paperwork. The perfect order rate KPI measures how many orders can be shipped without incident, where incidents refer to damaged goods, inaccurate orders or late shipments. Attaining a high perfect order rate should be the goal of every supply chain organization (and the warehouse manager) as it indicates organizational efficiency and high customer satisfaction. Warehouse managers have the task of ensuring that their warehouses are achieving high rates of perfect orders, in a fast moving and highly competitive business environment. • Shorter order lead times and stock availability: Order lead time is the length of time between the placing of an order and the receipt of the item by the customer. In today's business environment, competitive advantage is gained through fast, timely and accurate delivery. Competitive advantage must be gained through offering the best service by whatever channel the consumer decides. The most effective warehouses are those that have adapted swiftly to the changing times and have reduced order lead times, at reduced costs, without compromising on quality. • Delivery through multiple channels: Businesses are selling to customers using multiple channels in recent times. Warehouses, therefore, have to be able to present goods to customers in a variety of ways. These may include direct delivery of single items to the end user, multiple SKU (stock keeping unit) orders direct to store, and bulk orders to retail distribution centres. Each of these has its own different pick requirement, and is likely to rely on different skills and equipment. • Smaller, more frequent orders: Just-In-Time methods, increasing internet sales and initiatives

	such as efficient consumer response (ECR) and quick response (QR) are resulting in smaller, more frequent orders. This has necessitated changes in warehouse operations, with a move away from full pallet picking to carton and individual item picks. • Greater fluctuations in demand: High demand of certain products due to seasonality, pre- and post- Christmas sales, heavily discounted high demand sale seasons (such as Black Friday) are stretching warehouse resources to the limit as the rush to get products to stores intensifies. Organizations must be able to have adequate resources in place to meet demand during these peak periods; and have a much leaner operation during slower, quieter periods. • Sourcing experienced warehouse operatives: Warehouse managers must find ways to attract new staff. In many instances, working in a warehouse is not seen as being the most glamorous of occupations, and this discourages many young people from entering the industry. In some countries, an aging population and periods of high employment generally affect warehouse labour availability. Warehouse managers must be able to come up with creative ways of attracting and retaining their needed workforce. For example, by being flexible on working hours, which could include allowing shifts that coincide with school hours (for parents) or with spouses' work hours. Shifts could also be varied to coincide with worker preferences. • Environmental issues: Warehouse managers must see to the reduction of their warehouses' impact on the environment. This includes areas such as energy consumption, relating to lighting, heating, cooling and mechanical handling equipment (MHE). In addition, a warehouse can generate a lot of waste in its daily operation, therefore, the issue of waste must be a priority on the environmental agenda. • Data and information transfer: Data management is one of the challenges faced by warehouse managers. Modern supply chains produce vast amounts of data, and it is up to the warehouse manager among others to analyse this data and use it effectively. It must also be ensured that the data is transferred to the correct location. It is important that the warehouse manager is able to track items throughout the supply chain.

	2.5 Critical attributes of warehouse supervisors and managers: • They must have excellent communication skills: The ability to receive and convey messages clearly and explicitly. Miscommunication leads to confusion, wasted effort and a missed opportunity. • They must have an ability to delegate effectively: When a task is delegated, managers and supervisors must not oversee the task too closely; neither should they abrogate responsibility. They need to monitor how the task is progressing and give feedback on performance. • They must have motivational skills: Managers and supervisors need to understand their staff and adapt their approach to motivation and feedback according to each person's needs. Providing staff with consistent feedback when they are performing well, is as important as the feedback given to less well performing staff. • They must possess problem solving skills: Problem solving is about using logic, as well as imagination, to make sense of a situation and come up with an intelligent solution. It requires an individual to identify and develop options, and having done so, act decisively. Problem solving skills go hand in hand with decision making skills, all of which must be possessed by the warehouse manager. • They must be flexible: In today's ever-changing business environment, warehouse managers and supervisors need to be flexible, react quickly to urgent requests and shift priories easily. They oversee and undertake many different tasks, and as result must be able to handle stress caused by the pressure to meet deadlines. • They must have comprehensive knowledge of company processes and procedures: Warehouse managers and supervisors need to have a wide and detailed understanding of policies and procedures of the organization so that they can effectively train warehouse operatives and coordinate their work. They must be involved in, and be party to the compilation of warehouse procedures and processes. They must know both the administrative and operating procedures in the warehouse.

	• They must have the ability to train others: Warehouse managers and supervisors need to be able to pass on their knowledge effectively to their staff to ensure consistency and continuity. Effective training leads to better staff retention and supervisory succession within the company. • They must be customer oriented: Warehouse managers and supervisors must be fully aware of customer requirements and manage warehouse operations in such a way that customer satisfaction is achieved; whilst at the same time bearing in mind costs and the trade-offs that are potentially involved. • They must possess teamwork skills: Warehouse managers and supervisors must be able to work in groups, build relationships, cope under pressure, negotiate effectively, coordinate and allocate tasks, compromise where required and take decisive actions in the interest of their groups. They must be able to effectively communicate company goals to their teams, and outline how the teams are going to work towards achieving them. 2.6 Training: • Effective staff training is paramount for the efficient operation of the warehouse. Management must ensure that all warehouse staff receive an induction. It is useful to have a simple process flow map which shows the end-to-end supply chain and how each step impacts the final customer. This will engage warehouse staff and make them feel part of the bigger process. ^ Management needs to undertake a training needs analysis to identify which staff require specific types of training. ^ Effective training helps to engage staff and should be an ongoing process. ^ Training across disciplines not only provides the operator with a sense of progression but also builds flexibility into the operation. ^ Staff operating mechanical handling equipment (MHE) must be trained on each individual piece of equipment and obtain a license from the relevant authorities. ^ Staff must be shown how to lift heavy items without causing injury.

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Learning outcome Learner will:	Assessment criteria Learner can:
3.0 Understand key warehouse processes, systems and equipment use. These processes include receiving and put away, pick preparation and strategies, order picking methods, stock replenishment and reverse logistics.	3.1 Preparing to receive goods into the warehouse (Pre-receipt): • It must be ensured that suppliers present goods or products to the warehouse in the most appropriate way. ^ The warehouse manager must get involved in specifying and agreeing the packaging, items per carton, cartons per pallet and any specific labelling required, together with size of pallet and the mode of transport to ensure that the products ordered compatible with the storage facility. In light of the foregoing, it is recommended that samples are ordered and despatched in their transit packaging to ensure full compliance. ^ The method of delivery must be compatible with the unloading equipment available at the warehouse. ^ There needs to be consistency by product line to ensure accuracy during stock counts and reduce picking errors. For example, different suppliers of the same generic product packing in different quantities may lead to inaccuracies and delays both on receipt, picking, stock counting and despatch. ^ Discussions between the warehouse, procurement, customer services and the supplier should prevent many of these problems encountered in the warehouse. The premise is to discuss requirements with the supplier and if needed, request for things to be done differently. Measures must be put in place to identify suppliers who are not performing to standard and work with them to introduce improvements. ^ The arrival and departure of a significant number of vehicles each day at the warehouse will require the use of a yard management system to ensure that there is sufficient space to park the vehicles and that each vehicle is allocated to the correct dock door. The use of CCTV cameras will allow yard controllers to manage the movement and parking of vehicles efficiently. 3.2 Receiving/ In-handling:

	• Receiving, goods in or in-handling is a key process in warehouse operations. It must be ensured that the correct product has been received in the right quantity and in the right condition at the right time. Handling a product, the least amount of time possible (i.e. labour touch points) leads to reduced labour hours and as a result, reduced cost. Depending on the operation, labour can be the single biggest cost within a warehouse. It is also the most difficult cost to control. (-) Use of pallets: A pallet is a portable, horizontal, rigid platform used as a base for assembling, storing, stacking, handling and transporting goods as a unit load. Pallets allow goods to be lifted as a unit by a forklift, a pallet jack, a front loader, a jacking device, or an erect crane. ^ The benefits of palletizing products include protection from loss or damage during handling and transportation, and reduction in the number of people required to load and unload containers. The process of loading and unloading goods is sped up with palletization. > The trade-off, however, is the reduction of space utilization, at loading and despatch bays, and in containers. Depending on the number of pallets used in a (shipping) container, reduction in space utilization can be up to 10% of the space for the pallets alone. Additionally, depending on the load configuration, shipping costs can increase between 15 and 33% when using pallets for transporting large volumes of goods. (-) Use of slip sheets: Slip sheets are constructed from fibreboard, thick cardboard or thin plastic in the shape and size of the unit load, with the thickness of the sheet being approximately 2 centimetres. The load is placed on the slip sheet within the container and on arrival at the final destination, the slip sheet together with its load is removed by means of a specialist forklift attachment and placed on a pallet for storage. ^ Slip sheets increase the loading cube within the container, reduce the time taken to offload containers and are easier to clean. > However, they require both despatch and receiving warehouses to purchase a special

	attachment for the forklift truck. ^ Conduct your own additional research on the use of slip sheets < 3.3 Offloading: • ^ Vehicle details should be checked against the booking reference, and delivery notes against the advanced shipping notification, upon arrival. ^ Where relevant, vehicle seals must be checked against the delivery paperwork to ensure that the load has not been tampered with on route. ^ Before offloading temperature controlled vehicles, the temperature history of the vehicle whilst in transit needs to be checked, together with the current temperature of the goods. ^ Once the vehicle has been positioned at the appropriate bay for offloading, the in-handling team must have appropriate labour and equipment at their disposal to efficiently manage the offloading process. It is advisable to take photographs of the loads before offloading. This will be useful should there be any disputes regarding the load at a later stage. 3.3.1 Automatic unloading systems: • Equipment companies have introduced a variety of automatic unloading systems to speed up the process of unloading. These include the use of rollers, tracks, slip chains, loading plates, giant slip sheets, boom conveyors and automated guided vehicles. Automated unloading systems are particularly useful in high volume situations. Automation increases productivity, reduces staff fatigue and injuries, and positively contributes towards staff retention. For example, there is less bending and twisting involved with the use of a boom conveyor, as the conveyor is at a manageable height. The conveyor can be static or can be moved between loading doors as required. It can be extended into a trailer or container as cartons are unloaded, reducing the amount of operator travel. With the increase in automation, there is greater emphasis on uniform cartons as robots are now utilized for building pallets both on intake and for despatch. 3.4 Checking and quality control: • After offloading, some form of checking must take place before goods are put-away.

	Depending on the circumstance, the whole consignment can be checked or only a few goods may be randomly checked. For example, you may randomly check the goods of suppliers known to have a good track record of accuracy and consistency, whereas you may check the whole consignment of new suppliers or suppliers known not to perform to standard. Recording and reporting discrepancies both internally and externally are fundamental to the receiving process. ^ Some retailers have introduced Good Faith Receiving (GFR) where products are accepted into the distribution centre or store without checking on arrival. Random checks are undertaken and any discrepancies found are charged to the supplier on a pro-rata basis. GFR pressurizes suppliers to increase the accuracy of their shipments. ^ The utilization of barcode scanners has sped up the checking process greatly and also improved accuracy. Products can be scanned and the details compared in real time (where the appropriate technology has been installed) with the expected quantities to determine any discrepancies. ^ The introduction of Radio Frequency Identification (RFID) further reduces checking time as receiving bays. RFID uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID tag consists of a tiny radio transponder; a radio receiver and transmitter. Products that have tags fitted can be recognized and counted immediately on entry to the warehouse and details passed in real time to the warehouse management system. ^ Weighing scales may also be used for products that are not easy to check or are stored and sold by weight. ^ Certain products such as high-value items, food, hazardous goods, temperature-sensitive products and pharmaceuticals will require more stringent checking on receipt. An area close to the receiving bay should be set aside to spot-check items on arrival. This needs to be done as promptly and as efficiently as possible to avoid congestion and to get the products onto the system quickly. If there are issues, the items need to be taken to a specific quarantine area or,

	if space is an issue, to the storage area – but must be identified as defective or awaiting the results of tests. The warehouse management system (WMS) must be able to block access to products on the system, making them unavailable for picking until cleared for sale. Placing a physical sign at the location will serve as an additional failsafe. 3.5 Cross docking: • Cross docking is a logistical strategy where products and materials are unloaded from inbound transportation (such as trucks), and then immediately moved onto outbound transportation with as little storage time as possible. It is a process of receiving products through an inbound dock and then transferring them across the dock to the outbound transportation dock. Cross docking leads to supply chain efficiency by improving speed and productivity. ^ Cross docking requires the full support of suppliers as to how they present the product. This includes clear labelling and advance notice of arrival together with accurate, on-time delivery. The supplier is required to deliver the product in time for the departing vehicles to be loaded. Each departing vehicle may be taking cross docked items and items from the warehouse, as such the operation must be properly coordinated and the goods consolidated accurately. ^ Cross docking requires systems to identify the product that needs to be cross docked and a process needs to be in place to recognize and alert staff. ^ Sufficient space is required to moving products quickly and safely. Congestions in cross docking areas will slow up the process in a great deal and lead to potential tension between teams. There must be a well-marked staging area where the products can be placed prior to despatch. ^ Cross docking requires a lot of consideration and preparation. It must be programmed and monitored carefully, and requires a good collaboration among all members of the chain. 3.6 Recording: Product codes, descriptions, quantities, batch or lot numbers and serial numbers may be recorded, as part of this process.

	3.7 Put-away: • Put-away is the process of moving goods from the unloading bay and transporting them to the warehouse's storage, replenishment, or pick area. The put-away area can be managed by calculating resource and space requirements based on expected receipts and current backlogs. Products should be put away the same day they are received, because not doing so affects space, causes congestion, increases transaction errors, and makes product more susceptible to damage. ^ Today's warehouse management systems can allocate product locations in advance and instruct the operator as to where to place goods. Some warehouse systems will combine put-away with pallet retrieval, in a system called task interleaving or dual cycling. Task interleaving is the process of combining different tasks on a single trip within the warehouse. A warehouse worker will combine picking and put-away in one trip rather than performing the pick and the put-away in two separate trips. The system will instruct the operator to put away a pallet en route to collecting a picked full pallet or one that is required for replenishment. ^ In the absence of a put-away warehouse management system, the warehouse manager needs to calculate the optimum location for the goods and instruct the operators accordingly. Decisions must be made as to whether products should be placed in fixed or random locations. Specific product characteristics will affect product location decisions. Fast-moving items should be placed in the middle row of shelving (for example) so that the order picker doesn't have to spend time bending and stretching. Slower-moving items should occupy the lowest and highest shelves. 3.8 Steps to help improve productivity in the receiving and put-away area: • Allocate the supplier a time for delivery. • Estimate time to unload, check and put-away. • Allocate sufficient labour and mechanical handling equipment (MHE) for unloading. • Check if load requires special handling and also check for any special handling instructions

	(hazardous, fragile, temperature control, etc.) • Unload and check quality of delivery. • Record variances. • Attach label or ID tag. • Clear dock area and ensure that goods are on system and available to pick. • Locate effectively using system directed put-away. • Check stock rotation policy. • Undertake task interleaving or dual cycling – put-away and retrieve in same movement. 3.9 Pick preparation: • "Picking" refers to the process where products or goods are picked from a fulfilment centre or warehouse to satisfy customer orders. Although a simple concept, in practice, warehouse picking processes can be complex, especially in the case of large warehouses. Order picking processes can involve significant costs and affect customer satisfaction levels. Therefore, improvements in warehouse picking processes are required to help companies operate more efficiently and productively. ^ In order to be productive and efficient in the picking process, a great deal of preparation needs to take place. This includes having a comprehensive understanding of the products and their sales patterns. Placing products in the most appropriate location reduces travel distances and strain on operatives and as a consequence leads to improved productivity and overall cost reduction. ^ Prior to laying out a warehouse, deciding on the most appropriate handling equipment, installing storage systems and deciding on which form of picking system to introduce, and a full ABC analysis of stock movements and stock held, should take place. ABC analysis or classification refers to three classes or categories used in an inventory control or management system. The first, A, is the category for items that are outstandingly important, or business critical. The second, B, is the classification for items of average or middling importance.

	Category C is the designation for relatively unimportant items. Each class must to be handled differently, with more attention usually devoted to category A items, with less to B and still less further to C. ABC analysis is used by many companies to produce an effective warehouse layout, and is also part of the slotting process. Understanding ABC analysis begins with the understanding of Pareto's Law or the 80/20 rule. Pareto's Law or the 80/20 rule states that roughly 80% of effects come from 20% of causes. Example of the 80/20 rule in relation to the warehouse include: 80% of sales come from the top 20% of product lines; 80% of sales come from 20% of customers; 80% of staff problems come from 20% of the workforce, etc. ^ The picking area layout should be based on the number of pick-face visits, taking into account, size and weight of the products, and any special circumstances such as high security items. o Slotting: Slotting is a tool that calculates the optimum location for products within a warehouse. It is used to reduce the amount of travel time for operators by not only placing fast moving products close to despatch but also places items that frequently ship together next to each other in the pick-face area. Slotting can also take into account seasonality and suggest product transfers. The system can take into account parameters such as value, cube, weight and crushability. The slotting software can be integrated within many modern warehouse management systems (WMS) or can be sourced separately. ^ Successful warehouse slotting maximizes the use of available space within a warehouse through more efficient storage and picking, while reducing handling costs. This is accomplished by optimizing inventory location within the facility in relation to personnel and other factors. Efficient slotting allows for fewer workers to pick more orders more efficiently, ultimately reducing funds spent on labour. ^ Slotting can determine how many and what size of pick face is required for each product line. Very fast moving lines will require multiple pick faces to avoid a bottleneck at a single location.

(-) Order profiling: Through the profiling of the activity of items and orders received into the warehouse, it will be possible to determine which pick method to use, how much space to allocate and therefore where and how to store the product.

(-) Ways through which orders can be analysed > > Orders can be analysed as follows:

- Lines per order: This examines how many different product codes make up an order, and as a result will be possible to calculate how many pick locations will be visited for each order.
- Cube per order index (COI): This calculates the ratio of a product line's space requirement at the pick face to the number of picks per day. The ratio makes it possible to decide on which position in the pick run a particular item should be placed. The lower the COI, the better the space utilization of the product and therefore, it should be placed nearer to the despatch bay at the front of each run of racking.

3.10 Picking strategies and equipment: 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 throughput and the company budget. It is likely that multiple strategies will be used in today's warehouse as they look to cope with multichannel distribution requirements.

> > > The three categories of pick strategies include: - Picker to goods; - Goods to picker; and – Automated picking.

- Picker to goods (person to goods system): Many small to medium sized warehouse continue to operate picker to goods operations, with little automation.

  (-) Types of picker to goods methods or systems:

  - Pick to order (individual order pick or discreet order pick): This remains the most common method of picking. With this method, the picker takes one order or part of an order, and travels through the warehouse, either on foot with a cage or trolley or pallet using a pallet jack or fork lift truck, collecting items until the whole order is completed. The picker follows a route or pick path designated, by reading a paper pick list, reading instructions on

	a radio data terminal or following voice commands. Orders are picked in sequence for a specific customer order. (-) Advantages of pick to order: - Single stage operation; - Flexible; - Quick implementation; - Ability to isolate urgent orders; - Utilizes manual or technology systems. (-) Disadvantages of pick to order: - Low pick rate; - Very labour intensive; - Can result in bottlenecks at the pick face; - Training can take some time depending on the tools used. o Cluster picking (sort whilst picking): With this process, pickers pick items for multiple orders at the same time by clustering them into pick clusters. To reduce overall travel time, operators can take a number of orders out into the warehouse at the same time and pick into individual compartments on their trolleys or cages. (-) Advantages of cluster picking: - Multiple orders picked at the same time; - Reduces travel in the warehouse; - Reduces overall pick time. (-) Disadvantages of cluster picking: - Training can take some time; - Accuracy can be an issue; - Requires experienced pickers if a put to light system is not utilized; - Urgent orders cannot be separated easily; - Requires equipment to hold multiple orders; - Requires system assistance to combine orders; - Can result in bottlenecks; - May require second stage to park orders. o Batch picking: With this picking strategy, operators pick products for a number of orders at the same time. This is similar to cluster picking; however, rather than have a cluster of separate orders, these orders are consolidated into one pick list, and once picked, are later broken down into their constituent orders. (-) Advantages of batch picking: - Multiple orders picked at the same time; - Increased accuracy; - Very effective for e-commerce orders where there are 100s of orders for a single line; - Reduced travel; - Can be used successfully in cross dock operation. (-) Disadvantages of batch picking: - Urgent orders cannot be separated easily; - There is a need to return unallocated items to stock; - Requires sortation area and additional staff; -

	Requires system assistance to combine orders. > > There are two alternatives to batch picking: - Pick by line (***Conduct your own further research***); and – Pick to zero (***Conduct your own further research***). o Zone picking: With this picking strategy, products are picked from defined areas in the warehouse and each picker is assigned to a specific zone or zones and only picks items from within those zones. Zone picking can be effective in operations with large numbers of SKUs (stock keeping units), multiple orders and low to moderate picks per order. E.g. mobile phone and computer games retailers. The level of activity will determine the number of zones or pick locations allocated to each picker. Orders are moved from one zone to the next as each zone completes its pick. This movement can be undertaken by a cage; trolley or pallet being passed from one operator to another. However, it is more commonly done by conveyor. The volume of orders sent to each zone needs to be controlled so that each sector has an equivalent amount of picks. Zone picking can be described as a pick and pass operation, and tends to operate with a pick to light system***, although it can be manually operated. As an operator scans the next order to arrive in the zone or as the tote passes a barcode reader on the conveyor, a number of lights illuminate in the section. A digital display denotes the number of items to be picked. Once the pick is completed, the light is turned off and the picker goes to the next illuminated location. (-) Advantages of zone picking: - Less travel for the operator; - Orders can be picked simultaneously or sequentially; - Can accommodate different families of items on orders such as hazardous, temperature controlled, etc. (-) Disadvantages of zone picking: - Normally requires conveyors; - Cost of equipment; - Normally combined with pick/put to light systems; - Can lead to idle time if work is not balanced between zones. o Wave picking: Wave picking creates intervals known as “waves” that align with variables

	like the order departure plan or the transportation plan. Orders are combined and released at specific times during the day or are associated with vehicle departures, replenishment cycles, shift changes, product locations, product commonality, value-adding service requirements and priorities. The use of wave picking can balance workload by time or by area by logically grouping and releasing orders. Orders can be released at different times to different zones based on how long it takes to pick the orders. (-) Advantages of wave picking: - Ability to schedule work efficiently; - Orders are picked in time for a production run or vehicle departure. (-) Disadvantages of wave picking: - Urgent orders cannot be separated easily; - Requires a warehouse management system to manage the allocation. • Goods to picker (goods to person): With this strategy, pickers remain at their workstations while a software-driven Automated Storage and Retrieval System (ASRS) retrieves, conveys and delivers required products directly to the order picker's workstation in a designated product donor tote or tray. (-) Advantages of goods to picker: - High pick rates; - High accuracy; - Equipment moves, operators stay in the same place; - Reduced space requirement; - Product security; - Ergonomic workstations; - Training is less intensive. (-) Disadvantages of goods to picker: - High equipment costs; - High energy costs; - Potential system failure; - High opportunity cost i.e. could the investment have been spent more effectively elsewhere; - Standardized unit loads required; - Limited to smaller items. • Automated picking: With this strategy, robotic or semi-robotic technologies are used to enhance the work of human pickers. The requirement for increased speed, accuracy and productivity has pointed warehouse managers towards automation. o Warehouse automation: Automation can provide significant improvements in productivity and accuracy. It requires a great deal of preparation and time spent on design, evaluation and implementation. Within e-commerce distribution, where unpredictability is a constant

	factor, flexibility in the supply chain becomes critical. Flexibility can be derived from implementing the right automation that can support the fluidity that e-commerce services require. The right automation allows fewer manual touches, resulting in more accurate orders, improved ergonomics, lower labour costs and travel time, and fewer returns. It also saves space by operating in a smaller footprint. ^ There should be no attempt to automate a bad or broken process. It should always be ensured that the warehouse operation is working as efficiently as it can without the use of technology. Contemplate using technology to further improve the warehouse operation, only when everything is working efficiently. Streamline processes as much as possible and remove any unnecessary steps. (-) Advantages of automation include: - Increased space utilization and reduced space requirement; - Minimum supervision required; - Continuity of performance; - Product security; - Elimination of manual handling; - Ability to cope with hazardous/harsh environments such as refrigerated storage; - Coordination of product flows, avoiding bottlenecks. (-) Disadvantages of automation: - High opportunity cost…could the investment have been spent more effectively elsewhere; - High investment costs…building, equipment, information technology; - Potential system failure…operations are entirely reliant on technology; - Standardized unit loads are required; - High cost of disposal of equipment; - Lack of flexibility. (-) Examples of automated picking systems: - Compact picking system; - Order distribution system - Automated storage and retrieval systems (ASRS or AS/RS) etc. • 3.11 Handling and storage equipment: *** Conduct your own research on the following *** o Warehouse handling equipment: o Manual and mechanical handling equipment: Trolleys, cages, carts, garment rails, hand pallet truck, pallet jack, powered pallet truck, manual stacker truck, forklift trucks, low level order pickers (LLOP) and towing tractors, medium level order pickers (MLOP), high level order pickers (HLOP), conveyors.

	○ Warehouse storage equipment: - Floor/bulk storage; - Standard and narrow aisle pallet racking; - Very narrow aisle pallet racking; - Carton flow racking; - Shelving; - Carousels; - Vertical lift module (VLM) 3.12 Order picking methods: Picking methods currently used in today's warehouses include: - Paper pick lists; - Pick by label; - Barcode scanning; - Radio frequency identification; - Pick by light/pick to light; - Put to light; - Automated picking. • Paper pick lists (paper based picking): Paper pick list normally details the order number, location, product code, description and quantity to be picked. When used with a warehouse management system, each product line will be shown in sequence, enabling the picker to travel the most efficient route around the warehouse, and ending up as close to the despatch bay as possible. The operator is also free to choose a different route if it is felt that it is more direct. Any discrepancies are written onto the pick list. When the pick list is returned to the supervisor, the discrepancies should be checked immediately and alternative locations provided if there are shortages. Once an order has been picked, the operator has to return to the office for further pick lists or instructions. (-) Advantages of paper based picking: - Low cost; - Flexible; - Quick implementation; - Ability to isolate urgent orders; - Picker able to decide pick path; - Low maintenance; - Suitable as part of a contingency plan. (-) Disadvantages of paper based picking; - Low pick rate; - Not hands free; - Low accuracy; - Not real time; - Duplicated tasks; - Training can take some time; - Requires manual update of system from written instructions; - Requires return to desk for further instructions. • Pick by label: With this method, pick lists are a series of gummed labels on a sheet, which are printed in pick order. The picker attaches a label to each item picked. Once all the labels have been attached, that should be the end of the pick for that order. If there are any labels left over (as a result of no stock being available in the location), they need to be returned to the supervisor's office. Any discrepancies are checked immediately and additional labels printed if

	the stock is available elsewhere in the warehouse. (-) Advantages of pick by label: - Low cost; - Reasonably accurate; - Flexible; - Quick implementation; - Low maintenance. (-) Disadvantages of pick by label: - Low pick rate; - Not hands free; - Duplicated tasks; - Need to print labels; - Not real time; - Training can take some time; - Label information may be difficult to read; - Requires return to desk for further instructions. • Pick by voice: With this method, operators are issued with a headset and a microphone together with a small terminal that is attached to a belt or can be worn on the wrist or upper arm. The warehouse management system (WMS) sends messages to the computer via radio frequency (RF) transmissions, utilizing transmitters installed throughout the warehouse, and these messages are converted into voice commands. The operator also uses voice to communicate back to the system. The reduction in picking errors is significant in most of the companies that have adopted this technology. Some companies have, however, introduced a failsafe by scanning the item once picked or getting the picker to speak the last three digits of the barcode to confirm the correct item has been picked. (-) Advantages of voice picking: - Paperless; - Flexible, - Fewer processes; - Improved accuracy; - Improved productivity; - Quick training; - Hands free; - Improved safety; - Less strain on operators; - Real time stock update. (-) Disadvantages of voice picking: - Cost of hardware; - Difficult in noisy environments; - Requires system interface; - Requires maintenance; - Serial number capture can be an issue; - Accuracy issue if product in incorrect location; - Unsure of long term health issues. • Barcode scanning: A barcode consists of a series of vertical bars of varying widths that represent letters, numbers and other symbols. Barcodes are used to identify products, locations in the warehouse, containers (totes, cartons, pallets), serial and batch numbers. Barcode readers come in many different forms. They can be hand-held, static, truck-mounted or wearable. Barcode scanning, utilizing hand-held scanners with real-time data transmission

	has made data collection faster and more accurate in warehouse operations. It has also increased productivity by ensuring that operators do not have to return to the office for instructions each time they complete a task. The instructions are on screen in the form of text which the operator scrolls through and advances by choosing specific commands. (-) Advantages of barcode scanning: - Improved accuracy; - Paperless; - Flexible; - Real time stock update; - Ability to deal with multi SKU (stock keeping unit) locations. (-) Disadvantages of barcode scanning: - Low/medium pick rate; - Cost of hardware; - Requires barcode on every item; - Requires system interface; - Real time system requires wireless receivers throughout warehouse; - Requires maintenance; - Barcodes have the potential to be damaged, thus making reading difficult and/or inaccurate. • Radio frequency identification (RFID): RFID is a non-contact automatic identification technology where the target can be recognized automatically and the relevant data can be achieved through the radio frequency signal. It is a means of uniquely identifying an item using radio waves. With this method, data is exchanged between tags and readers, and enables the simultaneous reading of multiple items as opposed to barcodes, which need to be read individually. ^ Types of RFID tags: (-) Those that are passive, have no power source, limited data storage capacity, are read only and have a limited read range; and (-) Those that are active, have their own power source, have a larger data storage capacity, have a read/write capability and are readable from a greater distance. (-) Advantages of RFID: - Very high accuracy; - High productivity; - Real time stock update; - Track and trace throughout warehouse. (-) Disadvantages of RFID: - Cost of hardware and tags; - Requires suppliers to attach tags/labels; - Requires international standards; - Requires system interface; - Cost of maintenance; - Read distances may be problematic. • Pick by light/pick to light: This method uses light-indicators, LED or LCD modules mounted to

	shelving, flow racks, pallet racks or other storage locations. To begin the process, an operator scans a barcode on an arriving pick tote or shipping carton which denotes the next order number to be picked. This communicates to the system that the operator is ready to pick. The system then sends a message to the zone in which the operator is stationed and all the pick locations for that particular order light up at once. A digital display tells the operator the quantity to pick. Once picked, the operator turns the lights off to confirm the pick. The operator can then move on to the next location indicated. The pickers continue until the pick in their area is completed. Some systems allow the operator to scan the item before placing it in the shipping carton to further ensure accuracy. Other systems provide an image of the product to be picked to increase accuracy. The tote is then passed to the next zone for the rest of the order to be picked. All information is exchanged in real time with the enterprise resource planning (ERP) or warehouse management system (WMS). Pick by light requires operators to be stationed in zones looking after a certain quantity of SKUs (stock keeping units). The order tote moves between zones on a conveyor, cart or other transportation method. At the end of the pick, an operator will check the order number, possibly check the weight of the consignment, attach an address label, add the delivery documentation. Because operators are based in a specific area, this reduces the amount of walking required within the warehouse. (-) Advantages of pick by light/pick to light: - High accuracy; - High productivity; - High pick rate; - Easy to train staff; - Real time stock update; - Hands free operation; - Improved safety; - Damage reduction; - Simultaneous or sequential picking. (-) Disadvantages of pick by light/pick to light: - Cost of hardware; - Requires system interface; - System failure; - Cost of maintenance; - Low flexibility; - Long implementation time; - Limited in terms of product types; - Difficulty with batched or clustered orders. • Put to light: This system uses light modules that direct operators to the correct location to sort, or “put,” items into. Once the product has arrived at the ‘put’ station, the operator scans

	each item and a flashing light displays at each location indicating which containers require that product and how many items are required. Confirmed 'put' results are uploaded to the system in real time to update the warehouse management system (WMS). Put to light uses the pick by light principle. However, the specified quantity is not picked from the position displayed but rather the specified number placed in this position. Put to light technology requires order consolidation and a batch pick of products. (-) Advantages of put to light: - High accuracy; - High productivity; - Damage reduction; - High pick rate; - Easy to train; - Real time stock update. (-) Disadvantages of put to light: - Cost of hardware; - System failure; - Limited in terms of product types; - Cost of maintenance. • Vision pick: This is a vision based system where instructions are sent over a wireless network from the warehouse management system, via specialist software, to the operative wearing a head-mounted display and portable PC. Each operative can see a digital picking list in their field of vision and are guided through the warehouse by a navigation system to optimize routes and distances travelled. Products to be picked and order information are visually displayed enabling the operative to undertake visual checks. Vision picking is easy and intuitive to use, thus requiring minimal operator training. It can be used in virtually all warehouse environments without structural modification. 3.13 Factors affecting the selection of pick strategy or equipment: • The return on investment and payback periods for major capital investments will greatly influence the decision as to whether or not to choose automation over more manual processes. • Ergonomic and green issues: A greater concern over energy usage and potential taxation on environmentally unfriendly equipment is a factor that needs to be considered. • The long term strategy of the company will affect the decision to invest in new equipment. Any potential relocation of the business, changes in product profile or distribution channel

	suggest that any investment in full automation needs to be carefully considered. • The availability of labour is a key factor in determining the level of automation. The availability of a large and stable workforce of skilled and non-skilled operators at reasonable wages enables the company to be more flexible, saves on investment and improves cash flow. 3.14 Replenishment: • This refers to having the right products, in the right quantities and in the correct pick locations at all times to ensure a smooth and efficient picking process. It involves moving inventory from reserve status to primary storage so that it may be picked, packed and shipped. It is equally important to replenish pick faces regularly to ensure picker satisfaction, as it is to replenish the overall warehouse inventory to ensure customer satisfaction. ^ Timing is key in the replenishment process. Early instruction to replenish can cause as many problems as late replenishment. ^ Real-time warehouse management systems will recognize the need to replenish pick locations through real-time data transfer. These systems are able to identify the total actual order quantities and as a result replenish before the next wave of orders arrive on the warehouse floor. ^ In the absence of a real time warehouse management system, the warehouse manager will need to first ensure that the pick faces are designed to take the optimum quantity of product based on predicted sales per day or per shift, cubic capacity of the pick location, and staff need to be trained to identify replenishment requirements and inform the relevant personnel. ^ The results of a poor replenishment process are: - Order shortages; - Increased picking times and therefore; - Increased cost per pick and; - An overall reduction in service level. 3.15 Value adding services: • "Value adding" refers to the enhancement a company gives its product or service before offering it to customers. It can be considered as an extra special feature added by a company or producer to increase the value of a product or service. Adding value to products and

	services is very important as it provides consumers with an incentive to make purchases, thus increasing a company's revenue. Some value adding services in warehouse operations include: - Receiving, inspection and stocking; - Sub assembly; - reconfiguration; - Repair and refurbishment; - Full pick, pack and ship; - Compliance labelling; - Kitting and light assembly; - Outbound and returns processing; - Quality assurance; - Lot control, serialization; - Expedited shipment processing. ^ The warehouse's ability to undertake value adding services enables manufacturer's to postpone certain activities until the order arrives, resulting in fewer stock codes, and it enables retailers to transfer activities from the retail store back to the warehouse, freeing up valuable sales time. 3.16 Stock or inventory management: • This refers to the monitoring and control of goods and stock so that new stock can be ordered as required and the right numbers and quantities made available at all times. Warehouse managers are in a position to advise their inventory colleagues on levels of safety stock and the specific movements and characteristics of particular stock items. Many warehouse managers are not involved directly in the choice, purchase and replenishment of stock, however, they can play a role in the identification of fast, medium, slow, non-moving and obsolete stock. • Benefits of good inventory management strategy: o A good inventory management strategy improves the accuracy of inventory orders. Proper inventory management helps you figure out exactly how much inventory you need to have on-hand. This will help prevent product shortages and allow you to keep just enough inventory without having too much in the warehouse. o A good inventory management strategy leads to a more organized warehouse. If your warehouse is not organized, you will have a hard time managing your inventory. Many companies choose to optimize their warehouses by putting the highest selling products

	together and in easily accessible places in the warehouse. This, in turn, helps speed up the order fulfilment process and keeps customers happy. ○ A good inventory management strategy helps save time and money. Inventory management can have real-time and monetary benefits. By keeping track of which products you have on-hand or ordered, you save yourself the effort of having to do an inventory recount to ensure your records are accurate. A good inventory management strategy also helps you save money that could otherwise be wasted on slow-moving products. ○ A good inventory management strategy increases efficiency and productivity. Inventory management devices, such as barcode scanners and inventory management software, can help drastically improve your efficiency and productivity. These devices will help eliminate manual processes so your employees can focus on other – more important – areas of the business. ○ A good inventory management strategy keeps your customers coming back for more. It's a fact that good inventory management leads to what you are constantly striving for – repeat customers. If you want your hard-earned customers to come back for your products and services, you need to be able to meet customer demand quickly. Inventory management helps you meet this demand by allowing you to have the right products on-hand as soon as your customers need them. [Reference: https://www.scanco.com] 3.17 Despatch: • The order cycle time or lead time from order receipt to despatch is continually shortening and there is increased pressure on the warehouse manager to coordinate all activities efficiently to ensure that product is despatched on time and complete. Despatch documentation and labelling needs to be completed to ensure compliance with customer requirements and government legislation. Errors in export paperwork can result in non-shipment, seizure, fines

	and delays. 3.18 Security in the warehouse: • Core attributes of security within a warehouse: - Appropriate recording of inbound and outbound products; - Authorization for all despatches; - Accurate audit trails; - Regular stock checks; - Use of appropriate storage equipment; - Vigilance. • Product security: Poor security costs companies in lost inventory, higher insurance premiums, and personnel turnover. Product security can be achieved through good housekeeping, the use of security cages and carousels for storage, CCTV and through vigilance by staff. Closed circuit television at strategic points throughout the warehouse is a significant deterrent. Unannounced inspections and walkabouts by security and/or designed staff are also effective and cheaper. • Data security: Protection of data should be critically considered, in addition to product security. Warehouse management systems hold a large amount of sensitive data that need to be protected. Internally this can be done through the use of password protection for different access levels and firewalls for external protection. The data needs to be backed up daily and the backup files stored offsite. Protecting data from being stolen or copied must be of key importance. Equipment such as servers, computers and laptops need to be protected. These items need to be locked with key or code access, and personal computers need to be password protected, and those passwords changed regularly. 3.19 Reverse logistics: • Reverse logistics: refers to the process of planning, implementing and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal. The reverse logistics that directly impact supply chains the most are the return of products from the end consumer back to the manufacturer.

	○ Returns processing: A “product return” is a situation in which a buyer does not want a product, and returns it to the company to get their money back. The idea behind returns processing is to either return stock into the supply chain as quickly as possible, or dispose of it efficiently. Returned items should not remain in the facility for too long. ^ Where a company decides to operate the returns function within an existing warehouse operation, then the company is likely to set up a warehouse within a warehouse. This needs to be carefully planned to avoid cross contamination; for example, when dealing with damaged or defective goods, chemicals and hazardous products. ○ Product recalls: A product recall is a request from a manufacturer to return a product after the discovery of safety issues or product defects that might endanger the consumer or put the maker or seller at risk of legal action. These need to be handled carefully. Recalled products need to be quarantined on return so that the company can ensure, first, that all items have been received, and are no longer a potential danger to the public – which is normally one of the main reasons for recall – and secondly, that they are not mixed with good product and sent out in error. • Factors influencing the decision to operate an in-house reverse logistic programme or to outsource to a third party: - Level of returns; - Available space; - Available expertise; - Cost; - Control and efficacy; - Capacity and capability of third parties.

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Learning outcome Learner will:	Assessment criteria Learner can:
4.0 Understand key health and safety management issues in the warehouse.	4.1 Management role in health and safety management in the warehouse: • Warehousing is a very complex industry that exposes workers to a variety of risks. Employers involved in warehouse operations need to ensure effective health and safety management, looking at the risks involved in the workplace and then putting in place effective control measures to properly manage health and safety. Managers need to be vigilant and undertake regular risk assessments. They need to ensure that their staff are working to the correct procedures and that equipment are maintained to the highest standards. 4.2 Benefits of addressing and promoting positive health and safety in the organization: • Reduced costs and reduced risks: employee absence and turnover rates are lower, accidents are fewer, the threat of legal action is reduced. • Improved standing among suppliers and partners. • A better reputation for corporate responsibility among investors, customers and communities. • Increased productivity: employees are healthier, happier and better motivated. 4.3 The main causes of major injuries in the warehouse: - Slip or trip; - Manual handling; - Falls from height; - Hit by moving vehicle; - Unsafe use of forklifts; - Improper stacking of products resulting in person being hit by falling object; - Failure to use proper personal protective equipment (PPE); - Failure to follow proper lockout/tag out procedures, i.e. prevent equipment from being accidentally energized; - Inadequate fire safety provisions; - Repetitive motion injuries. 4.4 Categories of responsibility for health and safety; according to the Health and Safety Act UK: • Employer responsibilities: - Provision of a health and safety policy statement; - Provision of safety equipment; - Commitment to train staff. • Employee responsibilities: - Obligation to cooperate with their employers; - Obligation to

	undertake training, report issues and not to misuse equipment. • Manufacturers' responsibilities: - Ensure product is safe to use and fit for purpose. 4.5 Risk assessment: • Risk assessment: This refers to the process of identifying hazards and risk factors that have the potential to cause harm (hazard identification); analysing and evaluating the risk associated with that hazard (risk analysis, and risk evaluation); and determining appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control). ^ A risk assessment is an important step in protecting a workforce and organization, as well as complying with the law. It enables the organization to focus on the risks that have the potential to cause harm. The law does not expect the organization to eliminate all risks, however, it requires the organization to protect staff and visitors as far as is reasonably practicable. The organization is legally required to assess the risks in the workplace, and must put plans in place to control risks. ^ The organization needs to make a decision whether the necessary experience is available in-house to undertake the risk assessment or whether it needs to employ an external health and safety expert. ^ Hazard is anything that can cause harm, such as chemicals, working from height, being hit by a moving vehicle such as fork lift, etc. ^ The risk is the chance (likelihood), high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be. • Stages of risk assessment: 1) Identify the hazards; 2) Decide who might be harmed and how; 3) Evaluate the risks and decide on precautions; 4) Record and communicate findings, and implement them; 5) Review risk assessment regularly and update if necessary. • What a suitable and sufficient risk assessment must demonstrate: A risk assessment is not expected to be perfect, however, it must be suitable and sufficient.

	The risk assessment must show that: - A proper check was made; - The organization asked who might be affected; - The organization dealt with all the obvious significant hazards, taking into account the number of people who could be involved; - The precautions are reasonable, and the remaining risk is low; - The organization involved the relevant staff or representatives in the process. 4.6 Principles of controlling risk in the warehouse: • Try a less risky option (e.g. switch to using a less hazardous chemical). • Organize work to reduce exposure to the hazard (e.g. put barriers between pedestrians and traffic). • Issue personal protective equipment (e.g. clothing, footwear, goggles etc.) • Provide welfare facilities (e.g. first aid and washing facilities for removal of contamination). 4.7 Storage of hazardous products: Hazards may be created when storing hazardous products, which may affect people working within the storage site, the emergency services when dealing with an incident, the general public off site and the environment. • Common causes of incidents relating to the storage of hazardous products: - Lack of awareness of the properties of the dangerous substances. - Operator error, due to lack of training and other human factors. - Inappropriate storage conditions with respect to the hazards of the substances. - Inadequate design, installation or maintenance of buildings and equipment. - Exposure to heat from a nearby fire or other heat source. - Poor control of ignition sources, including smoking and smoking materials, hot work, electrical equipment etc. - Vandalism and arson. • Specific requirements of a hazardous goods warehouse: - Secure areas with restricted access.

	- Access doors fitted with restricted entry devices and lock-down capability. - Specialist extinguisher systems such as sprinklers. - Emergency lighting. - Automatic air ventilation systems. - Bunded storage area where spills are contained and prevented from leaking away. - Racking with protective mesh to prevent the escape of products such as exploding aerosols. - Drench showers and eye wash stations for staff. - Storage area for appropriate personal protective equipment. - Safe escape routes for personnel which are clearly signposted and illuminated. - Audible and visible alarm systems. • *** Conduct your own research on the "Classification and labelling of hazardous products…. GHS pictograms and hazard classes" *** 4.8 Warehouse layout and design: A warehouse should be designed and laid out to allow people to move around it safely. A well-thought out design and layout of a warehouse will help to reduce accidents, particularly those involving vehicles and slips/trips. 4.9 Warehouse fire safety: • Stages of fire risk assessment: - Identify fire hazards; - Identify people at risk; - Evaluate, remove, reduce and protect from risk; - Record, plan, inform, instruct and train; - Review and revise risk assessments as necessary. ^^ A fire risk assessment must be undertaken to ensure that fire safety procedures, fire prevention measures and fire precautions are all in place and correct. • What an emergency plan that describes what is expected of employees in the event of a fire emergency should include:

	- Provisions for emergency exit locations and evacuation procedures. - Procedures for accounting for all employees and visitors. - Location and use of fire extinguishers and other emergency equipment. 4.10 Slips and trips: • Slips and trips are serious problems. They make up the majority of general industry accidents. A working environment must be created where they are much less likely to happen. • What health and safety actions companies need to take regarding slips and trips: - Enforce good housekeeping. Don't allow spills to stay on the floor. - Aisles should not be allowed to become cluttered. Clutter can hide spills and cause fall hazards. - Remove or strictly control the use of cell phones. People walking in a warehouse or on a plant floor while texting or otherwise paying attention to their phone screen are making themselves vulnerable to accidents. - Anti-slip mats should be provided wherever possible, but in particular in areas known for wet or oily conditions. - Make sure workers wear appropriate footwear on the warehouse or plant floor. - Handrails must be installed wherever possible. - It must be ensured that lighting is adequate throughout the warehouse. - It must be ensured that people understand that running isn't allowed on warehouse floors, nor are other dangerous behaviours. 4.11 Manual handling: • This can often cause work-related problems including back pain and neck pain. Wherever possible, mechanical handling devices such as lift trucks, pallet trucks, trolleys etc. must be used, as they help avoid or reduce manual handling operations. • When considering a manual handling operation, the following must be taken into account: - The task; - The load; - The working environment; - Individual capacity.

	• All employees must be trained in safe manual handling techniques. Training must be specific to the tasks that staff undertake and all such training must be documented. 4.12 Working at height: • This must be properly planned, supervised and carried out in as safe a manner as possible. Equipment must be provided to allow working at height to be carried in as safe a way as possible. Any equipment that is provided to allow working at height must be inspected regularly to ensure that it remains safe and is being used in the correct manner. 4.13 Forklift trucks: • Measures that can be taken to prevent injury when operating or working near forklifts: o Ensure that workers do not operate a forklift unless they have been trained and licensed. o Develop, implement and enforce a comprehensive written safety programme that includes worker training, operator licensing and timetable for reviewing and revisiting the programme. o Establish a vehicle inspection and maintenance programme. o Separate forklift traffic and other workers where possible. o Evaluate intersections and other blind corners to determine whether overhead dome mirrors could improve visibility of forklift operators or workers on foot. o Make every effort to alert workers when a forklift is nearby. Use horns, audible reversing alarms and flashing lights to warn workers and other forklift operators in the area. o Enforce safe driving practices such as obeying speed limits, stopping at stop signs and slowing down and blowing the horn at intersections. 4.14 First aid: • The company must consider and plan for any accidents or emergency that could occur in which an employee or a member of the public is exposed to danger. It is recommended that procedures are in place to deal with emergencies such as serious injuries, spills or fire. There must be some provision for first aid.

	^ Assessment of first aid needs should be carried out to ensure that there are adequate and appropriate equipment and facilities in giving first aid to employees, including a first aid box and first aid room – depending on the size of the warehouse. ^ The company must have qualified first aiders. The number required will depend on the nature of the warehouse, number of employees and the location of the site. First aid training must be available to all first aiders, and they must be retrained before the expiration of their respective first aid training certificates.

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Learning outcome Learner will:	Assessment criteria Learner can:
5.0 Understand key issues relating to performance management in warehouse operations.	5.1 Performance management: • This refers to a process which contributes to the effective management of individuals and teams in order to achieve high levels of organisational performance. As such, it establishes shared understanding about what is to be achieved and an approach to leading and developing people which will ensure that it is achieved. o Performance management should incorporate: - Performance improvement: throughout the organisation, for individual, team and organisational effectiveness. - Development: unless there is continuous development of individuals and teams, performance will not improve. - Managing behaviour - ensuring that individuals are encouraged to behave in a way that allows and fosters better working relationships. 5.2 Performance measurement: • The need for measuring performance and productivity within the warehouse: o To ensure customer satisfaction through service improvement. o To ensure that there is a culture of continuous improvement within the operation. o To discover potential issues before they become major problems. o To train staff in the right areas. o To reward staff where appropriate. • Areas within the warehouse that requires measuring: o Reliability: This includes on-time delivery, order fill rates and accuracy. o Flexibility: Order cycle time is probably the best measure of flexibility as it covers all aspects of the customer order process; how we handle the order initially, whether we

	have the stock available, how quickly we can process the order through the warehouse, and finally, how quickly we can deliver to the customer. ○ Cost: Cost measurements include cost as a % of sales and productivity against labour hours. ○ Asset utilization: This includes efficient use of warehouse space, mechanical handling equipment (MHE), staff and storage equipment. • Steps to be undertaken in choosing the most appropriate measure: ○ Understand your business and its strategy. ○ Decide on the objectives. ○ Understand which key performance indicators (KPIs) are likely to assist in meeting the objectives. ○ Ensure the key performance indicators (KPIs) are aligned with other KPIs within the company. ○ Nominate key performance indicators (KPIs) owners. ○ Ensure that everyone is on board with achieving the targets. If the key performance indicator (KPI) is not relevant, replace it. ○ If the key performance indicator (KPI) is not achieved, analyse why and if necessary revise it. • SMART performance measures: The measures chosen must be SMART, meaning they need to be: ○ Specific: Objectives should specify what they want to achieve. Are they clear and unambiguous? ○ Measurable: Can we put a value on the key performance indicator (KPI)? E.g. how much, how long, how many? ○ Achievable: Are the targets you set achievable and attainable? ○ Relevant: Are the measures relevant to the overall goal and strategy of the company?

	○ Timely: Are the timescales realistic and how often do you measure? • Traditional productivity measures: *** Conduct your own research *** - Labour hours' utilization; - Warehouse area utilization; - Mechanical handling equipment (MHE) utilization; - Lines picked per hour; - Dock to stock time; - Order accuracy; - On time shipments. • Non-traditional productivity measures: *** Conduct your own research *** - Inventory measures; - Stock cover in days; - Stock turn; - Inventory accuracy; - Damaged inventory. • Balanced scorecard: The balanced scorecard is a strategic planning and management system that is used extensively in business and industry, government, and non-profit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. It was originated by Robert Kaplan (Harvard Business School) and David Norton as a performance measurement framework that added strategic non-financial performance measures to traditional financial metrics to give managers and executives a more 'balanced' view of organizational performance. There are four key aspects of the balanced scorecard: - Finance; - Customer; - Internal business processes; - Learning and Growth 5.3 Benchmarking: • This is a process of comparing performance with operations of other companies, or operations within the same company, identifying high performance or best-in-class operations and learning what it is they do that allows them to achieve that high level of performance. • Benefits of benchmarking: Benchmarking enables the organization to: ○ Understand its own performance. ○ Identify any shortcomings. ○ Introduce training programmes.

	○ Discover what others are doing better. ○ Identify performance targets that can be demonstrated to be achievable. ○ Accelerate and manage change. ○ Improve processes. ○ Understand what is best practice.

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Learning outcome Learner will:	Assessment criteria Learner can:
6.0 Understand the benefits of having a warehouse management system; and key considerations in selecting a warehouse management system provider or partner.	6.1 Warehouse management system (WMS): • A warehouse management system (WMS) is a software application, designed to support and optimise warehouse functionality and distribution centre management. It helps control and manage the day-to-day operations in a warehouse. WMS software guides inventory receiving and put-away, optimizes picking and shipping of orders and advises on inventory replenishment. A warehouse management system can be a standalone application or part of an enterprise resource planning (ERP) system, supporting the latest technological advances within the warehouse including automation, radio frequency identification (RFID) and voice recognition. o Enterprise Resource Planning (ERP) system or software: This is a management solution that integrates applications to help improve business operations, communication, and collaboration. An ERP software system streamlines processes across sales, order processing, finance, human resources, planning, production, inventory, procurement, and more. 6.2 Reasons why a company needs a warehouse management system: • Reduced operating expenses: A well-designed WMS reduces operating expenses in a variety of ways. The system determines the most effective use of both labour and space, which reduces waste. WMS software can help the organization determine where to keep certain materials, products and equipment to optimize the flow of your warehouse. • Enhanced inventory visibility: Inventory visibility is one of the most important components of warehouse management systems. WMS software provides real-time data on your inventory through barcoding, serial numbers and radio frequency identification (RFID) tagging. All of these methods enable users to document each item as it enters the warehouse, all of its

	movements on the warehouse floor as well as its movement during transportation from one location to the next. This type of visibility is necessary to create demand forecasts, which provide insight into which products are most popular with customers during specific times of the year. These forecasts assist leadership in deciding which products to invest in and which ones may be losing their place in the market. • Enhanced security: Most warehouse management programs require employees to use individual user accounts when entering transactions. This creates an audit trail that connects specific employees to specific transactions, which improves accountability and reduces the risk of theft and other issues. Employee theft can also be a problem in some situations. This results in loss of products and revenue. Nobody wants to accuse employees without having evidence, so a WMS can help management isolate exactly what's gone missing to provide an early warning that employee theft may be occurring. • Continuous improvement: One of the most important warehouse management system benefits is consistent updates. Warehouse management software vendors typically introduce new features regularly to reflect current industry best practices. This makes it easier for organizations to stay on top of the latest developments and allows them to continually improve their processes based on these innovations. • Improved employee morale: When operations flow seamlessly, employees feel better about their work environment. This is especially true when there are specific efforts being made to optimize their time so they always feel it's used wisely. There's less stress, and the improved productivity and profitability elevate workers' moods, particularly for warehouses offering holiday bonuses. • Improved relations with customers and suppliers: The benefits of warehouse management systems extend beyond the organization itself. With such high visibility of inventory and the ability to schedule the receipt of shipments, both supply and demand chains are optimized

	with the use of a WMS. One of the most obvious benefits for suppliers is the reduced wait at docks and loading bays. Customers enjoy overall improved order fulfilment, reduced delivery lead times and fewer order inaccuracies. The reputation of your business among customers and suppliers will improve under such a system. [Reference: https://www.selecthub.com] > > > Other reasons: • - Improved productivity; - Reduction in miss-picks; - Automatic replenishment; - Reduction in returns; - Minimized paperwork. 6.3 Best practice guidelines to ensure that the right choice of warehouse management system is made by a company: • Form a project team: Assemble a team of people capable of logical thinking who will decide what your company needs from a warehouse management system, and what functionalities it must have, and those it will be nice to have. • Define, record, review and improve current processes. Do not 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 warehouse management system. • 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 warehouse management system has brought about since implementation. • Produce a return on investment (ROI) report. 6.4 Main components of a warehouse management system (WMS) cost: The cost of a WMS can be broken down into the following: • License: The software license required to run the system.

	• Professional services: The costs for project management, training and go-live support. • Development costs: Software development costs for requirements not catered for in the package, including interfaces to third-party systems. • Support cost: This is typically an annual cost based on license costs and often development costs. • Hardware and infrastructure costs. 6.5 Attributes that a warehouse management system needs to be effective. What to look for in a WMS: *** Conduct further research *** • - Ability to interface with other systems; - Modular and scalability; - Accessibility; - Ease of operation; - Standard system; - Meets specific needs; - Capable of supporting warehouse best practice; - Reporting capabilities 6.6 Key considerations in selecting a warehouse management system provider or partner: • Experience: Look for providers that employ staff with significant operational experience as well as staff with the ability to produce best-in-class WMSs. • Longevity: Check how long the company has been in business and what their creditworthiness is like. • Choose a vendor who emphasizes the benefits of the software, not just the features. • Choose a provider that has already installed WMSs with clients in your industry or similar. • Ensure that the vendor can supply not only the system but also the installation, training, maintenance and help-desk service. • Verify that your prospective WMS provider is reinvesting significantly into research and development, and further product enhancements. • Choose a vendor you are comfortable working with. Try to find a vendor who is culturally similar to your company, is professional and well respected in the industry. 6.7 Steps to follow to make the purchase and implementation of a warehouse management system a success:

	• Preparing and allocating sufficient time and resources to the project. • Getting warehouse 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. • Ensuring that all staff are trained to an acceptable level.

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Recommended learning resources

Indicative reading	Warehouse Management 3rd Edition by Gwynne Richards; 2018. ISBN: 978 0 7494 7977 0 • For a full list of textbooks and publications relevant to this unit, please contact IPED - UK.
Study manual	A learning resource material is provided to guide the learner/tutor and to serve as a quick reference point for contents of the programme. The student is advised not to be over reliant on the study guide but to access the relevant textbooks or other academic materials as much as possible to help him/her with the course.