



WDP

WAREHOUSES WITH BRAINS



DESIGNING THE WAREHOUSE OF THE FUTURE

Case: Barry Callebaut's
New Sustainable Warehouse

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01. Introduction

When you think of a modern warehouse, you may visualise robots and machines constantly picking, sorting and packing items to be stored or transported. However, while some warehouses employ a wide range of modern technologies in their operations, an intelligent warehouse is more than just a combination of machines.

Developing an intelligent warehouse has its foundation in selecting the right location and working out its tailored design. Various decisions have an impact on the output and efficiency of a distribution centre. While companies want to offer the best customer experience, employee experience is becoming increasingly important too. Sustainability is yet another aspect that cannot be ignored when designing a warehouse. When do you add robotics and artificial intelligence? How do you know which is the best solution for your organisation? And finally, you also need to find the right partners for the client.

At WDP, we value the input of our dedicated partners, who have a wealth of expertise in varied fields. From design and construction to the materials and supply chain that will be installed in the warehouse. By bringing these partners to a round table beforehand to assess and analyse the requirements of an organisation, we reduce costs and help overcome obstacles during project execution. And in the end, the client will have a warehouse that meets all organisational needs- today and in the future.

In this e-book, you'll get to read about our project with Barry Callebaut, the leading chocolate and cocoa products manufacturer. This industry leader wanted a modern warehouse that could keep up with its ambitious growth story. The new distribution centre also had to match their sustainable goal to be carbon-neutral by 2025 and offer their staff the best possible work environment. Discover how we completed this project with the help of an ecosystem of experienced partners.

In the chapters that come after the Barry Callebaut case,

you'll find more tips and insights about building a sustainable and future-proof warehouse. Finally, we would like to extend our gratitude to Miebach Consulting for partnering with us in this project and their critical support in selecting other project partners. As you will see, they all played a significant part in Barry Callebaut's warehouse design.

We hope you enjoy reading this whitepaper. We are always available to answer any questions.

Joost Uwents

CEO at WDP



02. A Sustainable Warehouse for Barry Callebaut



Barry Callebaut is the world's leading manufacturer of high-quality chocolate and cocoa products. In 1996, Belgian chocolate maker Callebaut merged with the French Cacao Barry Chocolate Company. The Barry Callebaut Group is headquartered in Switzerland and has more than 12,000 employees in 63 factories worldwide. Their chocolates are sold in 143 countries.

In 2018, Barry Callebaut decided to build a new warehouse in Belgium. From this location, millions of tons of chocolate would be distributed in Western Europe and worldwide. Due to the enormous size of the warehouse, it was essential to make efficient use of the available floor area. And for Barry Callebaut, sustainability, in every aspect of the project, was necessary.

The perfect location

Previously, Barry Callebaut worked with eight smaller local warehouses to manage their logistics, with 60% of the stocks stored in the Aalst region. This led to a lot of extra costs and emissions due to avoidable transportation between these locations. With the company's clear vision about its future, it was sure that the current logistics would not support the expected growth. Therefore, the initial step was to find a suitable location for the new warehouse. For this, Barry Callebaut relied on the support of experts from Miebach Consulting, who helped them assess all factors and social impacts before settling on the best location.

To narrow down the search area, various factors were considered. First, the warehouse had to be located close to a highway that connects the facility with the port of Antwerp. This was essential for the export of chocolate to other countries and continents. Second, they needed an extensive site to be adequate for the enormous size of the distribution centre— with a total floor area that translates to 12 football pitches. And finally, the warehouse was to be built preferably within a 20-kilometre radius of Aalst to limit the travelling distance for the employees who worked in the existing warehouses.

Eventually, they found an ideal site of 65,000 m² in Lokeren. It is located in a triangle with Lokeren in the middle of Barry Callebaut's factories in Wieze and Halle. What's more, it is right next to the E17 highway that connects the warehouse with the port of Antwerp.



Building in height

Before designing a new warehouse, it is essential to get a grasp of the client's objectives. Barry Callebaut was able to project its needs for the next 12 years– the duration for which they signed a deal to rent the warehouse from WDP. The warehouse required a capacity of around 120,000 pallet spaces. Together with the supply chain experts from Miebach Consulting, Barry Callebaut analysed the situation and decided that the most practical solution to save space and reduce costs would be to build the warehouse vertically.

“When you have a product portfolio that lends itself to be automated, you should not hesitate to go for a fully automated solution. The sky is the limit! We found that we could keep around 80,000 pallets stacked vertically, while another 40,000 pallets needed to be stored conventionally,” explains Willy Raemdonck, formerly the Regional Logistics Manager and currently the new Site Manager for GDC at Barry Callebaut. “Not every pallet is suitable for a fully automatic warehouse, and our quality procedures do not allow for certain products to be mixed with others. So, we still needed dedicated zones to adhere to that segregation.”

Full automation is essential if you want to store pallets vertically. The pallets are first placed on conveyor systems that perform checks for weight and damage. Once a pallet has been approved, the monorail transports it to a crane that carries the pallet to an appropriate slot in the 40-metre-high bay cooling warehouse. Or the other way around when a pallet needs to be prepared for transportation.



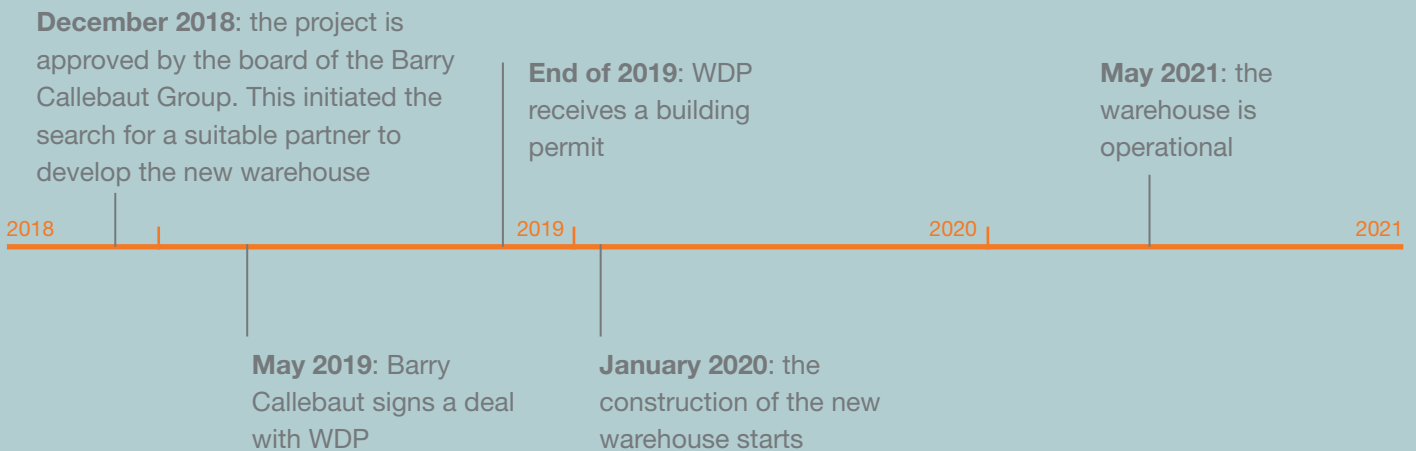
When you have a product portfolio that lends itself to be automated, you should not hesitate to go for a fully automatic solution. The sky is the limit!

– Willy Raemdonck,
Site Manager for GDC at Barry Callebaut



Timeline

The Barry Callebaut warehouse development was an efficiently managed and well-executed project. WDP brought on board all partners from the get-go at the design conceptualisation stage. This collaboration explains why the warehouse construction was finalised within a short timeframe for a project of such magnitude:



“We were looking for partners who had a proven track record of handling such a large-scale project. When WDP presented its plans, all stakeholders immediately had a seat at the table,” says Willy Raemdonck.

“Bringing on board every partner from the very first meeting of the design phase and onwards provided an efficient way of working. It allowed us to adapt the plans when necessary effectively. In such projects, challenges are unavoidable, but due to excellent collaboration among our partners, they were always able to find suitable solutions and ensure that we stayed on schedule.”

WDP collaborated with AAVO Architects for the warehouse design, who introduced Building Information Modelling (BIM) technology. We’ll explain this in detail in the next section. Besides Barry Callebaut, WDP, Miebach Consulting and AAVO Architects, other partners in this project included the Willy Naessens Group, Alheembouw, SSI Schäfer, Istema, SuReal and the city of Lokeren.

“Completing the application for a building permit in less than six months is quite rare for such a project. All plans were well worked out, and we are also grateful that the city of Lokeren has been in support of this project from the very first day.”

Getting a head start with BIM

The use of BIM methodology is one of the main reasons the design was such a success, and the construction deadlines were all met. BIM is more than a presentation of computer-generated images; it provides a real-time platform for communication between designers, engineers, the client and other parties involved in the project. In addition, BIM offers a 3D projection that allows analysis of the minutest technical details of the development and determines the timeline at different phases of the construction process.

“The digital model developed during the design phase made it possible to anticipate the positioning and volume of the storage equipment as well as ergonomics and the layout of social areas such as offices, restaurants and relaxation spaces,” says Damien Van Oost, Architect and Director of AAVO Architects. “During the execution of the project, and especially in the midst of the COVID-19 crisis, the BIM protocol was the common reference for all the participants in the project. The model effectively allowed us to anticipate various conceptual conflicts by avoiding execution errors and corresponding delays, supplements and litigations that often generate misunderstandings.”

A BIM model developed in the construction context can also give you a head start in the digital management of building maintenance. It works with a 3D Facility Management Model, where each element in the model is assigned a data sheet. This model allows for optimised data sharing, rapid problem localisation, planning of maintenance roles, maintenance of supplier data and other software updates concerning equipment. Thanks to its elaborate database, BIM effectively coordinates the evolution of the building from its conception to its recycling.

“

BIM’s 3D projection model allowed us to anticipate various conceptual conflicts by avoiding execution errors and corresponding delays, supplements and litigations that often generate misunderstandings.

**– Damien Van Oost,
Architect, Director of AAVO Architects**



Forever chocolate 2025: building a zero-emission warehouse

Sustainability is a strategic pillar for the Barry Callebaut Group. With Forever Chocolate, the company commits to sustainably producing all of its chocolate by 2025. Energy consumption was an essential consideration in constructing the new warehouse, but Barry Callebaut wanted to do more and secure a 'BREEAM Outstanding' certificate for the building.

BREEAM stands for 'Building Research Establishment Environmental Assessment Method' and is a sustainability certification for buildings with a minimal environmental impact. It assesses the building on various elements such as energy, water, health & well-being of employees, waste, pollution, transport and materials. The warehouse in Lokeren is the first of its size to receive a BREEAM Outstanding certificate. "Barry Callebaut is a leading company in the world of chocolate. If you want to be the best, you need to demonstrate it to the outside world. With Forever Chocolate, we wanted to build a zero-emission warehouse and a pleasant work environment for our people," says Willy Raemdonck.



Forever Chocolate 2025

To become carbon-neutral by 2025 and limit the new warehouse's energy consumption were crucial for Barry Callebaut. The distribution centre in Lokeren shall be a zero-emission site from the first day of operation. This could only be achieved by providing sustainable solutions during the design of the warehouse. Here are a few features that make this distribution centre a one of its kind in terms of sustainability:

- Solar panels are installed on the roof of the enormous building. This energy is sufficient to cover the entire electricity needs of the warehouse.
- A ground-coupled heat exchanger manages cooling and heating. This means that the warehouse does not use any fossil fuels to cool or heat spaces.
- Rainwater is collected and then released gravitationally into the surrounding streams of the industrial park. No pumps are needed. The basins are designed to ensure that the rainwater first infiltrates and only a limited, predetermined volume of water is drained from the site.

A healthy work environment

In a traditional warehouse, employees only get to see natural daylight when they leave the building. This arrangement is likely to have a negative impact on their well-being. Lighting is also vital for the prevention of accidents in the facility. Health and safety were, therefore, essential considerations in the design of Barry Callebaut's new warehouse:

- Inside the warehouse, there is enough space to ensure seamless and safe collaboration between man and machine. For example, although it is sufficient to provide an aisle width of 2.8m for reach trucks, this warehouse offers a total width of 3.6m to guarantee safety.
- Barry Callebaut has invested in appropriate lifting equipment, conveyer belts, and pallet labelling machines in terms of ergonomics.
- There is a lot of natural daylight in specific areas, thanks to the intelligent structure of the warehouse. After careful analysis, this was arrived at because sunlight is not recommended for certain chocolate products that have to be stored in darker spaces.





Meet the Dream Team for this project

Barry Callebaut

Leading manufacturer of high-quality chocolate and cocoa products. Barry Callebaut wanted a new distribution centre that is in line with the company's long-term sustainable growth strategy.

WDP

Logistics real estate specialist offering intelligent warehouse solutions. As project coordinator, WDP believes that co-creation and innovative collaboration make project execution seamless, timely and cost-efficient.

Miebach Consulting

Global supply chain expert providing solutions based on integrating consulting and engineering. Miebach Consulting helped Barry Callebaut analyse their needs and advised building the warehouse as a critical enabler for their supply chain strategy.

AAVO Architects

Architect office and BIM coordinator with experience in several BREEAM and BIM projects. AAVO designed the plans for the warehouse with a focus on carbon neutrality and the unique requirements of chocolate as a product.

Willy Naessens Group

Experts in industrial buildings and building new business premises. Willy Naessens Group specialises in using prefabricated concrete and metal constructions to provide sustainable and robust added value.

Alheembouw

Construction company with experience in complex and large developments. Alheembouw received the BREEAM certificate and assisted Barry Callebaut in building a unique, sustainable warehouse.

SSI Schäfer

Experts in warehouse equipment offering complete solutions for every project. SSI Schäfer helped Barry Callebaut with the setup of the fully automatic high-bay warehouse.

Istema

An engineer & study bureau with a focus on HVAC and sustainable techniques. Istema was responsible for the energy and technical concept of the building.

SuReal

An independent firm of architects and engineers with broad experience in large-scale projects. SuReal acted as sustainability manager and BREEAM assessor for this project.

The city of Lokeren

The Belgian city of Lokeren supported the project from the start. This smooth collaboration allowed the project to be delivered within the anticipated time frame.



03. 4 key questions to ask yourself

Before building a new warehouse, there are some crucial questions you need to ask. The answers will help avoid setbacks and delays during the construction process and create a future-proof warehouse capable of meeting the company's demands in the long run.

There is a lot to consider when designing a state-of-the-art and sustainable warehouse. By inviting all partners to sit at the design table, you can foresee challenges. These are easy to resolve during such an early phase of the project but could cost a lot of time and money later. Experts in the supply chain, equipment, sustainable technologies and automation industries can provide valuable insights to prevent and overcome difficulties during construction.



Together with Miebach Consulting and other partners, WDP has developed **four generic questions that should be answered at the beginning of each project:**

What are your objectives?

A warehouse is only a means to an end, so you need to understand the objectives of your business to find a balance between functionalities and costs. Is building a warehouse at this moment the right solution for your company? Do you have an idea of your needs five to ten years from now? How accurate can you plan your company's future, and how flexible does a solution have to be?

To identify these objectives and generate a long-term business strategy and vision, we always start with investment analysis. Maybe some requirements are not yet in the picture but are worth considering in the design phase of your building. This is precisely why you need to involve as many stakeholders as possible. For example, you will undoubtedly encounter obstacles that increase the overall budget if you construct a warehouse without input from supply chain and equipment experts.



How important is sustainability?

The answer to this question seems straightforward: sustainability has become part of most businesses' strategies, and various regulations have to be considered when designing a new warehouse. Still, many companies want to do more and be pioneers in green solutions. Customers also expect organisations to think about their ecological footprint. Younger generations, in particular, prefer products from brands that are environmentally conscious.

Deciding how far you want to go in constructing a green warehouse is an essential consideration at the beginning of any project. While it may slightly increase your total costs, it provides a wealth of benefits for your company's image. And, of course, more green technologies will save you energy and result in lower operational costs for your warehouse.

Having the right partners at the design table will help you define a sustainable vision and make impactful choices in implementing ecological solutions. From reducing the footprint caused by transportation to installing solar panels on the warehouse's roof to efficient energy use and waste reduction. Sustainability often goes hand in hand with providing a healthy, safe and pleasant work environment for employees. We shall examine this in more detail in Chapter 4 of this whitepaper.

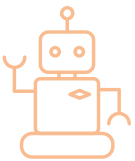
How volatile is your market?

Do you serve a stable market, or do you need a flexible solution? Do you have an e-commerce strategy, or are you planning to introduce online sales in the coming years? If you expect volume changes, this is a vital element to consider in the design of your warehouse. We also live in very unpredictable times. Ten years ago, costs and services were the main drivers in warehouse and supply chain design. Today there are many more factors to take into account.

As explained in the previous question, you cannot build a warehouse without thinking about sustainability. The global COVID-19 pandemic has also drawn our attention to the importance of resilience and ensuring business continuity. You want your warehouse to be operational in all circumstances. Although many companies experienced a difficult period due to the virus, some saw their business booming. Take, for instance, television manufacturers and swimming pools.

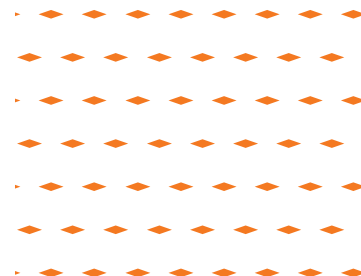
In the future, a warehouse could suddenly need to carry more inventory than it does today. Although many of these elements cannot be foreseen, good preparation by complementary partners with a good understanding of your industry can make a difference in increasing your business' resilience.

What technologies do you need?



Automation and robotics have become very important in warehouses and the supply chain. Taking over manual tasks from employees will reduce physical stress and increase productivity and efficiency in the warehouse. But just as the warehouse itself, technological tools are only a means to an end. Data analytics, machine learning and artificial intelligence help streamline processes, make predictions and improve your decisions. But not every company needs these technologies, so you should consider your current and future needs.

Many companies find this to be a challenging exercise. Due to the various technologies and tools available, it can feel like a jungle. What's more, the most recent and innovative solution may not always be the best solution for a specific warehouse. But suppose you have experienced partners with staff who keep up with the latest trends and have implemented different solutions for various clients. In that case, you have all the necessary support to make the right decisions when designing an efficient and future-proof warehouse.





There is no one-size-fits-all strategy in warehouse construction. Instead, Design-thinking is essential to find the right solutions that correspond to a company's current and future needs. This is why WDP surrounds itself with a diversified ecosystem of established partners. In the following chapters, we'll give more specifics on sustainability and automation.



04. Planet, People and Profit

Building a sustainable warehouse goes further than just saving on energy consumption. You should develop a vision and strategy around three key pillars: environment, people and finances.

First, you want an intelligent warehouse that is environmentally friendly and improves the company's ecological footprint. Second, a modern warehouse has to consider the health and well-being of its employees, with enough access to natural light and technologies that reduce manual labour. And finally, the warehouse must be efficient to generate financial benefits in the short or long term.

In this chapter, we elaborate on each of these pillars.

A positive impact on the planet

A decade ago, the environment was certainly not the most crucial consideration in the design of a warehouse. Today, you need to be compliant with all kinds of regulations, and your decisions can have a significant impact on the way clients perceive your business. Just as many organisations switch to a fleet of electric company cars, an environmentally conscious warehouse can change your brand's general perception and help you become carbon-neutral eventually.

Analysis by Miebach Consulting reveals that the main driver for sustainability could either be internal or external pressure. Younger generations, especially, expect that companies take responsibility for leaving a positive impact on the planet. As customers, they might choose a different brand if you fail to address environmental issues in your organisation. And as potential employees, they may probably prefer working for an employer that shares their vision of a sustainable planet.





So, how do you build an environmentally-friendly warehouse? Here are some tips:

- **Choose the right location:** having a sustainable warehouse is one thing, but transportation can significantly increase the footprint of your business. The closer your warehouse is located to your customers, the fewer the emissions released when delivering the goods. Finding a suitable location depends on your business strategy. If your customers live in an urban area, choosing a site just outside of the city could be wise. If export is essential, you may need a convenient location with easy access to highways or transportation hubs such as airports, railyards or ports.
- **Reduce your energy consumption:** various elements can reduce the energy consumption within the four walls of your warehouse. Using suitable insulation materials can save you a lot of energy while improving your employees' comfort. Think about access to natural light, materials that have a positive impact on air quality, etc. Installing sensors can be helpful in monitoring lighting in rooms and managing resources such as water and gas. If some parts of the warehouse require cooler temperatures, this should also be featured in the design plans to provide a smart layout for the warehouse.
- **Install solar panels:** the roofs of most warehouses provide ample surface to install solar panels that can generate most of the energy required inside the warehouse. Solar panels are an essential ingredient in the setting up of a zero-carbon warehouse.
- **Manage water & waste:** harvesting rainwater is a good idea when you need to use a lot of water in the warehouse. Avoid pumping systems by leveraging gravity to drain water and factor solutions and waste management technologies.



Your staff's well-being

The second pillar for a sustainable warehouse concerns the people who work in your facility. Most traditional warehouses are not the most pleasant places to work. They are often either dark or illuminated by artificial light sources. Due to a lack of technology and intelligent designs, manual labour can put a lot of physical and mental stress on employees. This may, in turn, put their health and safety at risk. In recent years, employers have been paying a lot of attention to the well-being of their staff. Healthy and happy workers are more motivated and productive. Smart warehouse and supply chain designs can significantly improve the lives of the people operating in your facility:



- **Reduce manual work:** many studies indicate that people working in warehouses have a higher than average likelihood of developing musculoskeletal disorders. Although this does not come as a surprise, such problems could be reduced by having the proper layout and technologies. For example, organise your goods to reduce the distance employees cover on foot, or use robotics to bring products and pallets to your employees. Suitable conveyor belts will also ensure that employees put less strain on their backs when bending to pick up items.
- **Provide enough light:** our bodies use natural light to regulate their internal clock. It gives us the right amount of energy in the morning and makes us sleepy in the evening. Sunlight is critical for our health and well-being. This cannot be replaced by artificial light such as LED lamps. Installing windows can have a positive impact, especially in rooms where people work most of the day. There are, however, some warehouse products that must be protected from natural light. So, you need to carefully consider all this during the design phase of the warehouse.
- **Safety first:** most safety precautions in warehouses are strictly regulated, but of course, you can always go a step further in developing a safer work environment. Provide enough space for authorised vehicles to drive through the warehouse. Make sure every corner of the building is well-lit to avoid accidents caused by poor visibility. Install signage and markings on the floor to guide people. The latter is a versatile solution that can be implemented with ease if you decide to change the layout of the warehouse.
- **Automate:** robotics, artificial intelligence and machine learning. These are all technologies that help increase efficiency and safety in a warehouse by streamlining processes or taking over dangerous activities and heavy lifting. In Chapter 5, you'll find some examples of technologies that could significantly improve the supply chain in your warehouse.

Long-term success

A sustainable warehouse sounds excellent, but in the end, you want your organisation to make a profit as well. Fortunately, all pillars are connected. Investing in the environment and the people working in your warehouse may cost you a bit more in the initial stages of a project, but it will offer many benefits in the long run. For example, it will improve your company's general perception and guarantee happy, healthy and motivated employees who are more productive.

Ultimately, your decisions should always be in line with the culture and philosophy of your company. However, it is also essential to understand the identity of your customers. What do they expect, and how do you see this evolve five to ten years from now? What is the commercial strategy for your company? The answers to these questions can have a significant impact on the design of your warehouse.

There are lots of scenarios that can change the way you approach the construction of a warehouse. Therefore, a thorough analysis should always precede the actual project. This is precisely why you need to involve many players with expertise in different fields: design, construction, supply chain, materials and technologies, etc. Eventually, this will save you lots of unnecessary costs and headaches.



05. Adding Brains to Your Warehouse

In the past, Artificial Intelligence (AI) was associated with science fiction movies, but today, the concept refers to technologies that are very accessible and commonplace in industrial environments. Your warehouse can record a lot of efficiency with the right solutions. However, not every piece of technology is the best choice for your needs, and you should always avoid investing in solutions that you have not identified a need for. The array of technologies can be overwhelming, but the right partner will help you make the correct assessments and effectively implement appropriate solutions in your warehouse.

Automation & Robotics

Most warehouses install technologies and robotics that make processes more efficient and reduce the human strain. Here are a few examples of well-established solutions:

- **Robotic arms:** to automatically pick and pack items or to monitor palletising processes.
- **Monorail:** a rail or beam for fully automatic and electrified transport of pallets.
- **High-speed conveyance:** conveyor belt for automatic transport of small/medium load units.
- **Autostore technology:** for automatic storage and retrieval with goods-to-person picking of materials.



Artificial Intelligence

AI technology is here to make our lives easier by increasing productivity, accuracy and safety in warehouses. It can process a lot of data to make the best decisions about the shortest routes to place items, streamline pick-and-pack processes, provide accurate inventory control, etc. Moreover, artificial intelligence never needs a break and can work 24/7. Many warehouses have several integrated AI technologies that communicate and function in harmony as a set of well-oiled machines.

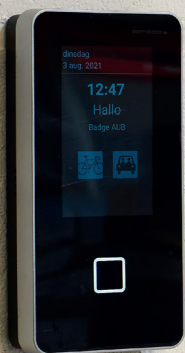
AI can also improve safety by assessing and analysing risks. It can take over dangerous and repetitive tasks, allowing the warehouse staff to focus on more valuable activities. AI will never entirely replace the need for human hands in a distribution centre, but it allows companies to use their people and resources more efficiently.



Digital twin

Some warehouses have already incorporated a lot of AI technology. For instance, to efficiently load trucks, predict the impact of the weather, etc. A digital twin can even support your supply chain. This model simulates the impact of certain decisions and can also make predictions about upcoming disruptions. It enables you to provide real-time responses to incidents and avoid costly downtime in your warehouse.

With the increasing importance of data and Artificial Intelligence, they have become essential considerations for anyone wishing to build a modern warehouse. Every distribution centre should have a minimum degree of automation, but each technology must be thoroughly evaluated. The input of a stakeholder who understands both the technologies and your company and industry needs is incredibly valuable in designing an efficient and profitable warehouse.



06. Building business resilience

For years, business resilience used to be no more than a fancy buzzword on company slides or in the shareholder reports of many organisations. Today, everybody realises that good preparation and long-term thinking are essential to afford agility when dealing with unprecedented circumstances. The coronavirus pandemic will not be the last shock that puts pressure on businesses around the world.

This uncertain future makes it even more important to have the right partners by your side. Building a future-proof warehouse is more complex than you think, but the input of an experienced ecosystem of experts will save you a lot of time and money. Barry Callebaut is an excellent example of a successfully delivered project, thanks to the concerted efforts of professionals from various backgrounds and expertise.





Are you looking for a new warehouse?

WDP is your partner of choice for the development and lease of logistics real estate on a permanent or short-term basis. Get in touch to learn more!

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