Is your organization ready for Robotics?

Roadmap Robotics in warehousing

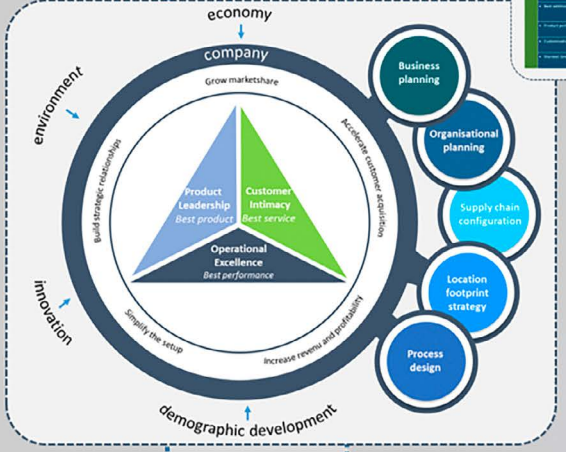
Step 1
Supply chain strategy

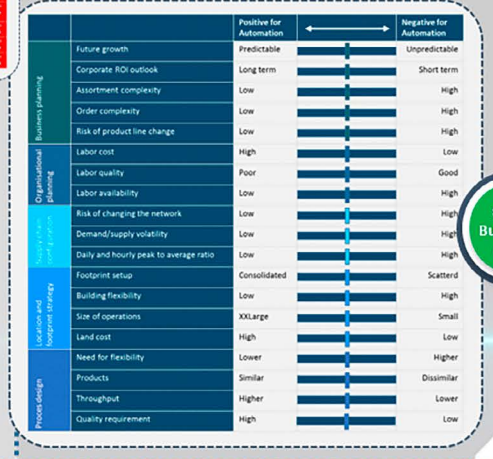
Step 2
Robotics Assessment

Step 3
Solution development

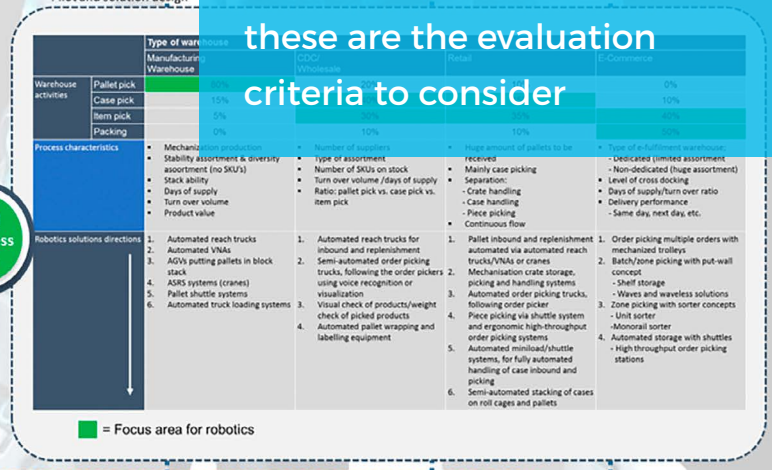
Step 4
Implement solution

Four clear steps to start Robotics in warehousing – these are the evaluation criteria to consider





solid Business case



continuous alignment

What are the business drivers implementing robotics?

What is the readiness of the organisation and expected improvement potential?

How to match the future business setup with investment and project planning?

Pilot and proof of concept implementation

logistiek»

Buck Consultants International

St. Onge Logistics Engineering Company

TICM

- Interim management
- Project management
- Change management

Four clear steps to start Robotics in warehousing – these are the evaluation criteria to consider

Contents

This white paper is a production of Logistiek. nl, in cooperation with Buck Consultants International, St. Onge Company and TICM. The roadmap and recommendations in this publication are based on extensive experience in practice with the design, implementation and usage of automated material handling systems, and also on international publications. The authors appreciate to receive your reactions via the following e-mail addresses:

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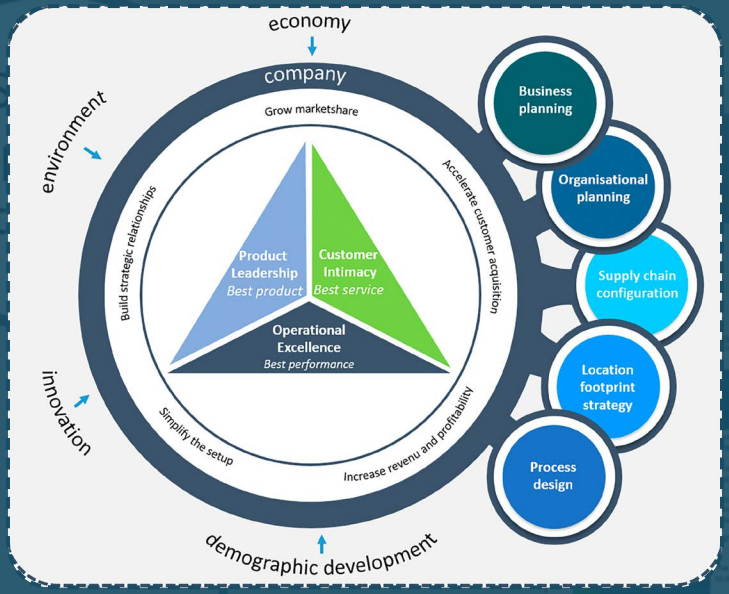
Introduction

Robots. Some people believe that we can turn off the lights in most of the warehouses within a couple of years. Robots will be doing the job, supported by operators, working in cooperation with new technology. From a technical point of view, it would be logical to assume that robots will be implemented on a large scale in the internal logistics processes of warehouses. However, the question is whether the robots are also the right solution from a strategic business point of view. If this were the case, what robot solution(s) would fit your warehouse(s) best? In addition, what would the business case be like and what are the implementation requirements, to successfully use robots in the long-term?

This white paper defines a large number of evaluation and decision criteria to be taken into account before deciding whether to invest in robots. In order to come to the right decision, the roadmap guides the evaluation process on a high level. To achieve this objective, a framework has been defined to streamline the internal as well as the external discussion about this innovative topic. The Framework does not only contain technical and economic elements, but also social and organizational ones. Furthermore, factors such as employment, labor circumstances and the creation of an attractive innovative working environment need to be taken into account. The preparation of the business case for the implementation of robots is complex. Last but not least, the risk factors need to be considered. Main aspects need to be considered: take your time, be precise, take out the emotions and keep an overview on all relevant aspects. The objective of the white paper is to contribute to the quality of the strategic decision-making processes, which are used to define and implement a Robotics strategy in the organization.

Step 1 – Define the added value of Robotics for your business strategy

Evaluation strategy



Introduction

Making the right choices regarding robotics starts with identifying logistical needs in relation to the long-term strategy of the company. The preconditions and dynamics of the environment, which the company must maneuver within the organization, determine to a large extent the logistical processes.

Preconditions are related to competition, product market combinations, geographic markets, and type of products and services. The dynamics of environment is about the volatility of the business, innovation speed, product life cycle of products and services, and the stability of the strategic starting points of the company. For instance, the change to e-commerce has an impact on the order profile for a wholesaler and thus has an impact on the design of robotics.

A good strategic scenario analysis can be helpful in weighing whether robotization of logistical processes is of added value for the company.

Steps that can be followed:

1. Which trends, innovations and developments are relevant to the company?
2. What are the market dynamics and competition fields?
3. What are the strategic business choices in the long term and what is the impact of this on the value proposition?
4. Which scenarios are possible and what impact does it have on operational management?

Identifying all these elements and analyzing their impact on business operations help to make the right choices for the logistics strategy. It is essential to determine the preconditions for costs of logistics, working capital, speed to market, assortment choices and service levels for performance to be well-identified before creating a roadmap for robotics.

Step 1 – Define the added value of Robotics for your business strategy

Future business strategy

- What geographical growth do you expect for your company?
- What business changes do you expect when entering new markets?
- What are your companies strategic and financial targets (Return on Investment) and limitations?

Value proposition

- What is the importance of speed and responsiveness to gain market share for gaining market share?
- What level of flexibility is required in your market(s)?
- Which future distribution channels do you foresee and how will they impact current channels?
- What is the impact of new technologies and innovations to your services?
- What are the business and financial risks and limitations?

Strategy related to distrubiton channels

- What is your go-to market and distribution strategy and how are these linked to product- and service requirements?
- How do you deal with the “Amazon” effect?
- How do you differentiate service levels?

The business strategy determines the preconditions for the required competitiveness of the organization and therefore the choices regarding the robotics solution.

1. Relevant trends, innovations and developments

To analyze the applicability of robotics it is important to test trends, innovations and developments. Testing must take place at:

- business planning
- organizational design
- supply chain configuration
- location footprint strategy
- design process

Examples of relevant questions:

- Which relevant trends, innovations and developments are there?
- What will our company do in five years and what products/services will we deliver?
- Which organizational forms, leadership qualities and business models are required?
- Which technological developments are coming and what are the consequences for our sector or organization?
- What does the world look like in 2025?
- What are the consequences of all technological, political and economic developments and what are the business risks?
- What are the consequences of all trends and developments on customer groups, sales markets, distribution networks, manufacturing/supplier footprint etc.?
- How can we respond with our organization to the changes that are coming at us?
- What are the dynamics of the labor market?

Step 1 – Define the added value of Robotics for your business strategy

2. Market dynamics and competition

Every market segment and industry has its own dynamics and characteristics. With their specific business strategy, companies make choices in the way they respond to customer needs and distinguish themselves from other market players.

Market dynamics differ per market segment and industry, and are largely determined by the following four factors. Each of these factors has an impact on the usefulness and necessity of robotics.

A. Product-life-cycle dynamics: Due to the influence of faster innovation and shorter time-to-market new models of products followed each other quickly. The product life cycle is getting shorter and shorter. This forces companies to continuously adjust and renew the composition of the product range, and as a result, the design of the logistics process.

B. Demand/supply: The imbalance between demand and supply influences the turnover rate of products and the predictability of demand. These have a lot of impact on lost sales and obsolete stock, but also on the required capacity and flexibility of logistics systems.

C. Business volatility: The demand variation and profile largely influence the stability and consistency of the workload of logistic systems and thus process efficiency and logistic costs per product.

D. Responsiveness: Investments in assets (e.g. robotics) affect the financial flexibility and responsiveness of a company. Finding an investment profile that keeps the right balance between working capital, service levels and logistics costs is the challenge here.

Step 1 – Define the added value of Robotics for your business strategy

In addition to market dynamics, an analysis of the competition provides input for making choices regarding business planning, organizational design, supply chain configuration, location footprint strategy and process design. Five forces play a role here:

- competition from new entrants
- negotiating position of customers
- negotiating position of suppliers
- possible substitution of products
- tactical maneuvers of current participants in the industry

3. Strategic business choices and value proposition

The structure of the supply chain structure is a consequence of the choices made in the value proposition of the company and the further development of this proposition towards the future.

The focus can be different for each company:

- Operational excellence: focus on low production costs, but also customer convenience. The focus of robotics will mainly be on reducing labor
- Customer intimacy: focus on good relationship with customer and possibility to adjust product to customer's needs (customization). The main emphasis will be on reducing turnaround time or making the product more customer specific
- Product leadership: focus on the best and most innovative products, with particular emphasis on improving the quality of the logistics processes

Step 1 – Define the added value of Robotics for your business strategy

4. Scenario planning

The scenario analysis step collects the information from the first three steps in such a way that alternative possibilities can be compared and to test critical starting points for robustness.

Take the following points into consideration when developing scenarios:

- Suppress the need to make decisions based only on known information, also review trends and developments that can have an impact on business operations, and specifically the interaction between potential issues and markets.
- Do not put too much weight on unimportant factors, prioritize and evaluate trends first qualitatively before being quantitatively supported.
- Assume that the future is not like the past, develop scenarios together with the most important stakeholders and build the scenarios around the critical uncertainties of the business.
- Stay realistic and eliminate emotional decision making: focus on objective decision making.
- Analyze both the impact of each scenario and strategic alternatives developed.

In short, first review the principles of logistics for the long-term strategy of the company before starting with a detailed plan for a robotics solution.
Prevent tunnel vision and approach the robotics challenge from an integral perspective. Robotics is not a standalone solution, but should ultimately add value to the business and the value proposition of the company.

Step 2 - Determine the process improvement potential of robotics

Supply chain performance drivers

	Proces design KPI		Relevance to business 1 = Winner 2 = Qualifier 3 =Non value add			Current performance (score 0-10)	Future business requirement (score 0-10)	Required movement (future-current)	Can Robotics support improvement Yes/No	
Service	Delivery reliability	Perfect orders level, OTIF	1	2	3				Yes	No
	Delivery speed	Order lead time end to end	1	2	3				Yes	No
	Order size	strict or flexible minimum order size policy	1	2	3				Yes	No
	Transactional value	High or low value	1	2	3				Yes	No
	Agility to demand changes	The ability to respond to demand changes	1	2	3				Yes	No
	Working capital	Fixed to variable cost	1	2	3				Yes	No
	Geographical coverage	National, regional, global	1	2	3				Yes	No
Product	Lowest price	Product price competitiveness	1	2	3				Yes	No
	Best performance	Product performance competitiveness	1	2	3				Yes	No
	Best additional features	special/unique features relevant to your customer	1	2	3				Yes	No
	Product portfolio	Product range vs. Competitiors	1	2	3				Yes	No
	Customization	Level of value add services	1	2	3				Yes	No
	Shortest time to market	Product life cycle management	1	2	3				Yes	No

Introduction

Robotics can improve the logistical processes qualitatively and make them more efficient and cheaper compared to manual processes. Yet it is questionable whether robotics is useful to consider and evaluate. It is not only cost/technical aspects that play a role in determining whether robotics can make a meaningful contribution to achieving business objectives but also can it be a hindrance if the chosen solution is not able to move with the business developments.

General evaluation

To map the logistical environment of the warehouse and to determine which requirements robotics must meet, it is good to deepen your knowledge in the following focus areas. How does the organization score in these areas and what added value or obstacles will the robotization bring. These areas of interest are shown below; there are also some examples of the added value or obstacles that robotics can have in this.

Business planning

Fast changing environments, with rapidly growing and/or changing, require flexibility. The logistical system must be sufficiently flexible to deal with dynamics.

Step 2 - Determine the process improvement potential of robotic

Supply chain scenario planning

- How will your production and purchasing volumes be impacted by future market developments?
- What distribution strategy is required to make this feasible?
- What is your product and assortment strategy and how do you allocate inventory within the distribution network?
- What are your requirements regarding facilities and the real estate flexibility over time?
- To what extend impact labor market dynamics your logistics performance?

Evaluation Robotica

- Are robots adding value to your processes and services and which process limitations need to be adhered to?

Business case planning

- What are the required investments? (S/M/L/XXL)
- What information is required to evaluate whether the robots are adding value to the business requirements and needs?
- Which process limitations need to be adhered to?
- How can you motivate your stake holders and your organisation to invest in robotics for your company?

If the dimensions of products change quickly, or if new assortments can be added through acquisitions, then the system must be suitable for this. If the articles always must fit in a bin of 60 cm long, 40 cm wide and 30 cm high, then one runs a risk. In such an environment, robotics can sometimes be a hindrance.
A few important general remarks:

- Future developments and growth
- ROI guidelines
- Complexity and assortment diversity
- Assortment variability
- Order complexity

Organizational planning

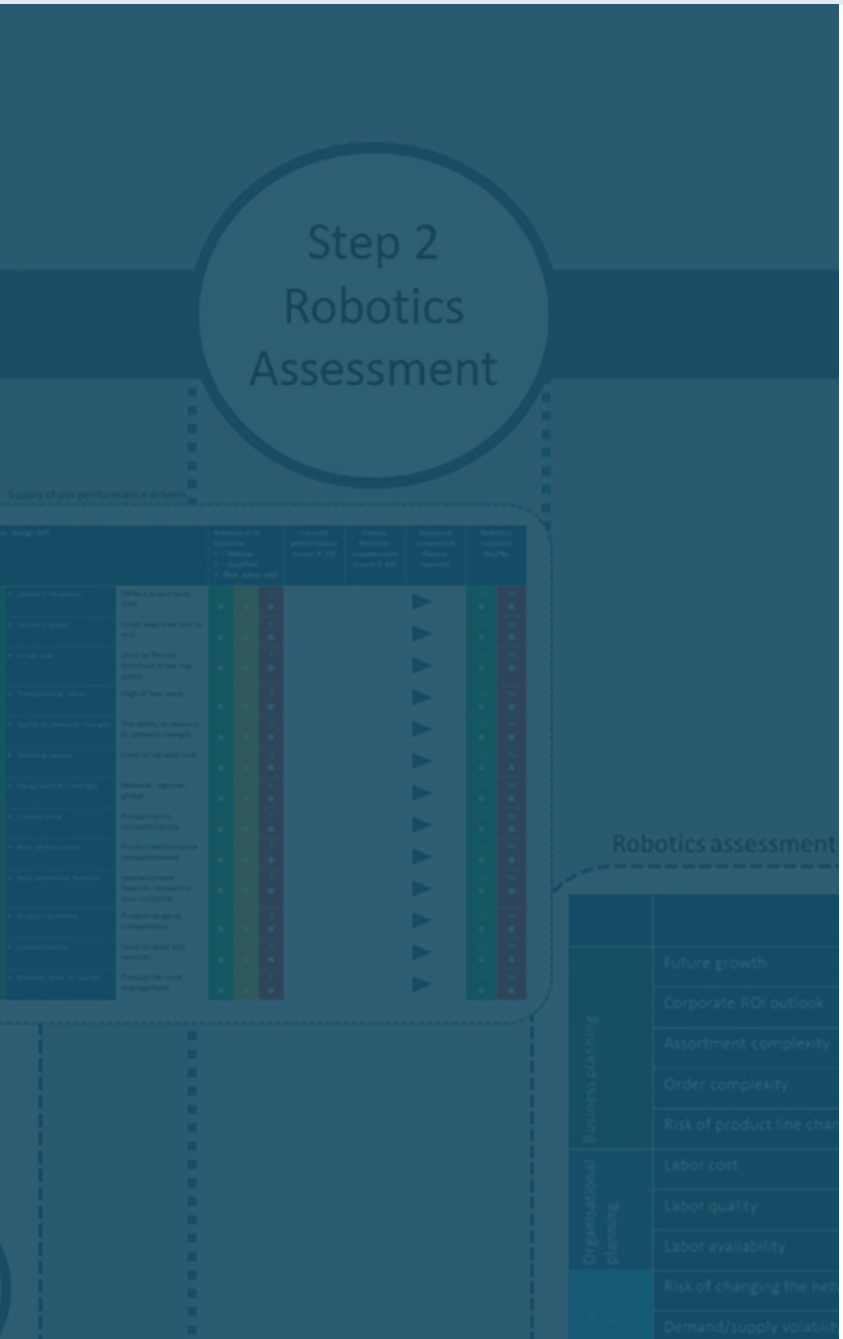
Robotization requires investments that should be recouped through staff cut backs. The higher the personnel costs, the sooner the investment will be recouped. The robots also earn back earlier in three or five-shifts than in a one-shift service. The robot replaces three employees in a three-shift service instead of one in a one-shift service, which makes sense. Another point, is the availability of staff. Specially of motivated and active employees. Robotization can be more expensive than a manual solution, but it will soon stop if the employees are not available. This is especially the case when work and delivery are also required at night and during the weekend, such as in the e-commerce environments.
A few important general remarks:

- Labor costs
- Labor availability
- Labor quality

Supply chain configuration

The cooperation with the partners in the chain also determines the requirements for the

Step 2 - Determine the process improvement potential of robotic



logistical capacity. If the supply chain is constantly subject to change, for example whereby it is decided not to deliver from stock but to use cross-docking, different demands are placed on the logistical capacity of the warehouse. Therefore, in a very dynamic supply chain environment it may be better to opt for manual solutions. For example, in more stable environments, where investments have been made in rigid production capacity, robotization can be very profitable.

A few important general remarks:

- Supply chain variability
- Supply and demand patterns variability
- Average and peak hour patterns

Location and footprint strategy

The stability of the supply chain is also applicable to the use of robots or the choice of robot types. The new generation of robots is particularly scalable and movable, for instance, KIVA-like solutions. These can be moved to other countries with limited costs, not only if the supply chain network changes but also if one had to move to another building through growth. If the supply chain configuration is more stable, robotization may be more static and cheaper.

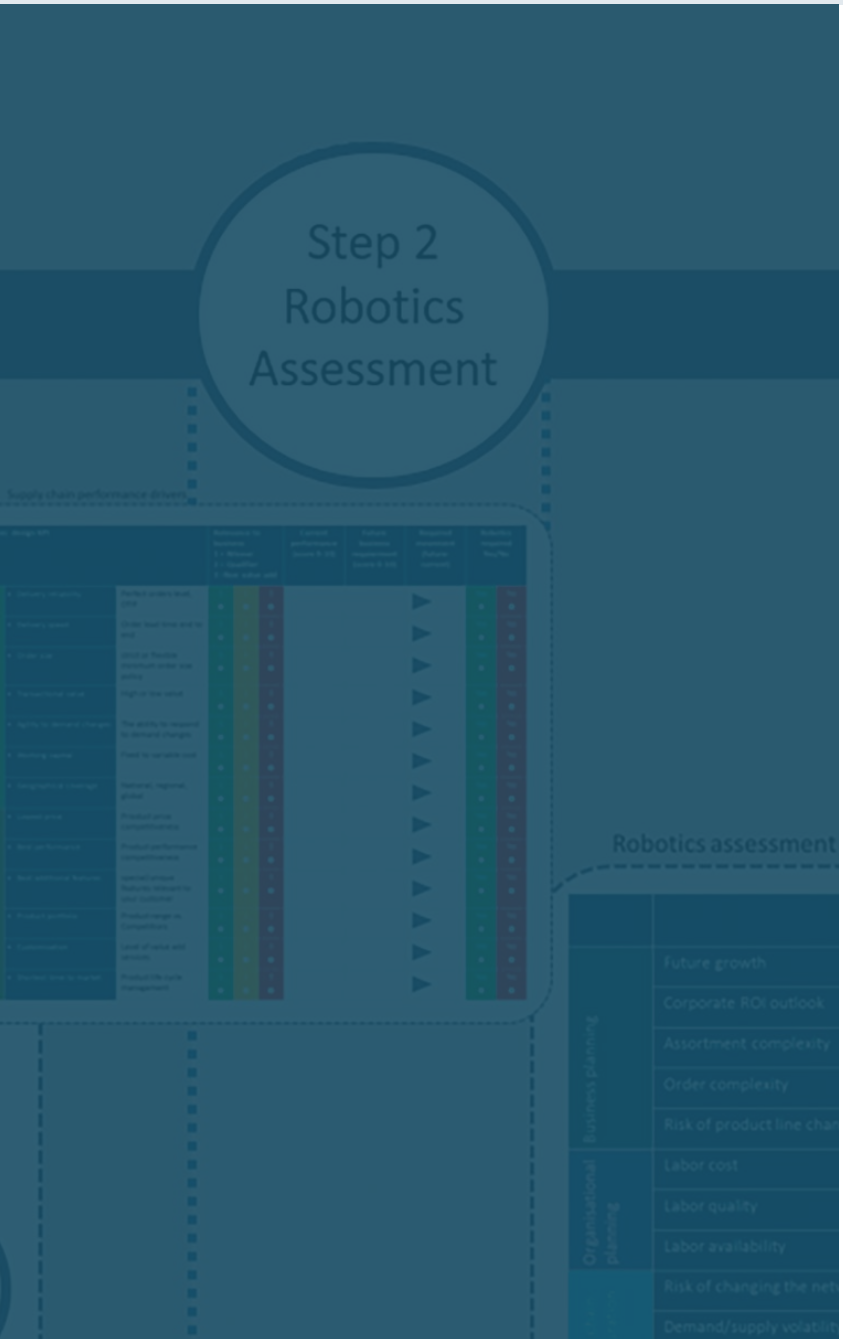
A few important general remarks:

- Footprint flexibility
- Flexibility of available facilities such as buildings
- Scope of the operation
- Land costs

Process design

If one has to deal with large fluctuations in the order pattern, then robotization can also be a barrier. In many consumer electronics environments, turnover in the 4th quarter often amounts to 40% of the annual turnover. In the other quarters, only 20% of the annual turnover is real-

Step 2 - Determine the process improvement potential of robotic



ized. The robotization must be able to convert this 40% in the 4th quarter. Robots standing still half of the time for three quarters of the year can become too expensive.
If the environment must be able to continuously collect orders with multiple items from the warehouse while the lead time must be less than an hour, robotics can offer a good solution. Especially when the distances are large and a high logistical quality is required. This service can sometimes only be realized with robotics.
A few important general remarks:

- Need for flexibility
- Products to be processed
- Persistence capacity
- Logistical quality requirements

Evaluation of important remarks

These areas of attention will have to be evaluated and tested for each organization. If one is in a very flexible and dynamic environment, the question is what added value can robotization bring not only now but for 2, 3 years and so on down the road. In addition, what requirements there are for robotization. Packaging robots are easier to move and to modify than complex storage systems with a lot of static equipment. What forms of robotization can then be applied, and for which processes are manual solutions preferred. It is possible to generate alternative solutions with the help of this input.

Step 3 - Solution development

Rating Robotica

		Positive for Automation	Negative for Automation
Business planning	Future growth	Predictable	Unpredictable
	Corporate ROI outlook	Long term	Short term
	Assortment complexity	Low	High
	Order complexity	Low	High
	Risk of product line change	Low	High
Organisational planning	Labor cost	High	Low
	Labor quality	Poor	Good
	Labor availability	Low	High
Supply chain configuration	Risk of changing the network	Low	High
	Demand/supply volatility	Low	High
	Daily and hourly peak to average ratio	Low	High
Location and footprint strategy	Footprint setup	Consolidated	Scattered
	Building flexibility	Low	High
	Size of operations	XXLarge	Small
	Land cost	High	Low
Proces design	Need for flexibility	Lower	Higher
	Products	Similar	Dissimilar
	Throughput	Higher	Lower
	Quality requirement	High	Low

Introduction

Robotization of logistical processes have been taking place for 25 years, but the possibilities were limited in the past and the costs were often too high. Due to technological developments, robots have become increasingly attractive and more widely applicable. As a result, the use of robots has gained rapid acceleration. This is mainly due to:

- Increased flexibility
- Costs reduction of robots
- Scalability of applications

Development of logistics concept

Implementing robots is not a goal in itself. The aim is to develop a logistics concept that:

- Provides the desired logistics service and capacity
- Has the lowest logistics costs
- Can be flexibly adapted to changing circumstances
- Can grow with the organization

The logistics concept starts initially at the doors of the goods receipt process and ends at closing the doors of the truck, which brings the orders to the customers. However, the logistics concept continues; it is precisely through cooperation with the chain partners that other possibilities of robotization are possible or become more feasible.

Step 3 - Solution development

Development Robotics solution

- What are the results of the basic calculations?
- Which suppliers are able to fulfill your business needs?
- Which operations model fits your organization best?
- Design the optimal solution balancing Capex, Opex, labor and available space.

ROI-analyses

- What is the result of financial evaluation of the planned robotics solution (ROI, nett value)?
- What is the result of the qualitative evaluation of the robotics solution?

Implementation future solution

- What is the optimal implementation plan, transition scenario and fall back scenario (costs, risks, tools)?
- How are the capital request and planning, contractual agreements and the assest management organized?
- How to start? Big bang, phased or via trial and error?

The logistics concept includes:

- Material handling equipment to receive and control the goods
- Material handling equipment to store the items
- Storage methods to store the desired number of items
- Material handling equipment to collect the items
- Material handling equipment to package the goods and prepare them for dispatch
- Provision of information to make the right information available in the correct manner to employees and goods
- Controlling the equipment so that the goods can be processed in the right way
- Organization that knows how to make this complexity work best
- Coordination with chain partners about the delivery of the goods and/or information provision, so that it fits better with the material handling solution

With all these material handling solutions robots can be used to efficiently and reliably carry out the process. The robots can be fully integrated into the storage systems, and then ensure the storage of the goods and the collection of the goods.

Approach

The starting point of the logistics design concept is mapping the storage needs and logistic flows that must be processed by the concept. This should include:

- How many SKUs (unique items) have to be stored and what are the characteristics of these goods
- How many pieces and volumes must be stored per item
- What are the characteristics of these goods
- How many goods must be entered per unit of time
- How many orders and order lines must be issued per unit time
- What is the physical volume that needs to be processed and how diverse is this
- How should order lines be consolidated

Step 3 - Solution development

- What is the required and desired packaging
- Which information carriers must be added
- What does the material flow diagram look like? Now and in the future?
- And so forth

These logistics flows must first be mapped for the current situation. Then they have to be upgraded to the future in order to determine the future requirements.

Generating solutions

Once the logistics flow and storage needs have been determined, the alternative solutions can be mapped out. Which manual and robotic solutions can be used to arrive at a fully operational solution. It is always good to develop various solutions side by side:

- Completely manual solution
- Semi-manual solution with limited application of robots in sub-areas
- Extensive robotized solution for the entire concept

Several alternatives are possible for each of these variants. The aim is to design a complete logistics concept for every solution. In this design process, it is important to properly calculate all quantities. This applies to the capacities of individual robots (capacity per shuttle, how many shuttles are needed, on average and during peak days) and for the entire concept. Some examples of possible solutions are shown in the table below. However, there are many more.

Step 3 - Solution development

Pallet handling	Collo picking	Piece picking	Packaging	Internal transport
Pallet cranes	Layer pickers	Shuttles	Poly bagging	Conveyors
Pallet shuttles	Shuttles	Miniload picking	Carton dropping	AGVs
AGVs	Miniload cranes	A-frames	Carton folding standard	Monorail conveyor
Automatic reach trucks	Carousels	Carousels	Carton folding specific	Shuttles
Automatic VNA trucks	Stacker cranes	Robot picking	Envelope packing	Pipe line
Roll-through locations	Robot picking	Sorting	Carton erectors	Floor chain

To have an overview of possible solutions and the advantages and disadvantages of each solution, information must be collected from the market and suppliers via internet sites, such as Logistiek.nl and from experts. Most attention is generally paid to what the robots are capable of. In the inventory, it is also important to know what the preconditions and limitations are of the solutions in question. At the same time, who can deliver what the advantages and disadvantages of each solution per supplier is checked. The naming of the preconditions is especially often forgotten.

Quantitative evaluation of possible solutions

The alternative logistics solutions that have been designed will have to be quantified and calculated. Initially this can be done at a high level and can take place with the help of benchmark data. Within this a first selection emerges. These will then be further calculated to arrive at the correct numbers and capacities.

Step 3 - Solution development

Potential solutions per warehouse type

= Focus area for robotics

		Type of warehouse			
		Manufacturing Warehouse	CDC/ Wholesale	Retail	E-Commerce
Warehouse activities	Pallet pick	80%	20%	10%	0%
	Case pick	15%	40%	45%	10%
	Item pick	5%	30%	35%	40%
	Packing	0%	10%	10%	50%
Process characteristics		▪ Mechanization production ▪ Stability assortment & diversity asoortment (no SKU's) ▪ Stack ability ▪ Days of supply ▪ Turn over volume ▪ Product value	▪ Number of suppliers ▪ Type of assortment ▪ Number of SKUs on stock ▪ Turn over volume /days of supply ▪ Ratio: pallet pick vs. case pick vs. item pick	▪ Huge amount of pallets to be received ▪ Mainly case picking ▪ Separation: - Crate handling - Case handling - Piece picking ▪ Continuous flow	▪ Type of e-fulfilment warehouse; - Dedicated (limited assortment - Non-dedicated (huge assortment) ▪ Level of cross docking ▪ Days of supply/turn over ratio ▪ Delivery performance - Same day, next day, etc.
Robotics solutions directions		1. Automated reach trucks 2. Automated VNAs 3. AGVs putting pallets in block stack 4. ASRS systems (cranes) 5. Pallet shuttle systems 6. Automated truck loading systems	1. Automated reach trucks for inbound and replenishment 2. Semi-automated order picking trucks, following the order pickers using voice recognition or visualization 3. Visual check of products/weight check of picked products 4. Automated pallet wrapping and labelling equipment	1. Pallet inbound and replenishment automated via automated reach trucks/VNAs or cranes 2. Mechanisation crate storage, picking and handling systems 3. Automated order picking trucks, following order picker 4. Piece picking via shuttle system and ergonomic high-throughput order picking systems 5. Automated miniload/shuttle systems, for fully automated handling of case inbound and picking 6. Semi-automated stacking of cases on roll cages and pallets	1. Order picking multiple orders with mechanized trolleys 2. Batch/zone picking with put-wall concept - Shelf storage - Waves and waveless solutions 3. Zone picking with sorter concepts - Unit sorter -Monorail sorter 4 Automated GtM systems via Kiva, Butler type of solutions 5. Automated storage with shuttles - High throughput order picking stations

Step 3 - Solution development

In the calculations, which will be made for each alternative, a distinction is made between the following points:

- Surfaces, rooms and number of m2 of building space
- Storage capacity
- Throughput capacity
- Number of employees, direct and indirect
- Equipment required
- Investments
- Operational costs

These calculations are made for both the whole and sub-areas. By calculating alternatives an insight is gained into which parts robots benefit and in which areas manual solutions are better. This often results in new concepts that should be re-calculated.
From these calculations the solutions can be arranged at the lowest operational costs to be processed per unit, investments, throughput capacity and so on.

Evaluation of solutions on characteristics of environment

The arithmetic testing of the alternatives results in an overview of the necessary space, investments, operational costs, number of employees and so forth for all alternatives. All alternatives must comply with the requested storage and throughput capacity; if this is not the case, the physical capacity will have to be expanded to make the alternative feasible.
After the arithmetic test has taken place, a sensitivity analysis comes next. Below is an overview of what the alternatives are tested on:

- Delivery performance
- Quality of the deliveries
- Implementation ability
- Scalability of the solution to start up in phases
- Lead time for implementation, while ongoing operation continues

Step 3 - Solution development

- Flexibility, which tests how the solution still delivers the desired output and performance, if the following logistic characteristics become larger or smaller than assumed:
  - Number of SKUs
  - Number of order lines
  - Number of orders
  - Number of items per order line
  - Number of lines per order
  - Number of days of storage in storage
  - Available lead time between order receipt and delivery
  - Number of suppliers
  - Number of customers
  - Others
  - Dependency on technology
  - Dependency on availability of employees
  - Risk of standstill due to faults
  - Backup scenarios
  - Others

Based on these criteria, it is possible to test which solutions are most suitable for the company and the dynamics of the environment can be considered.
The dynamics in a finished product warehouse of a large-scale FMCG producer is much less than the dynamics of a logistics service provider that specializes in multi-client e-fulfillment. E-commerce companies often use robotics to be able to collect and deliver orders within short lead times; without robots this would be too expensive.

Choice of solution

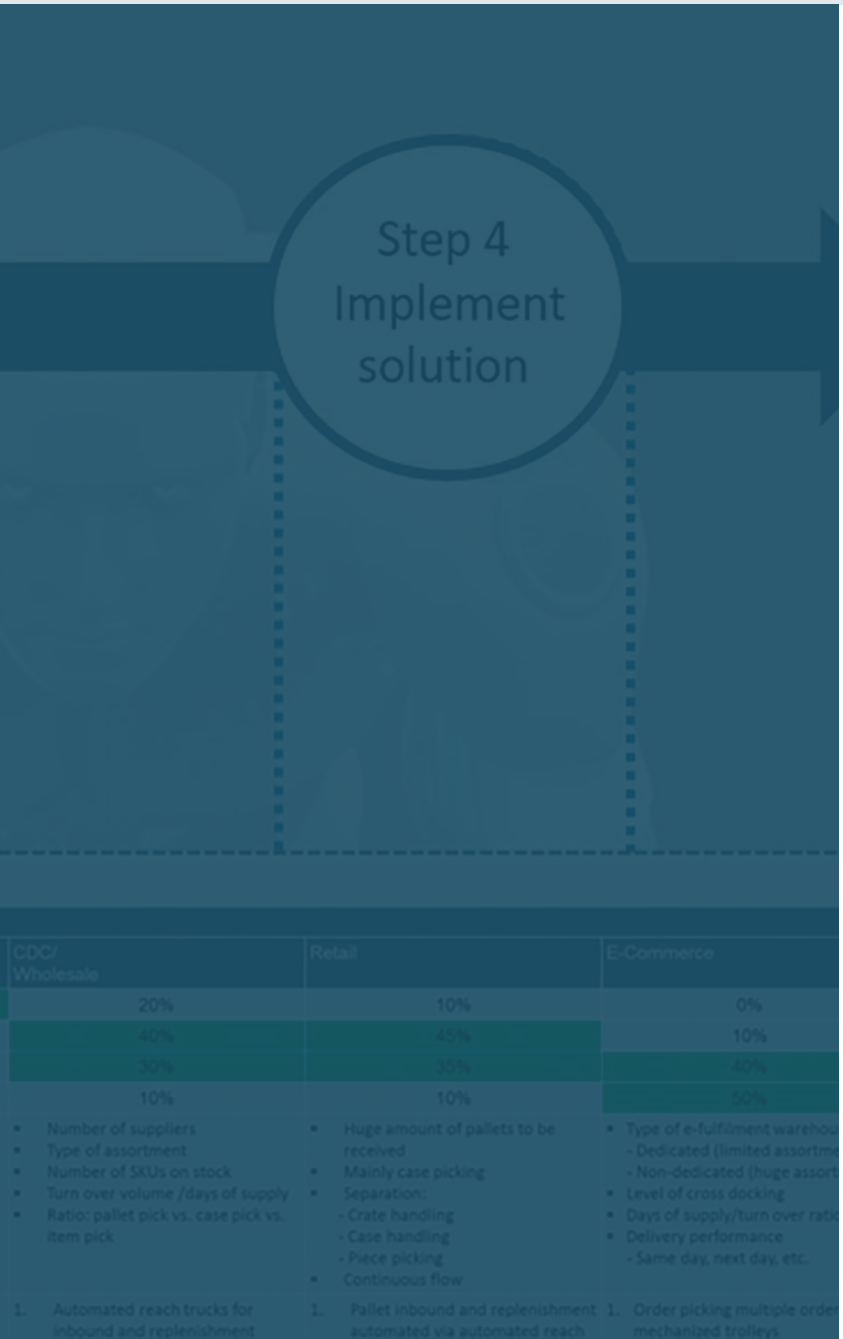
By calculating the alternatives and by evaluating the solutions of the other criteria, a preference occurs for a solution. This solution can be a merging of partial solutions, which together

form a whole. This solution then establishes which added value has any form of automation and robotization for the logistics concept. These automation and robot solutions can then be developed, since it is then known what the functional and capacity requirements are for each solution.

Purchase and contract

After the choice of directed solution has been determined, it is possible to start by specifying the solution, selecting the possible suppliers, requesting and evaluating quotations. The main attention goes to establishing the functional performance requirements in which the system must comply with the support that is required of the suppliers and/or partners during and after the go-live. The contract must be prevented from being based on the purchase of a static supply. It must be taken into account that the system has to be developed further during purchasing, and therefore expertise in the organization or intensive cooperation with the supplier/partner has to be developed.

Step 4 - Develop a realistic implementation plan



Introduction

Once a decision has been made to robotize and a supplier has been selected, during the implementation process we can identify a number of areas to focus on:

- Detailed design of the chosen solution
- Building and testing
- Organizational structure
- Go-Live & Ramp-Up
- Optimization and continuous improvement

Detailed design of the chosen solution

When selecting suppliers, a number of basic choices will already have been made, but the design and detailing work will not start in earnest until the contract has been signed. This involves the following elements:

- Mechanical design
- Functional design
- Interface design (including modifications to the legacy applications)

Throughout this entire process, it is important to closely monitor the interdependencies between these different processes. For example, the functional design is inextricably linked to the interface design, but there is also a direct relationship between the mechanical and functional design. Whether a Best of Breed WMS package or, alternatively, a bespoke solution built by the integrator is opted for, in both cases it is important to remain closely involved in the design process and to take on joint responsibility for this. Insufficient involvement at this stage may lead to unpleasant surprises at a later stage, resulting in a solution that does not, or does not fully, support the desired business processes.

Step 4 - Develop a realistic implementation plan

Implementation of robotics

- When selecting suppliers, which procurement and contract process do you use?
- Who is responsible for the acquisition, development, management, the updates and monitoring of the software?
- Are the right people available for the implementation and support of the new processes, plus are they capable of working with the new processes?
- How do you set the start-up processes in motion and which scenarios would enable start-up risks to be managed?
- What form does the schedule take for the transition and run-up to the new system? How do you test the processes and integrate these in the current structure (including supplier integration and involvement)?
- Which phases will follow the start-up and pilot phases?
- What is the best way of structuring continuous improvement processes?
- How do you structure your asset management and contract management (investments, SLAs, maintenance, upgrades)?

Building and testing

Following the design phase, the process of building and testing will commence in each of the aforementioned areas. This process mainly involves:

- Component testing
- Flow testing
- Integration testing

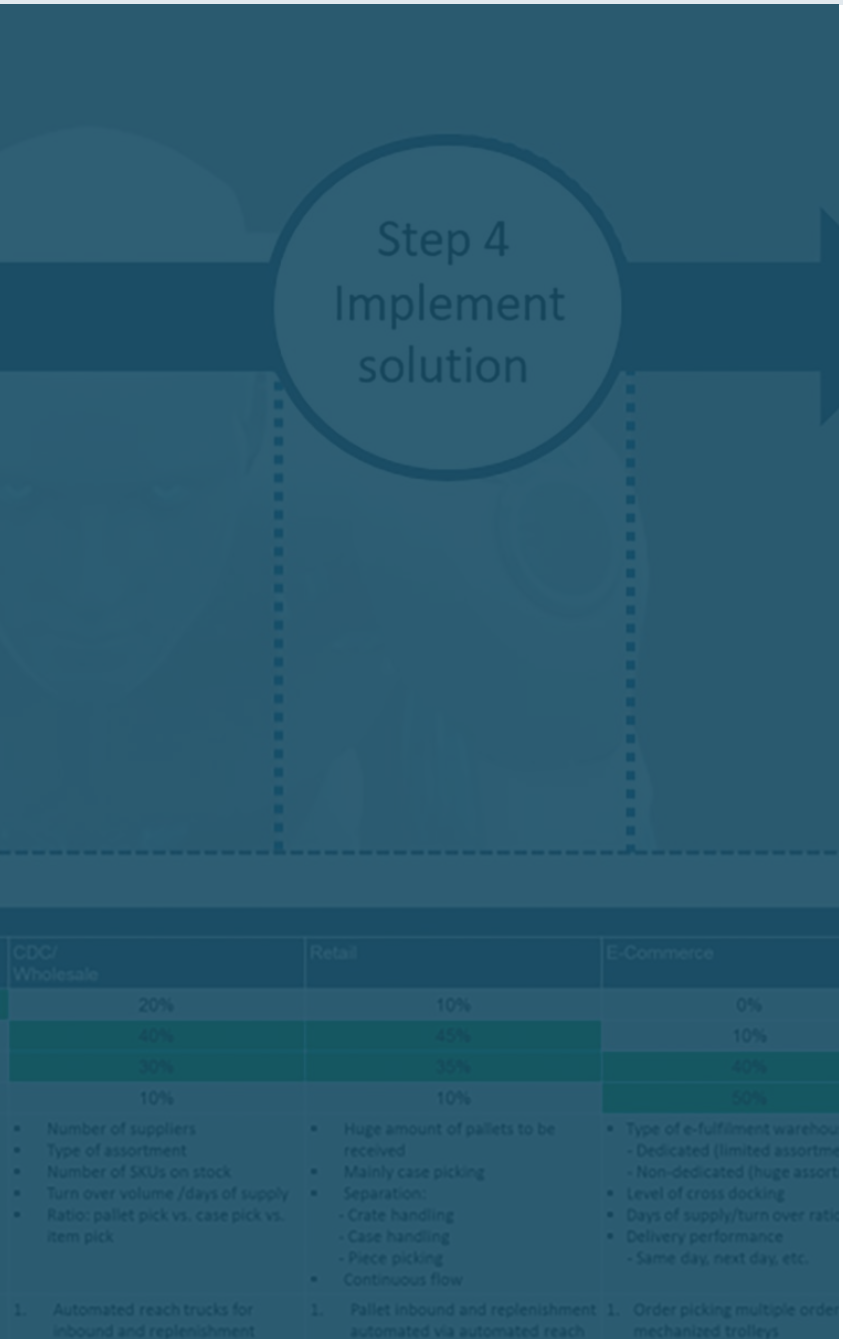
During this phase, more than ever before, it is important to ensure that the right numbers of people are available with knowledge of the company's own business and systems, but also that these same people participate in testing with the supplier. That is because, even once testing of the entire system has been completed in accordance with the design documentation, errors can still arise in the specifications, or there may be differing interpretations which result in the system not being 'fit for business'.
This process is also the perfect opportunity to allow the initial future key users to become acquainted with the new system.

Organizational structure

During the project phase, specific knowledge will be required at specific points in time.
In some cases, this knowledge is required from the very start to the end of the project, for example, the knowledge that ICT brings to the table, but support with building and testing and the support provided by HR and asset management must be identified in good time and should be included in the project schedules and budgets.

To ensure controlled Ramp-Up and optimal use of the new system, it is vital that the right staff are selected in good time. The transition from a manual to complex mechanized environment also calls for a critical look at the workforce and you should ask yourself whether staff are equipped with the right competencies and skills. Not only will new roles potentially have

Step 4 - Develop a realistic implementation plan



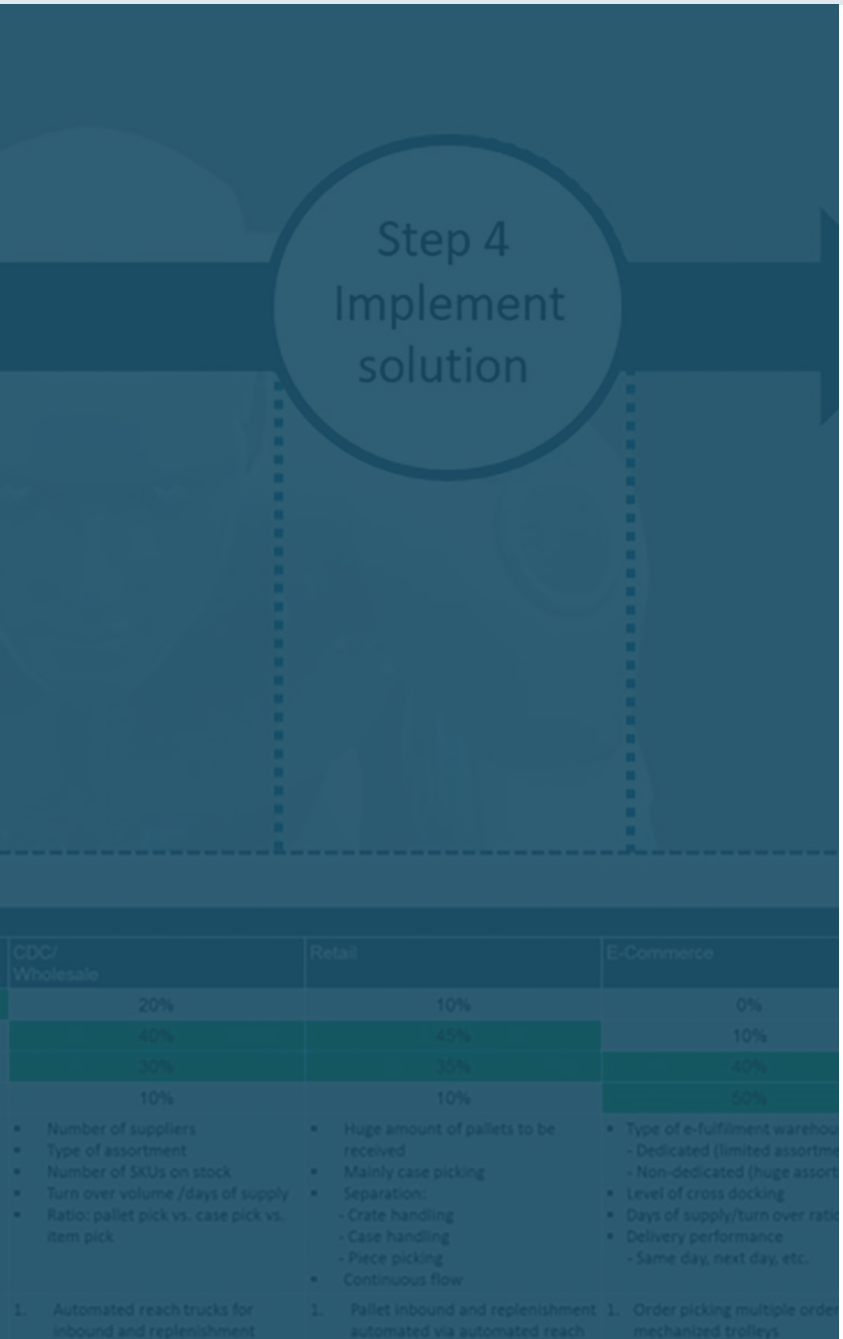
to be created, such as a specialized technical service, but a transition of this kind will also require relevant input from your current middle management team. Not only do they have to effectively manage the change process within the workplace, but they must also be capable of acquiring thorough knowledge about the new system within a short period of time. Prompt selection, training and recruitment of the right people is therefore of crucial importance. It is worth bearing in mind that not everyone will be capable of making this transition, therefore at an early stage also start to develop a well thought-out mobility plan.

Go-Live & Ramp-Up

The Go-Live and Ramp-Up process is a project in its own right, which has to be carefully planned and managed; after all, it is no longer about testing within the safe project environment, but about genuine customer orders. The Ramp-Up process consists of a number of phases, which are more or less the same for the majority of projects. First and foremost, it is worth noting that when Ramp-Up commences, the system will, by definition, react differently than planned. That is because all software logic is built on the data set that is based on the final situation and therefore unexpected or even adverse reactions will occur when insufficient volume is going through the system.
In addition, during the initial weeks, user errors and functional problems will be commonplace. As soon as that phase has ended and the volumes increase, capacity issues will be evident. Apart from things like undersized tables and databases, physical bottlenecks will also become evident in the system. To mitigate these issues,
a number of actions are taken:

- Sufficient support of the integrator during the Ramp-Up
- Sufficient analytical capacity from the disciplines that are involved
- A continuous improvement program

Step 4 - Develop a realistic implementation plan



At this stage, in an improvement program of this kind, the focus should be on being able to quickly gather and share information. A suitable communication structure, for example, several daily stand-up meetings, is required for this.

Optimization and continuous improvement

Once the Ramp-Up has been completed and the operation of the system is stable, the optimization phase will commence. However, the basis for this phase must have been created much earlier on. During the contract negotiations, agreements have to have been reached about:

- An asset management strategy based on a healthy balance between risks, costs and performance.
- A long-term continuous improvement program which is based on clear and shared SLAs and KPIs.

An investment in a solution of this kind often means a long-term collaboration between the client and supplier. That is why, for both parties, the guiding principles in the above agreements should be the joint aspiration to achieve maximum performance throughout the system's life cycle.