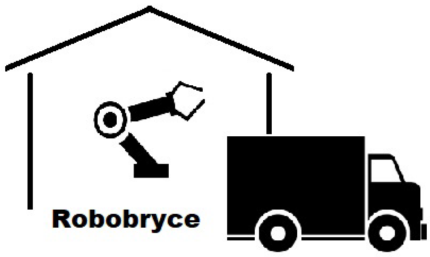
AICPA & CIMA
Together as the Association of International Certified Professional Accountants

Strategic Case Study Examination

November 2023 – February 2024

Pre-seen material



Context Statement

We are aware that there has been, and remains, a significant amount of change globally. To assist with clarity and fairness, we do not expect students to factor these changes in when responding to, or preparing for, case studies. This pre-seen, and its associated exams (while aiming to reflect real life), are set in a context where current and on-going global issues have not had an impact.

Remember, marks in the exam will be awarded for valid arguments that are relevant to the question asked. Answers that make relevant references to current affairs will, of course, be marked on their merits.

Contents

Introduction

Robobryce is a quoted company that creates solutions for handling objects, primarily in warehouses and factories. Robobryce assists its clients by developing and installing the systems required to store and retrieve inventory. For example, Robobryce might support an online retailer by supplying a system that can pick goods from storage in response to customer orders.

You are a senior manager in Robobryce's finance function. You report directly to the Board and advise on special projects and strategic matters.

Robobryce is based in Tessland, a developed country that has an active and well-regulated stock exchange. Tessland's currency is the T$. Tessland requires companies to prepare their financial statements in accordance with International Financial Reporting Standards (IFRS).

Warehouse handling

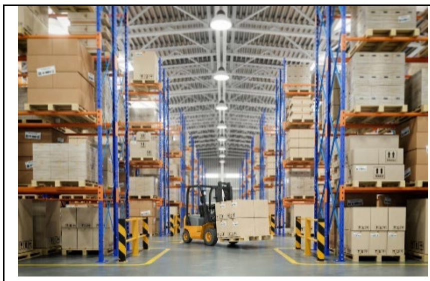
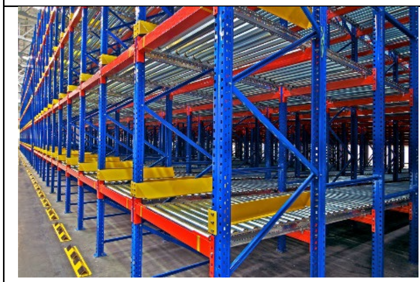
Many entities rely on warehouses for the storage and management of significant quantities of parts or goods. The average area of a warehouse in Tessland is 1,500 square metres. More than 40% of the country's warehouses exceed 9,300 square metres. Some organisations have warehouses of up to 95,000 square metres.

Larger warehouses can simplify inventory management by enabling large quantities of particular items to be stored together. Their size can, however, complicate the management of the warehouses themselves. The largest warehouses can require more than 1,000 staff, who may have to cover distances of hundreds of metres in order to retrieve each item required to fulfil a despatch instruction.

Warehouses often store many different item types that must be kept safe and accessible. The design and equipment of warehouses can have a significant impact on the efficiency of their operations and on the associated costs.

<u>Storage options</u>

 	Goods are often shipped on wooden pallets, which enable them to be lifted by forklift trucks. Pallets enable efficient loading and unloading of delivery vehicles and the movement of goods within warehouses. Pallets are a standard size, which simplifies the management of inventory. Goods that are transported in shipping containers are rarely shipped on pallets because the pallets themselves will typically require up to 10% of the available volume inside a container. Warehouses receiving such goods often load them onto pallets on arrival to enhance the efficiency of storage.
	Block storage is the simplest way to manage palletised loads within warehouses. An area of floorspace is designated for a particular item and pallets are stacked on top of one another. Block storage relies on the goods being strong enough to stack. They must also be held in sufficient quantities to make a stack worthwhile. The product must also have a long shelf life so that there is not a constant need to unstack pallets in order to use the oldest inventory first. Block storage is inefficient if products cannot be stacked because it wastes the overhead space. Warehouses generally have high ceilings, and it is desirable to make the best possible use of that height.

	Warehouses are often fitted with racks that enable pallets to be stored as single units and make full use of the available ceiling height. Each pallet has a specific location that is directly accessible. The aisles between racks are usually 3 metres wide, which permits forklifts to access them and insert or extract pallets. Wider aisles are sometimes used to enable larger and more powerful forklifts to operate, although that arrangement will reduce the number of racks that can be accommodated. It is possible to have narrow aisles, creating more space for storage, but that requires the use of narrow aisle forklifts that cost more to buy and require skilled operators.
	There are various specialised racking systems that can store pallets several units deep. These include racks with lanes that enable forklifts to drive into them and racks with rollers that enable forklifts to push additional pallets in from the front. These systems enable much more efficient use of space, but at a cost in terms of flexibility. Only the pallet at the front of the rack is immediately accessible. That should not be a problem if all pallets in a row contain the same product, but it could be necessary to extract a particular pallet because, for example, it has goods that are close to their expiry date. In that case, all of the pallets in front must be removed before it can be accessed.
	Some smaller items can be stored more efficiently in cartons that are stored on shelves. Shelves can be configured to store different combinations of weights and carton dimensions.

The organisation of warehouses can have a significant impact on their capacity. For example, a warehouse of 1,000 square metres could accommodate the following numbers of standard pallets, depending on configuration:

Levels of racking	Wide aisle	Narrow aisle	Full depth push racks
1	270	300	570
2	540	600	1,140
3	810	900	1,710
4	1,080	1,200	2,280
5	1,350	1,500	2,850
6	1,620	1,800	3,420

These are maximum capacities. It can be difficult to operate a warehouse efficiently if it is at 100% capacity. It may be preferable to aim for 90-95% capacity.

<u>Warehouse picking – picker-to-goods (P2G)</u>

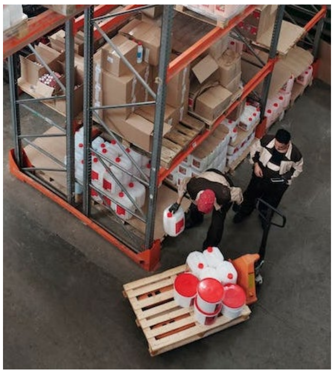
Picking is the process of obtaining goods from the warehouse and preparing them for despatch to the factory or to a customer. Picking is affected by the nature of the business. Goods may be picked as:

- entire pallets
- whole cartons
- individual items

In each case, picks may be multiples of pallets, cartons or items.

The nature of the business can also affect the number of items in a typical pick. Some warehouses may have to fulfil orders that consist of multiple items. An online retailer's customers may order several products, each located in different areas of the warehouse, at once. A supplier of vehicle parts could receive orders for 90-100 line items that are required urgently by car dealership workshops.

Picks can be organised in different ways:

Individual order pick 	A picker is given responsibility for a single order, collecting all of the items and returning to a workstation to prepare the order for despatch. This approach is simplest. It is likely to be the fastest way to prepare any given order. The picker is dealing with only one order at a time and so there is no risk of an item being added to the wrong order and sent to the wrong customer. It may be necessary to walk or drive a forklift over a significant distance if there are several items on the order that are stored at some distance from one another. That is a particular problem if orders comprise small numbers of items because pickers will have to return to their workstations frequently, creating a great deal of unproductive time. Sometimes, orders will consist of items that cannot be combined with anything else. Perhaps an entire pallet has to be picked and creates an entire load for a forklift or for a picker's trolley.
Cluster pick	A picker is given multiple orders at once and picks items for each from different racks and shelves. The picker can then fulfil several orders at once, increasing productivity through reducing walk times for each order. This approach may work well for an online retailer, whose customers tend to order a small number of products at once. There is an increased risk of errors, with items being placed in the wrong order when the picker returns to the workstation and prepares orders for despatch.
Batch pick	Items for a number of orders are picked and brought to a secondary handling area, where a further pick allocates items to individual orders. This approach might be suitable when certain products are ordered frequently, such as a retailer that has discounts on popular items.
Zone pick	Picking is subdivided into zones. For example, an online retailer of electrical goods may set aside separate zones for large kitchen appliances, small kitchen appliances and electronics. Each item in an order would be picked separately from its respective zone and the goods would be combined as appropriate in the despatch area.

These approaches are known as "picker-to-goods" because they involve pickers walking or driving round warehouses while collecting goods to be prepared for despatch. Items that are small and light may be carried in tote boxes or trays. Heavier items may be placed on trolleys, which can be driven by electric motors and steered by the picker. Pickers may use forklifts for even larger items.

Pickers can also be supported by collaborative robots (cobots) which carry goods that have been picked by the human picker. The cobot is a powered trolley that guides the picker to the location of the goods that are to be picked. The cobot displays the item to be picked on its screen upon arrival at a location. The picker can then stack the item on the cobot before it departs for the next location. This system is suitable for medium to large items. It improves efficiency because the picker does not have to return to a workstation after picking each item.

Warehouse picking – goods-to-picker (G2P)/robot-to-goods (R2G)

Picking has traditionally been a labour-intensive process because it has proved difficult to automate the retrieval of goods that are different in terms of size and weight. There are, however, new technologies that enable goods to be collected and delivered to human operators for packaging and despatch. These technologies are often referred to as Automated Storage and Retrieval Systems (ASRS).

Automation offers a number of advantages:

- faster than human pickers
- less likely to drop or damage inventory through mishandling
- enhances security because fewer operators have access to stores
- reduces risk of injury by collecting and transporting items mechanically
- fewer picking errors

Picking can be automated in several different ways, in particular through the use of carousels and robots.

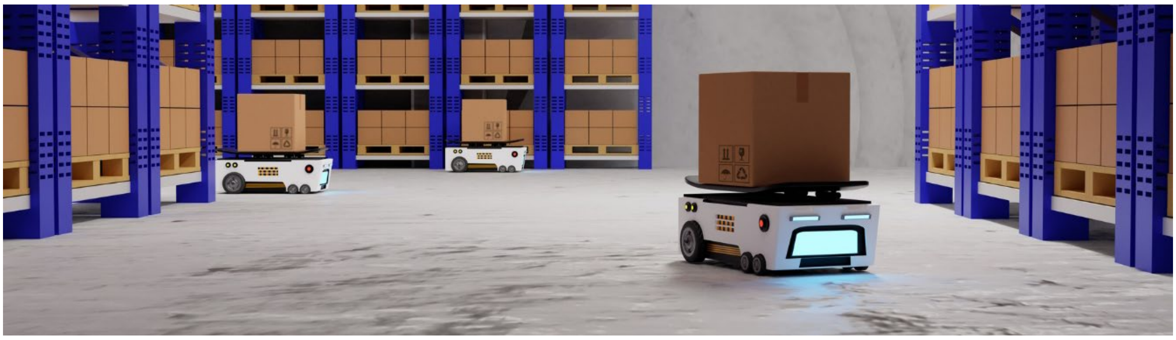
Carousels are used to store different products that can be brought to their operators' workstations to fulfil orders. Inventory is often held in storage bins that can be transported either vertically or horizontally, depending on the design of the carousel, to deliver the correct bins to operators' workstations. Goods required for orders are collected and the carousel delivers the next bin.

Horizontal carousels can be configured in a number of different ways. They can be a highly-efficient means of transporting goods around a warehouse and in facilitating picking of goods. Horizontal carousels can be adapted to store and present hanging garments or different types of container other than open bins.

Vertical carousels are essentially a type of industrial shelving that can be rotated so that the relevant item of inventory is brought to a convenient height. Pickers are less likely to be injured by having to bend or stretch in order to retrieve items. There is also no need to use ladders to retrieve items that are out of reach from ground level.

Some carousels have robotic picking arms that can collect goods, potentially increasing the speed of picking and reducing the need for human operators.

Robots are generally more flexible than carousels. Warehouse robots are electrically powered and can move independently. Some have the ability to lift items for picking. Warehouse robots that lack onboard intelligence are known as automated guided vehicles (AGVs). They can operate automatically but require guidance. Autonomous mobile robots (AMRs) are more flexible. They have the ability to map their environments and to plan their routes. One significant difference between AGVs and AMRs is that the latter can bypass an obstacle. An AGV that encounters an obstacle in its programmed path will simply stop until the way is cleared.



Robots can automate the goods-to-picker approach by collecting a pallet or bin containing goods from inventory and bringing it to a designated human operator's workstation. The picker will then pick the parts required for the order or orders that are being processed, before the robot returns the pallet or bin to its space in the warehouse. This system is more flexible than the carousel approach because several robots can be programmed to converge on any given workstation, with sufficient spacing to prevent bottlenecks in picking.

Some robots can pick items from inventory and deliver them to the next stage in processing the order. This is referred to as robot-to-goods (R2G).

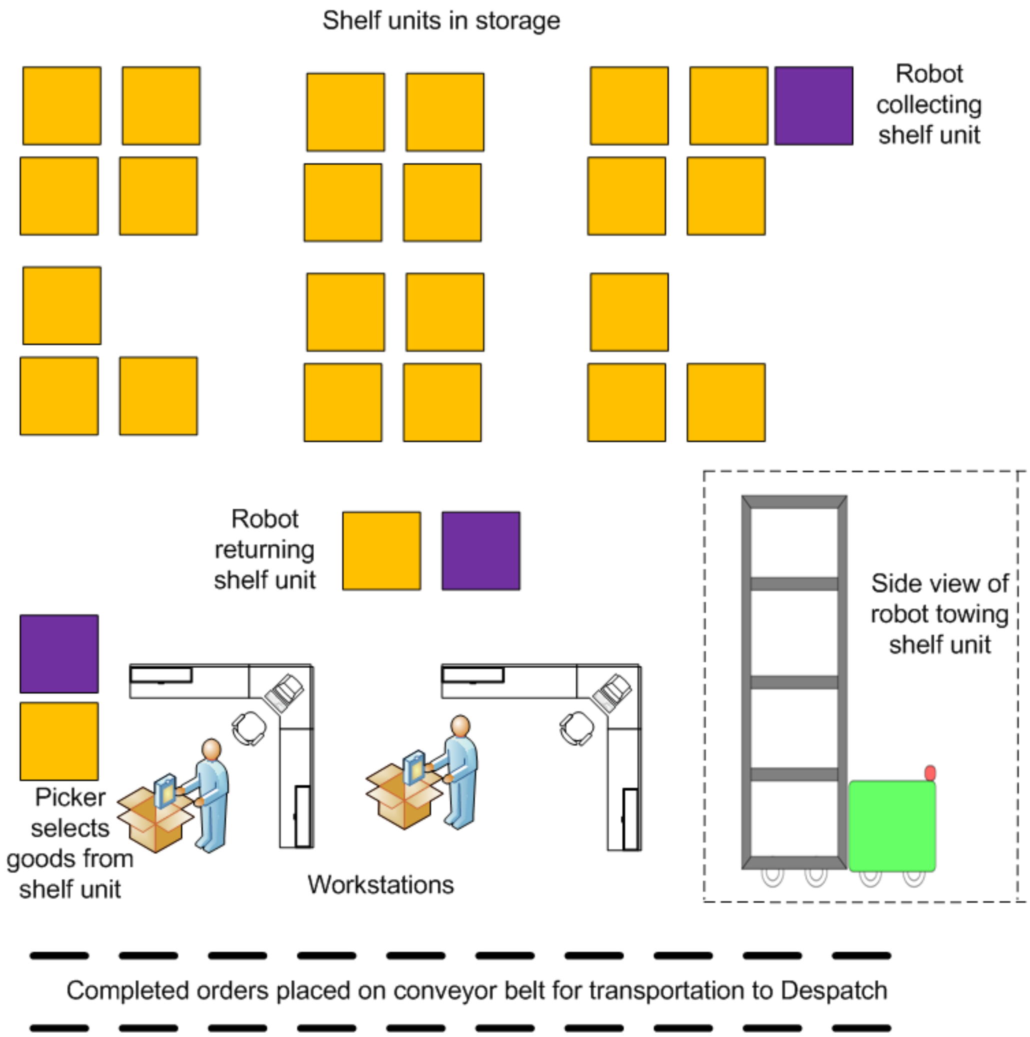
Mobile robots can be guided in various different ways:

- Linear route robots follow a path that is embedded in or placed on the warehouse floor. That can simplify navigation and reduce the risk of collisions. The routes can take the form of rails or wires.

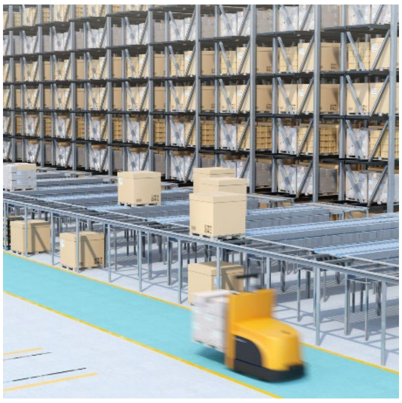
  Wires can generate a magnetic field that enables robots to draw electrical power by induction, which eliminates the needs for robots to return to charging points in order to remain operational.

  The flexibility of these robots is limited by the need to lay additional rails or wires in order to create new routes. They cannot bypass obstacles that have been left on their route, which suggests that they are better suited to AGVs rather than AMRs. AGVs are generally cheaper than AMRs, so that is not necessarily a disadvantage.

- Barcode-guided mobile robots can navigate flexibly, provided the environment they are operating in has the necessary barcodes in place. Lasers on the robots can be used to read labels and so to identify objects that have been mapped, such as shelves and doors. The robots use electronic maps to plan routes to shelves that are collected and transported to the relevant workstation.



- Laser-guided mobile robots navigate using lasers to determine their position relative to objects. The simplest systems use mirrors that enable robots to determine their location on the floor, which is mapped, and so enables them to plan and follow a route. More sophisticated systems can create their own 3D maps, enabling them to identify objects, determine locations and avoid obstacles.

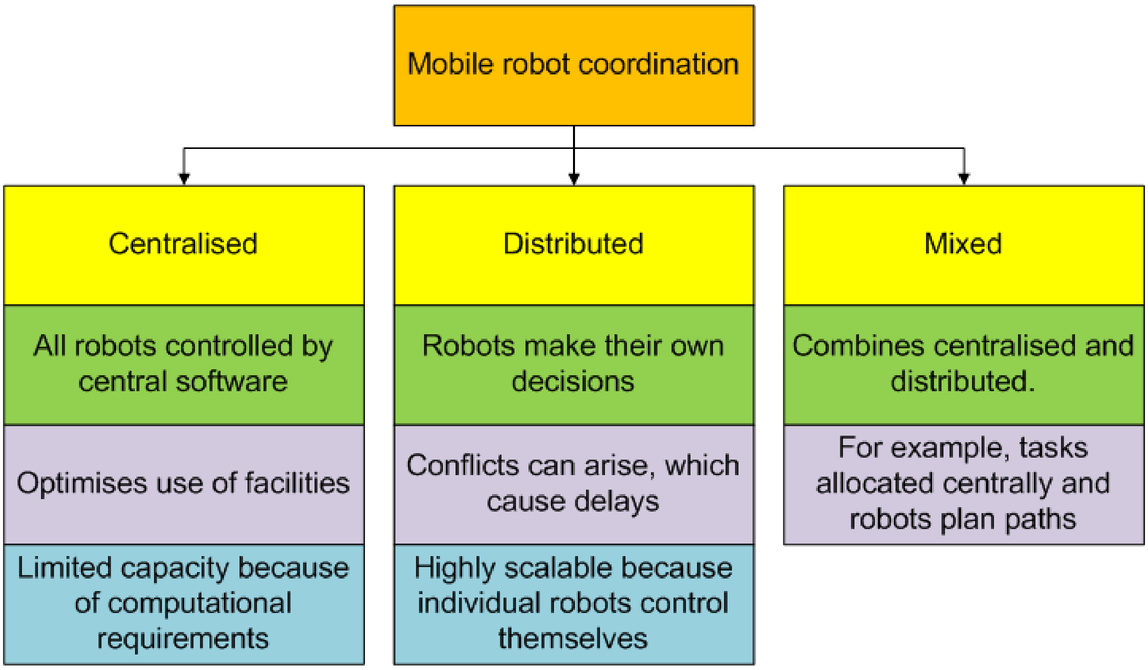


These systems are often used on relatively large and heavy robots, such as autonomous forklifts. They are often used for the transportation of heavy loads, such as full pallets. That often makes them better suited to putting incoming goods in storage rather than picking goods for despatch. That type of application requires robots to follow predefined routes and so they may be better suited to AGVs for the sake of minimising costs.

AMRs that rely on laser guidance can be dangerous if they fail to detect human traffic. That risk can be dealt with by designating zones that robots are programmed to avoid and restricting pedestrian traffic to those zones.

Coordinating movements of mobile robots

The nature of the application dictates the choice between AGVs and AMRs. AMRs are preferable when robots require significant onboard intelligence, including the ability to plan their own routes and avoid obstacles. AGVs are cheaper but are restricted in terms of onboard intelligence. They must be guided by a central system. Their sensors can detect unexpected obstacles in their paths, but they can then do no more than stop and transmit an error message to the control system. They cannot navigate a route around an obstruction.



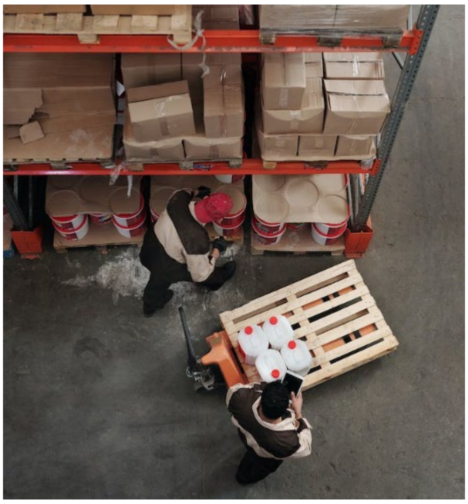
Centralised systems allow for the best possible use of robots and floor space. Software manages the operation of robots, allocating retrieval tasks to individual devices, setting paths and tracking locations. The software prevents collisions and avoids holdups by plotting paths and determining optimal routing. That could mean slowing a robot down or even making it stop briefly to permit another robot with a higher priority to pass.

Centralised systems become much more complicated as the scale of the operation grows and the number of robots increases. That constrains the number of mobile robots that can be operated simultaneously.

Distributed systems use AMRs that have been programmed to operate with a high level of autonomy. That relieves the pressure on the centralised control software because each robot determines its own path and manages conflicts independently.

Mixed systems can be faster than centralised systems. They relieve the central control software of some of the burden of managing individual robots. Most complex automated warehouses focus on mixed control systems.

Human-robot interactions



Some tasks can be carried out more efficiently by humans than by robots. For example, humans are better at removing plastic film from palletised goods or opening cardboard cartons and picking individual items from the resulting opened case.

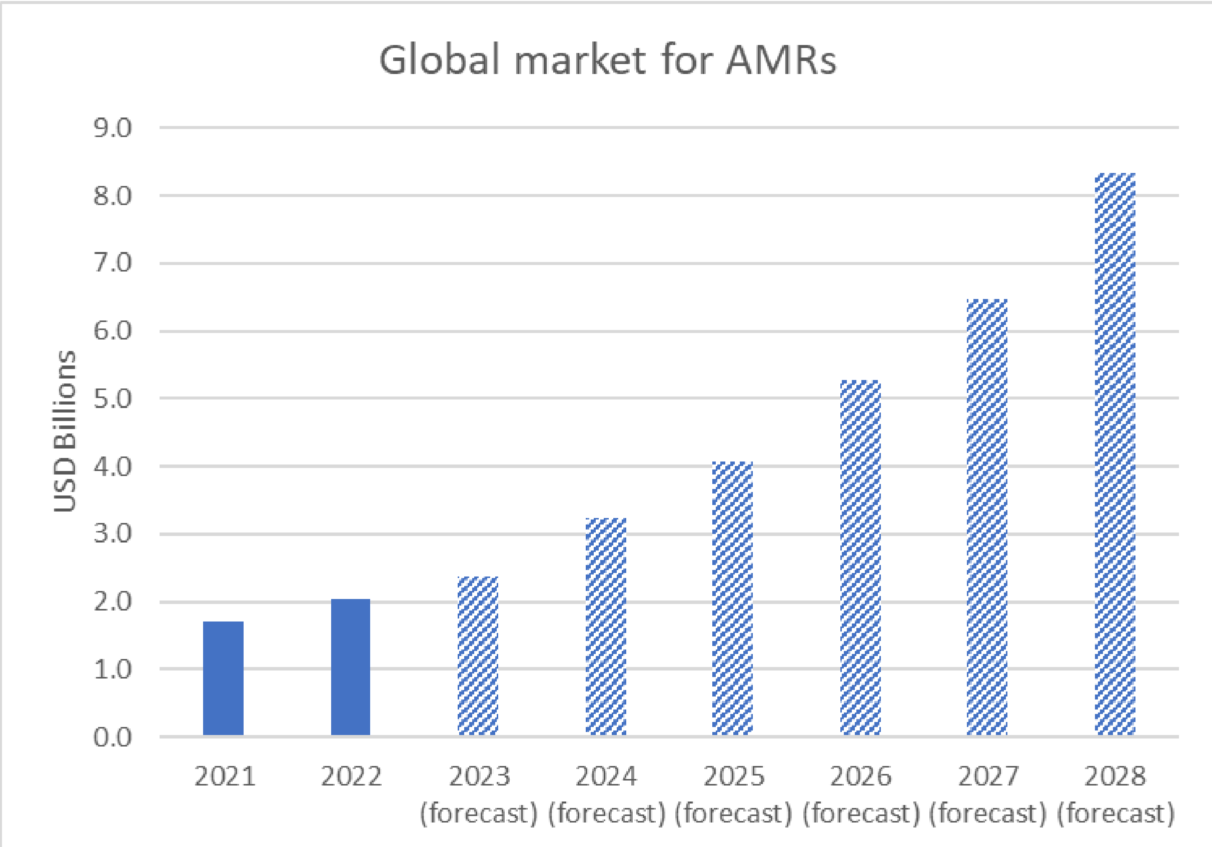
Humans may be required to work in collaboration with robots. A human might be directed to a particular aisle to pick items for collection by a robot. In that case, the sequencing of tasks for both humans and robots has to be managed so as to optimise the use of both, minimising both idle time and the total distance travelled in the course of each shift.

The design of robots should take account of the actions that will be undertaken by warehouse staff. For example, loading and unloading robots by hand can create the risk of accidents if the loading platform is at an awkward height or there is a risk of items falling and injuring employees.

Safety issues are also important when mobile robots and humans work in the same areas. Collisions and dropped loads can lead to serious injuries. Robots can be fitted with sensors that enable them to identify the presence of humans.

Market for automated warehouse equipment

The market for warehouse automation is growing, fuelled by wider changes such as the growth of online retailing. For example, the global market for AMRs is expected to increase as follows:



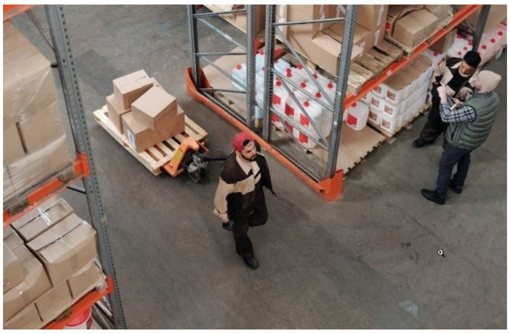
<u>Warehouse management systems</u>

A warehouse management system (WMS) consists of software that monitors movements of inventory within a warehouse and ensures that inventory is managed and used in an efficient and cost-effective manner. WMSs support tasks such as storing incoming inventory and picking items in order to fulfil orders.

Automated warehouse equipment, including carousels and robots, must be capable of integrating with users' WMS systems, both standard packages and bespoke systems written to meet specific requirements.

Robobryce

Robobryce was established in 1952 as a manufacturer of warehouse fittings and equipment. Developments in manufacturing and in traditional retailing, such as the introduction of supermarkets, encouraged the construction of large warehouses. The company has grown steadily since then, being quoted on the Tessland Stock Exchange in 1971.



Robobryce's initial product range focussed on carts and similar devices that could be used to transport goods. These were designed to be pushed or pulled by human operators. Over time, the product range was expanded, to include shelves and forklift trucks. All production took place at a factory in central Tessland.

Robobryce has always taken an innovative approach to product development. Its shelves are highly adaptable and can be assembled and configured in many different ways. They can also be supplied with specialised fittings that enable them to store unusual products such as rolls of carpet. It has several different models of forklifts, including conventional, high reach and narrow aisle designs. Robobryce works closely with clients, advising them on the design of their warehouses so that they can be optimised in terms of capacity and efficiency of operation.

Robobryce introduced its first autonomous products in 2005. These proved commercially attractive, despite the limited capabilities of the products that were available on the market. Warehouse operations were changing because of developments in logistics and, in particular, the growth of online retailing. Warehouse operators found themselves having to pick individual units instead of full pallets, as had often been the case before.

By 2008, demand for autonomous products had grown to the point where Robobryce decided to relocate production of its existing range of non-automated and non-autonomous products to a factory in Darrland. Darrland has a relatively weak economy and wages are low. Despite that, the country's educational standards are high, enabling Robobryce to recruit skilled production staff for less than would have to be paid in Tessland.

The Darrland factory continues to operate because there is a strong demand for its products. Warehouses vary in size, and it can be more efficient to use human operators rather than robots to run small warehouses, taking instructions from the WMS. Large warehouses may rely on mobile robots to facilitate inventory movements, but they often use traditional shelving for storage and low-technology devices such as conveyor belts for transportation.

Most of the production equipment at Robobryce's Tessland factory was shipped to Darrland. The Tessland factory was then re-equipped for the manufacture of high precision, autonomous equipment. The Tessland factory makes extensive use of industrial robots for manufacturing and assembly tasks and for handling of inventory and finished goods.

Robobryce currently employs 12,000 production staff, of whom 7,000 are based in Darrland and 5,000 in Tessland. The company is one of the world's largest manufacturers of automated warehouse systems. It designs warehouse solutions on a global basis, supplying hardware and software in order to implement its designs.

Products

Robobryce offers a wide range of products for use in warehouses.

Darrland factory	Tessland factory
• Forklift trucks – primarily optimised for use in warehouses (e.g., narrow aisle and high-reach designs). • Hand trucks – both open trucks and trucks with forks that can lift and transport pallets. Robobryce's hand trucks are electrically powered but require a human operator to steer them. • Shelving – modular shelving units that can be built into a variety of configurations that are suitable for the vast majority of warehouse layouts.	• Horizontal carousels – primarily suited to the storage and retrieval of limited quantities of goods that can be stored in bins or hung on rails (e.g. garments). • Vertical carousels – primarily suited to store and retrieve goods on shelves from floor to ceiling. Goods are always presented at a suitable height to be lifted safely. • Mobile robots – Robobryce offers a wide range of mobile robots, including both AGVs and AMRs. It has robots suited to G2P and R2G roles. Robobryce's robots are regarded as being amongst the most technically advanced on the market.

In addition to manufacturing warehouse hardware, Robobryce provides customers with extensive consulting support in the design and installation and ongoing support of warehouse systems. The company employs 800 business advisers who can assist at all stages of the design of a new warehouse or the upgrading of a new facility. That support is vital because of the need to integrate autonomous devices with warehouse management systems (WMS).

Robobryce has extensive research and development activities, focussed mainly on autonomous products:

- Mechanical engineers aim to develop the physical attributes of autonomous products. These include enhancing the precision with which products can be picked, without causing damage, and the capacity of autonomous products, enabling them to carry larger quantities safely.
- Electrical engineers are interested in powering products that rely on electric motors, whether they are autonomous or non-autonomous. Many of Robobryce's products are powered by batteries and must be recharged at regular intervals. Ideally, these products should operate for as long as possible between charges and the charging times should be as rapid as possible.
- Software engineers design software and write and test program code. Robobryce's software engineers focus on autonomous products, with a view to adding capability and

enhancing reliability. Hardware developments such as new sensors and more powerful processors create a need for software upgrades that can make use of these opportunities. Robobryce must also maintain its software to ensure that its products can continue to operate in conjunction with warehouse management systems.

Robobryce's research laboratory is located in a large building beside the Tessland factory. The company employs 900 research and development staff, split equally between mechanical, electrical and software.

Extracts from Robobryce's annual report

Robobryce's mission and values

<u>Our mission</u>

Robobryce's mission is to pursue the growth of our business in a manner that advances social wellbeing.

<u>Our vision</u>

Robobryce's vision is to enhance the efficiency of our customers and, in so doing, to add value to society.

<u>Our values</u>

- Robobryce aims to enhance social wellbeing and the quality of life.
- Robobryce aims to meet stakeholders' needs.
- Robobryce aims to innovate and to be at the forefront of the implementation of new technologies.

Robobryce's Board of Directors

Professor Sudhakar Pattanaik, Non-Executive Chair

Sudhakar is a mechanical engineer by training. He taught engineering at a prestigious university, rising to the rank of professor and Dean of Engineering at the University of Central City in Tessland. He served as Principal of the University before retiring from academic life and joining Robobryce's Board in 2021.

Sudhakar is a member of the Council of The Institute of Mechanical Engineers of Tessland.

Ewa Durska, Chief Executive Officer (CEO)

Ewa worked for a major retailer as a logistics manager, eventually reaching the position of Head of Logistics before leaving the company to join Robobryce as Director of Research.

She has served as Robobryce's Chief Executive Officer since 2021.

Eamonn McCauley, Chief Operating Officer (COO)

Eamonn studied electrical engineering at university. He joined Robobryce in 1998, initially as a member of Research and Development before moving into Production. He completed a part-time MBA degree during that period.

Eamonn managed Robobryce's autonomous products factory from 2014 until 2022, when he was promoted to COO.

Filiz Yildiz, Chief Finance Officer (CFO)

Filiz is a professionally-qualified accountant. She has had a varied career, working for several organisations in finance-related roles. She was Chief Accountant at a major manufacturer of construction equipment before she joined Robobryce as Head of Treasury.

Filiz was promoted to CFO in 2020.

Dr Hassan Khattaf, Director of Research

Hassan studied data science at Tessland's Capital City University and completed his PhD at the University of Central City, where he taught and researched until 2016. He left academic life to join Robobryce as a research manager.

Hassan was promoted to Director of Research in 2019.

Hou Xijin, Human Resources Director

Hou studied Human Resource Management at University. She worked in the Personnel Department of a major bank after graduating, during which time she completed the Tessland Institute of Personnel and Development qualification. Hou spent 5 years as Head of Human Resources at Robobryce's non-autonomous products factory in Darrland before returning to Tessland as Head of Human Resources.

Hou was promoted to Human Resources Director in 2023.

Didier Auroux, Senior Independent Director

Didier had a successful legal career, working for one of Tessland's largest commercial law firms. He was a partner of the firm and served as managing partner for 3 years before retiring.

Didier joined Robobryce's Board as Senior Independent Director in 2020.

Nina Isabel Coria, Independent Non-Executive Director

Nina worked as an economist at the head office of a major bank for much of her career. She was involved in policy development for much of her time, rising to Chief Economist. She retired from banking in 2016, spending 4 years as a Professor of Economics at Capital City University. She joined Robobryce's Board in 2020.

Nigel Taylor, Independent Non-Executive Director

Nigel spent most of his career working for a major management consulting firm. That involved significant overseas travel and gave him a broad experience of working with manufacturing companies on a consulting basis.

Nigel joined Roboryce's Board when he retired from the consulting firm in 2022.

Board responsibilities

Ewa Durska Chief Executive Officer			
Eamonn McCauley, Chief Operating Officer	Filiz Yildiz, Chief Finance Officer	Dr Hassan Khattaf, Director of Research	Hou Xijin, Human Resources Director
• Production • Marketing • Integration of strategic plans	• Financial reporting • Management accounting • Treasury	• Software maintenance and development • Physical product development • Product safety	• Staffing matters including recruitment, retention, remuneration and training • Factory health and Safety

	Board committees			
	Audit	Risk	Remuneration	Nomination
Professor Sudhakar Pattanaik, Non-Executive Chair	♦	♦		♦
Didier Auroux, Senior Independent Director		♦	♦	♦
Nina Isabel Coria, Independent Non-Executive Director	♦		♦	♦
Nigel Taylor, Independent Non-Executive Director	♦	♦	♦	

The Chief Internal Auditor reports to the convener of the Audit Committee.

Robobryce's Principal Risks

Risk impact	Risk mitigation
Customer demand within key business segments can be cyclical. Also, many customers are in industries that are highly competitive, which puts pressure on both investments and willingness to bear costs.	Robobryce pays close attention to all available information about customers and adapts plans and budgets accordingly. The company also aims to be flexible and adaptable, with a view to reflecting demand in managing capacity.
Customer projects can be significant and can take a long time to implement. That can lead to problems such as revisions to specifications by customers; difficulties in predicting costs accurately; penalties for late completion; and customers becoming insolvent during the project.	Robobryce assesses risks on a case-by-case basis and monitors progress closely throughout. Contracts are conducted in accordance with detailed specifications that allow for possibilities such as requests for changes in deliverables and the possibility of a supplementary charge for any additional costs.
Robobryce does business in many different countries, both as a supplier of warehouse products and systems and as a buyer of parts and materials.	Robobryce hedges currency risks as appropriate, focussing on the management of economic and transaction risks.
Robobryce faces significant IT risks, both in terms of its own operations and in respect of the design and installation of automated warehouse systems that rely heavily on software for the operation of autonomous products.	Robobryce has systems in place for the management of IT risks. Those systems are kept under constant review and are updated as necessary in order to minimise IT risks.
The company depends heavily on its technical and management staff to ensure that it remains at the forefront of product development and can ensure that there is capacity to maintain the design and installation of customers' systems.	Robobryce keeps staff salaries under constant review and ensures that they are competitive in comparison to rivals. The company also invests heavily in training and staff development, with a view to ensuring that skilled staff have a clear career path open to them.

Robobryce Group
Consolidated statement of profit or loss
for the year ended 31 December

	2022	2021
	T$ million	T$ million
Revenue	14,911	13,867
Operating costs	(11,631)	(11,024)
Operating profit	3,280	2,843
Finance costs	(1,100)	(1,100)
	2,180	1,743
Tax expense	(305)	(227)
Profit for the year	1,875	1,516

Robobryce Group
Consolidated statement of changes in equity
for the year ended 31 December 2022

	Share capital	Retained earnings	Currency reserve	Total
	T$ million	T$ million	T$ million	T$ million
Opening balance	800	9,296	(86)	10,010
Profit for year		1,875		1,875
Dividend		(426)		(426)
Loss on translation			(6)	(6)
Closing balance	800	10,745	(92)	11,453

Robobryce Group
Consolidated statement of financial position
as at 31 December

	2022	2021
	T$ million	**T$ million**
Assets		
Non-current assets		
Property, plant and equipment	8,141	7,653
Goodwill	5,815	5,815
Software development costs	5,428	4,939
	19,384	18,407
Current assets		
Inventories	2,154	1,757
Trade receivables	3,034	2,607
Bank	167	124
	5,355	4,488
Total assets	24,739	22,895
Equity		
Share capital	800	800
Currency reserve	(92)	(86)
Retained earnings	10,745	9,296
	11,453	10,010
Liabilities		
Non-current liabilities		
Borrowings	11,000	11,000
Current liabilities		
Trade payables	1,978	1,654
Tax liability	308	231
	2,286	1,885
Total equity and liabilities	24,739	22,895

Extract from competitor's financial statements

Robobryce is one of six major companies that compete for the design and implementation of automated warehouse systems. Its most direct competitor within this market is Pavrobot, which is also based in Tessland. Pavrobot's manufacturing interests are restricted to autonomous products such as carousels and mobile robots. The company does not manufacture non-autonomous products. Indeed, it sometimes specifies Robobryce shelves when it designs client warehouses.

Robobryce and Pavrobot frequently bid against one another for warehouse contracts.

Pavrobot Group
Consolidated statement of profit or loss
for the year ended 31 December

	2022	**2021**
	T$ million	**T$ million**
Revenue	18,788	17,097
Operating costs	(14,279)	(13,421)
Operating profit	4,509	3,676
Finance costs	(1,400)	(1,400)
	3,109	2,276
Tax expense	(435)	(296)
Profit for the year	2,674	1,980

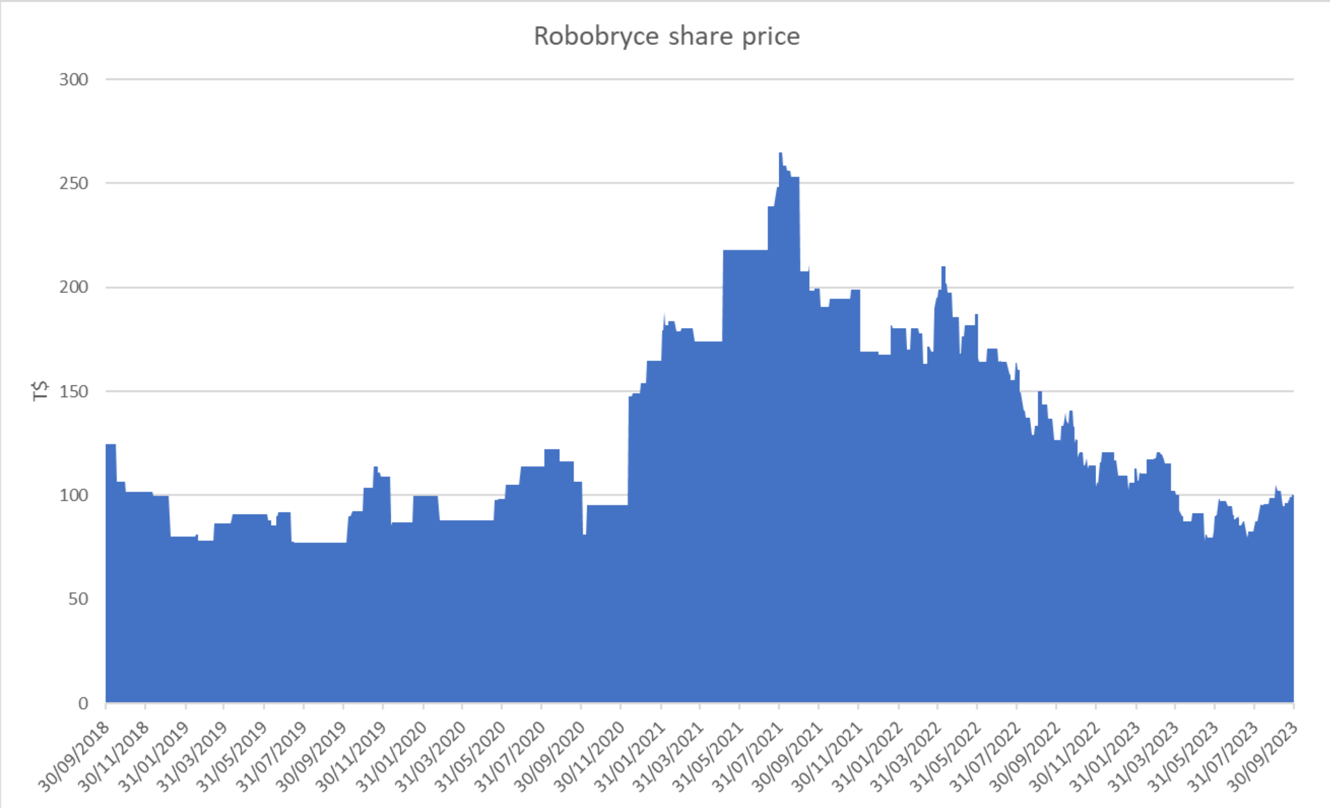
Pavrobot Group
Consolidated statement of changes in equity
for the year ended 31 December 2022

	Share capital	**Retained earnings**	**Currency reserve**	**Total**
	T$ million	**T$ million**	**T$ million**	**T$ million**
Opening balance	1,000	9,907	(103)	10,804
Profit for year		2,674		2,674
Dividend		(583)		(583)
Loss on translation			(9)	(9)
Closing balance	1,000	11,998	(112)	12,886

Pavrobot Group
Consolidated statement of financial position
as at 31 December

	2022	2021
	T$ million	T$ million
Assets		
Non-current assets		
Property, plant and equipment	10,822	9,956
Goodwill	6,764	6,764
Software development costs	4,960	4,514
	22,546	21,234
Current assets		
Inventories	2,390	1,875
Trade receivables	3,570	3,077
Bank	928	682
	6,888	5,634
Total assets	29,434	26,868
Equity		
Share capital	1,000	1,000
Currency reserve	(112)	(103)
Retained earnings	11,998	9,907
	12,886	10,804
Liabilities		
Non-current liabilities		
Borrowings	14,000	14,000
Current liabilities		
Trade payables	2,111	1,765
Tax liability	437	299
	2,548	2,064
Total equity and liabilities	29,434	26,868

Share price history

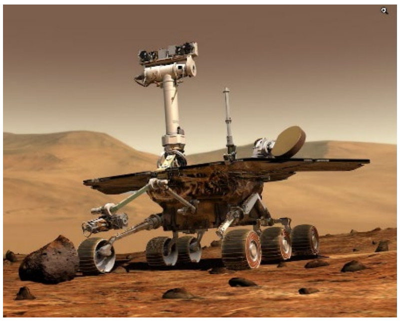


Robobryce's beta is 0.91.

News stories

Happy Comic

Readers' questions



Question: I watched a documentary about robots and was amazed that they can operate independently and still navigate without crashing into things all the time. How do robots do that?

Ivan, age 12

Answer: There are lots of different ways in which robots can avoid damaging collisions. The easiest is to use a bump sensor, which is a simple switch that is hidden behind a bumper. The switch is pressed if the bumper hits an object and the robot stops. The robot will then respond to the obstacle according to its programming. It could send a message that it has stopped and will await electronic instructions, or a human operator could reposition the robot and reset it, or the robot could be programmed to reverse a short distance and turn slightly, before setting off in a slightly different direction, hopefully avoiding the obstacle.

The most complex robots use LIDAR, which operates in a similar way to radar, but it uses laser light instead of radio waves to scan ahead and create an image. If a robot has a powerful enough processor, it can interpret LIDAR images and use them to avoid objects or to identify the destination for a journey. LIDAR has the advantage of being able to detect objects before a collision. With the right programming, robots can predict the course of moving objects and can take evasive action if there is a risk of a collision.

These are just two examples. Robots can be equipped with lots of different types of sensors that can be used to identify their locations, track objects and locate specific items.

Tessland Telegraph

Tessland Foods opens lights-out warehouse

Tessland Foods has opened its first lights-out warehouse. This will be used to manage materials used by the company to manufacture pies and ready meals.

The new warehouse uses horizontal carousels to store and transport sides of beef. The warehouse management system can select specific items to be picked within minutes of a request from the factory, so inventory can be selected on the basis of its age and its quality.

The warehouse was designed and installed by Robobryce.

The warehouse is referred to as lights-out because it does not require any staff to work alongside the automated equipment. That means that the warehouse does not have to allow for the needs of humans during routine operation. In a cold store environment, that means that there are fewer heat sources in the warehouse, which reduces operating costs because less must be spent on energy to power refrigeration. In theory, the warehouse could operate in complete darkness, with the lights being switched on only if a member of staff has to enter for maintenance purposes.

Tessland Telegraph

Supermarket price wars continue

Supermarket customers continue to enjoy price reductions as the five major supermarket chains continue to cut their prices in order to win market share. This is good news for customers, but less welcome for investors in supermarket shares. Industry experts believe that the retailers are making little or no profit on popular items. If the price cuts continue, then supermarkets might actually start to incur losses at the checkout.

Professor Marika Bogren, a leading economist, commented that the price war might appear illogical, but it is consistent with game theory. In game theory, each player's payoff is affected by the decisions of others. Game theory assumes that players act rationally and in their self-interest. Supermarket boards might cut their prices in order to maintain sales volume and retain market share. If a rival reduces prices still further, then it might be rational to cut prices even further in order to avoid being driven out of business.

Professor Bogren added that it would clearly be more rational for all supermarkets to set prices based on reasonable margins and for all to enjoy the benefits of a stable and profitable market. Sadly, game theory suggests that such outcomes are unlikely to remain stable in practice.

Tessland Daily

Mixed news for warehouse staff

Logistics work in warehouses has a reputation for being poorly paid and stressful. Workers often have to keep up with pressure to process orders quickly and accurately. They are also at risk because of the need to lift and carry goods.

Warehouse work is changing because of the increased emphasis on automation. Each new generation of robots adds capabilities with respect to their ability to conduct tasks that previously depended on human labour. Robots can pick items from shelves and transport them to workstations for processing. The processing might be carried out by a human, who can focus on packing and labelling goods for despatch. Alternatively, robots can carry out tasks that were previously too complicated for machines, including wrapping packages.

Automation need not replace staff entirely. Collaborative robots (or “cobots”) are designed to work alongside humans, using sensors to avoid accidents and injuries. Cobots can eliminate much of the heavy lifting that might have been required in some warehouses.

There is no doubt that automation will replace many of the workers required in large warehouses, but the jobs that remain will be potentially more interesting and better paid. There will be a greater need for staff trained in IT and for engineers to maintain and repair automated equipment.