

THINK ACT

BEYOND MAINSTREAM



April 2016

Of Robots and Men – in logistics

Towards a confident vision of logistics in 2025

THE BIG

3

1.5 MILLION

jobs expected to be replaced by robots within the next ten years in the Eurozone.

Page 3

100,000 EUR

will be the full cost of a logistics robot in less than two years.

Page 4

20-40%

cost reduction in handling thanks to expected robotic solutions.

Page 7

The mass arrival of robots in logistics is no longer a question. The real question is how soon, and how to better prepare for it.

Robotic logistics solutions have developed at great pace since the giants of the internet made them the spearheads of their expansion plans. Robotization differs from mechanization (or automation) in that it provides a flexible and reconfigurable solution that can be integrated seamlessly into existing infrastructures with human operators. The cost reductions and the maturity of the solutions are such that we are now approaching a tipping point before the widespread presence of robots in warehouses.

As a direct consequence, the robotization of logistics will lead to the disappearance of several hundred thousand unskilled jobs over the next ten years – and, in time, up to **1.5 MILLION DIRECT JOBS** in the Eurozone – unless preparations are made for the transition. While a decision in favor of robotization seems inevitable from a microeconomic point of view, its macroeconomic significance is uncertain. The offsetting of these lost jobs through increased added value upstream or downstream of the value chain or exports

is not as evident as it has been for the manufacturing industry.

Logistics cannot, by definition, be exported. The most credible solution is for countries to improve their competitiveness and become the most attractive logistics hub in larger clusters. Robotization can then be seen as the solution that improves their attractiveness rather than the problem.

Paradoxically, the toughening of social regulations actually encourages the roll-out of robotic solutions by increasing their return on investment. What next? An excellent way forward would be to:

1. Subtly oversee the transition by creating an ecosystem around a flexible and evenly spread robotization process.
2. Simplify regulations to compensate for the forecast "additional cost" of arduous logistics work.
3. Encourage logisticians to revamp their business model on the basis of this new reality.

The economic impact of robotic solutions is becoming a reality.

The return on investment of logistics automation solutions will soon drop below three years thanks to flexible and collaborative robotic solutions. These new solutions, which are now helping human operators and machines to work side by side in the same warehouse without the need for any major transformation, are causing us to rethink the way work has been organized over the last few decades. Their operational scope includes the moving of pallets, stacking/unstacking, order preparation or palletizing and, before long, loading.

The cost threshold at which robotic solutions become viable – in most of western Europe – is now **EUR 100,000-110,000 PER UNIT**: this level of investment generates a positive ROI in three years, thanks to a productivity gain of 20-30% in mature markets. As such, the total hourly cost of a robot is around EUR 18-20/hour – for the same number of hours worked – when the average cost of a human operator is EUR 14-15/hour in the Eurozone (a figure that rises to EUR 17-18/hour in France or even EUR 20/hour in Belgium). Though an argument based on unit costs does not provide the most accurate picture, given that integration costs decrease in accordance with the size of the suite of robots installed, it does enable a comparison to be made. And while this calculation does not take into consideration the possibility of extending the hours "worked" by robots either, it does highlight the increasing relevance of robotization. → **A**

In the long run, the increase in productivity, the lengthening of the lifespan of robotic solutions and the drop in equipment prices will all be factors in favor of robotization, while the cost of human labor will continue to rise structurally. → **B**

LOW-COST ROBOTIZATION IS COMING SOON

The total cost per unit still often exceeds EUR 120,000.

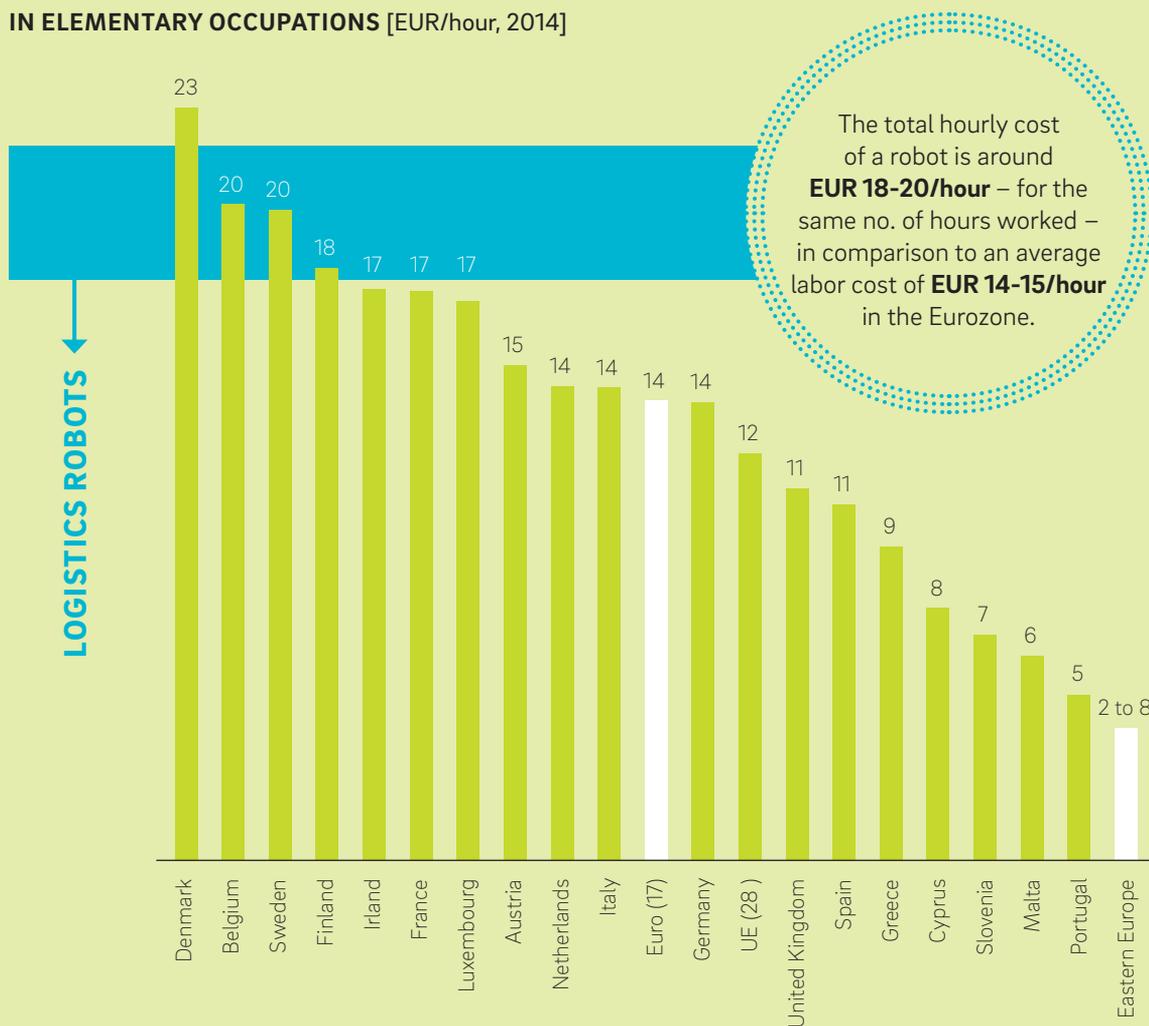
This cost includes equipment (EUR 20,000-50,000); the environment (marking, security, adaptation of the warehouse, etc – up to EUR 50,000 – though this is becoming increasingly unnecessary with current solutions); system costs (EUR 45,000), project management (approximately 10% of the total cost); and maintenance and energy costs. Most estimates also include storage gain but rarely energy savings (lighting, heating, etc) and even less so the reduction in inventory shortage and work accidents, which would nevertheless significantly improve the equation in favor of robotization. → **C**

A

ROBOTIZATION

Though imperfect, a comparison between the hourly cost of robotic and manual solutions highlights the relevance – in the most expensive European countries – of robotization in the logistics industry.

ESTIMATE OF AVERAGE HOURLY COST IN ELEMENTARY OCCUPATIONS [EUR/hour, 2014]



The total hourly cost of a robot is around **EUR 18-20/hour** – for the same no. of hours worked – in comparison to an average labor cost of **EUR 14-15/hour** in the Eurozone.

CAGR 2008/2014

Source: Eurostat, Roland Berger study

6 THINK ACT

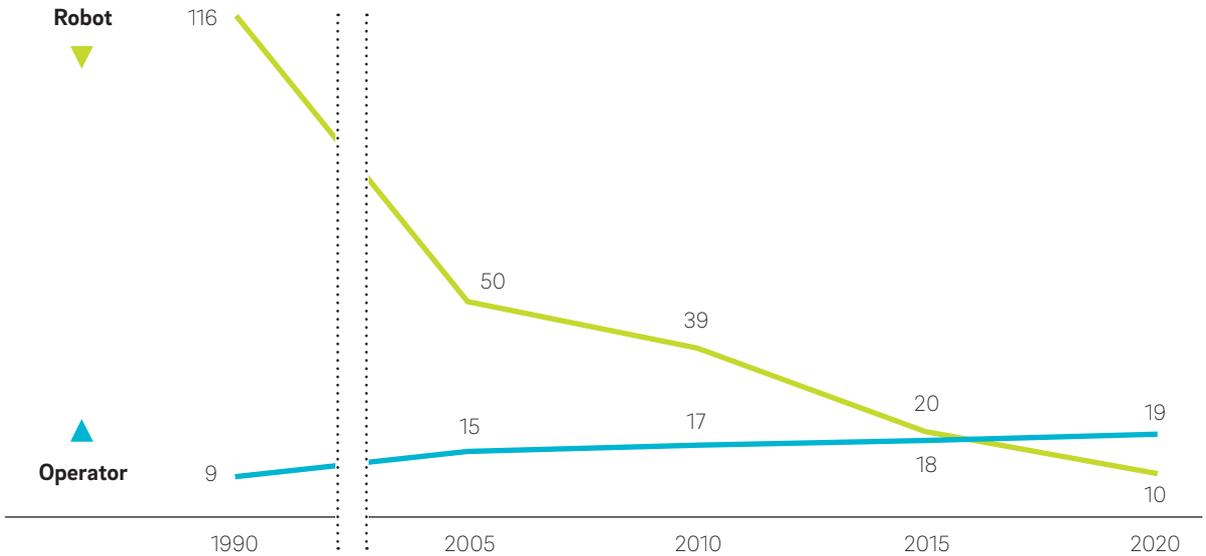
Of Robots and Men – in logistics

B

THE HOURLY COST OF ROBOTS V HUMAN OPERATORS

[EUR/hour, France]

Over time, increased productivity, the lengthening in the lifespan of solutions and the drop in equipment prices all favor the move towards robotization, while labor costs continue to rise.



1) Retroactive comparison of the cost of a robot without taking technical capability into consideration, based on the evolution of the cost of industrial robots.

2) Illustration of the elementary labor cost, based on the evolution of the hourly minimum wage in France.

Source: IFR, INSEE, Eurostat, Roland Berger study

The total cost of robotic solutions is falling sharply.

This fall should accelerate and lead, by 2020, to the appearance on the market of a large number of solutions costing less than EUR 100,000, thanks to the emergence of low-cost solutions developed by research-institutes or start-up spin-offs (Rethink, Fetch, etc), which are more agile than established industrial robotics giants (ABB, Kuka, etc) and more likely to go for market disruption. The price of industrial robots almost halved between 1990 and 2005 and did so again in less than five years between 2010 and 2015, when the least expensive solutions were available for EUR 20,000 (Unbounded Robotics UBR-1), with major manufacturers also offering complete solutions for between EUR 40,000 and 50,000 (ABB Yumi - ABB IRB340). → [D](#) → [E](#)

The growing pace of the development of recognition and work-environment analysis technologies, which enable collaboration between humans and machines, will lead to a significant fall in the environmental costs of robotic solutions.

With the improvement in gripping techniques, the solutions on the market are also less expensive and more efficient, while integration timeframes are also shortening. Learning technology will enable robots to be quickly set up by replicating human movements. They will also continue to learn from their own mistakes. This evolution towards learning will make the technology more accessible to small businesses and will favor the quick and distributed emergence of robotization – quicker than in manufacturing industry.

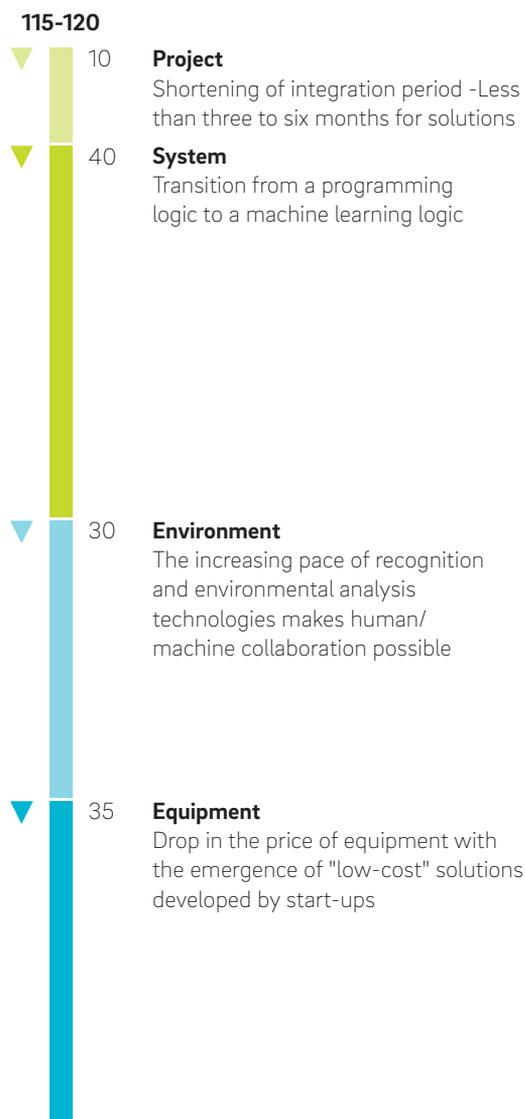
C

ESTIMATE OF THE FULL COST OF A ROBOTIC LOGISTICS SOLUTION

[thousands of EUR/unit, 2015]

The total cost of robotic solutions is falling due to the drop in equipment and integration costs.

PRICE DROP FACTORS



Excluding energy consumption of approximately EUR 1/hour, which is partly compensated for by haulage, lighting and heating savings

A 20-40% SAVING IN HANDLING COSTS

Manufacturers and research teams are understandably devoting their attention to order preparation – which alone represents 40-50% of storage/handling costs – a task involving a high running time with low added value (up to 70% of the task).

Unsurprisingly, manufacturers promise significant picking productivity gains since robots, assuming they are in continuous use, are four to six times more efficient than human operators (up to 800 items per hour). In practice, such productivity rates are significant only if they speed up the sales cycle. Even the most advanced robotic solutions are rarely fully automated (80% at best), with human operators invariably managing complex formats or items with the lowest rotations.

Initial feedback, which is cautious, seems to indicate a drop in handling costs of 20-40% with these configurations, a figure that varies depending on the complexity of order preparation operations, the order range, the warehouse layout, etc. In general terms, this level of productivity gain is enough to finance the investment. → **F**

Attention needs to be drawn, however, to a number of technical obstacles. The formation of mixed pallets, the stability of upright stacking and unstacking operations and the picking of variable, flexible or oversized packaging are just some of the operational realities on which trial projects continue to stumble. There is no doubt that these hurdles will be overcome in the near future.

D

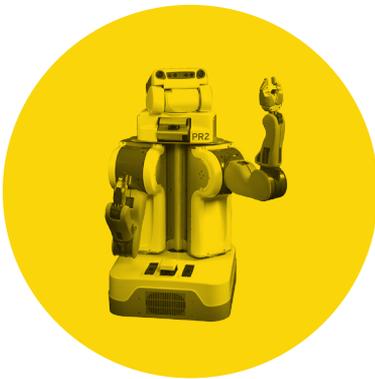
ROBOTIC SOLUTIONS

Though solutions are not entirely comparable, their price evolution highlights the change in the scale of robotics solutions designed for order-preparation operations.

EXAMPLE OF THE PRICE EVOLUTION OF LOGISTIC ROBOTS

Willow Garage's

PR2



2010

USD 400,000

Unbounded Robotics

UBR-1

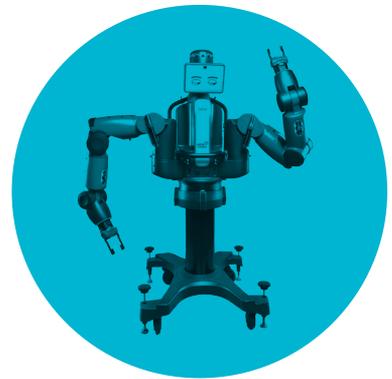


2012-2014

USD 35,000-50,000

Rethink Robotics

Baxter



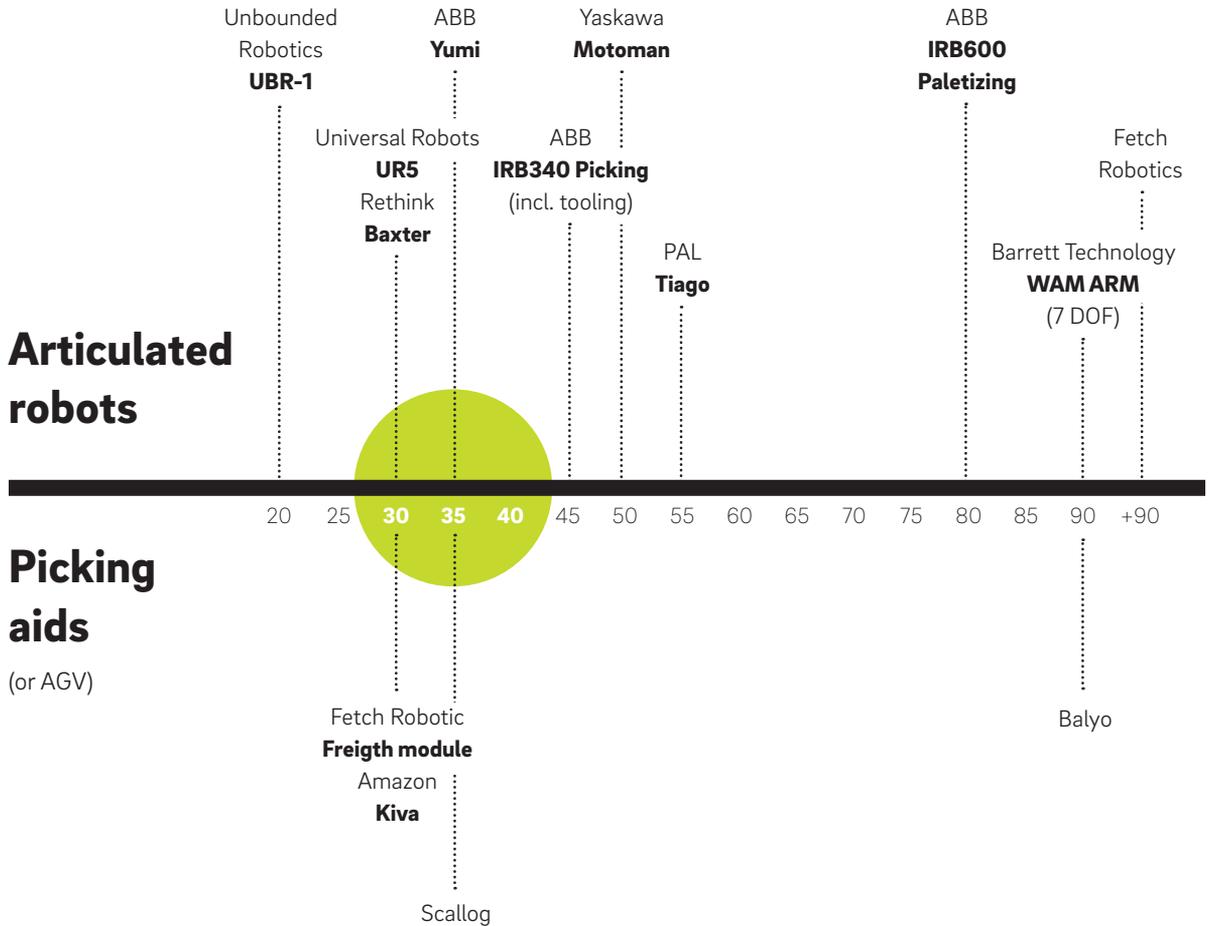
2015

USD 22,000

E

EXAMPLES OF ORDER-PREPARATION ROBOT PRICES ¹⁾

[thousands of EUR/unit]



ROI: under 3 years ²⁾

1) EUR/USD exchange rate as of 09/15 – indicative prices – equipment only

2) Depending on use and productivity gains

Source: Companies, press, Roland Berger study

F

EXAMPLES OF PRODUCTIVITY GAINS FROM AGV (Automated Guided Vehicles)

TOYOTA - PICK & GO

Standard pallet-truck adaptation for moving pallets and assisting the operator during order preparation.

PRODUCTIVITY:

up 25%

(industrial)/manufacturer
60 to 100% (depending on use)

Forecast ROI: **less than 36 months**

Energy saving: **-7%**

Storage saving: **30-40%**

Price: **EUR 60,000-90,000**

Source: manufacturers, press

BALYO

Automation kit for a standard GPS-guided fork-lift truck, capable of loading/unloading a pallet.

PRODUCTIVITY:

up 60-70%

Forecast ROI: **less than 18 months**

Price: **EUR 90,000**
(for one unit as a standalone)

KIVA / SCALLOG

Shelf-carrying system capable of moving around the warehouse and transporting products to the packer.

PRODUCTIVITY:

up 20-40%

Forecast ROI: **24-36 months**

Storage gain: **up to 30%**

Price: **EUR 25,000-35,000**
(estimated) (for 10 units)

A SIGNIFICANT INTANGIBLE GAIN

These solutions offer more than a mere direct productivity gain. They can also yield social and commercial benefits and can enhance the image of companies.

By investing in robotics, employers can cut their growing "social debt" in advance.

Aside from the continuing rise of labor costs (2%/year in the Euro-17), both the stiffening of regulations pertaining to difficult working conditions and the anticipation of increased direct care of musculoskeletal disorders should be factored into the "economic" equation. The creation of the French system relating to the difficulty of working conditions (with an "additional cost of 2-5%" per employee) is the most specific example of this.

The faster pace of work flows brought about by robotization will also impact on turnover. The development of e-commerce has revealed the need for selective mass picking on a near 24/7 basis.

This need for responsiveness – to enable delivery in less than 24 hours, in less than four hours and soon in less than an hour – has more to do with allowing online retailers to continue taking market share from traditional commerce than with responding to the needs of impatient customers. What robotization therefore offers is a far greater increase in turnover than in productivity gains.

Another factor that should also be taken into account is the image boost for brands investing in these technologies, which paradoxically makes them appear more human.

Robotization reconciles consumer brands with their socially conscious customers, who are sensitive to the continued denouncing of working conditions at warehouses and factories run by tech giants. Who now blames automotive manufacturers for employing robots? The importance of image thus explains, albeit only partly, the significant investment made by internet giants – retailers and otherwise – in the robotics industry.

Are we facing a robotic bubble or an industrial revolution? Most certainly a short-term bubble, but a long-term reality.

A THRIVING SECTOR...

Investments in robotic start-ups (including drones) have increased more than fourfold since 2010 and stood at almost USD 570 million in 2014. In a bid to make up for lost time, the major industrial groups (Yaskawa, ABB, GE, Fanuc, etc) are continually shoring up their market position. The most impressive action in this respect remains **the eight successive purchases made by Google between 2012 and 2014**. According to the Robo-Stox (TM) Index, which tracks robotics companies, their stock market performance has outstripped that of the S&P 500 fivefold since 2005.

Though logistics equipment accounts for less than a 2% share of the global robotics market, which was valued at USD 27 billion in 2015, it attracts a significant amount of media attention. The lion's share of robotics investments continue to be funneled into manufacturing, particularly the automotive industry. Viewed from another angle, the majority of investments in logistics equipment are still channeled into traditional mechanization solutions (conveyors, lifting equipment, etc, accounting for approximately 80% of investments).

In terms of start-ups, a 2015 review of nearly 140 active robotics companies reveals that less than 10% of them propose logistics solutions. Most innovation is targeted at healthcare (25%) and domestic and leisure

equipment (25%). In terms of logistics solutions, the bulk of research is conducted into gripping (e.g. Rethink Robotics, Bionic Robotics GmbH, Empire Robotics, Grabit) and the autonomous transportation of packages and pallets (Fetch Robotics, Clearpath Robotics, Grey Orange Robotics and France's Scallog, which is modeled on Amazon's Kiva Systems solution).

... THAT IS ONLY STARTING TO DEVELOP DESPITE WIDESPREAD COVERAGE IN THE MEDIA

Although mobile solutions (Automated Guided Vehicles and Automated Mobile Robots) are growing fast, they still only account for a few tens of thousands of units. The International Federation of Robotics reported a increase of over 40% in sales between 2012 and 2013, with projected sales for the period between 2014 and 2017 being more than 10,000 robots, a forecast that evidently does not take into account Amazon's investment in nearly 15,000 robots, announced at the end of 2014. Less than 10% of companies operating warehouses in the United States have already deployed or tested this kind of solution and less than 2% in France, for example (PRG survey 2015).

The fascination for the robotization topic comes, then, from the seeming threat it poses to the current societal and economic balance.

What will be the impact on employment?

1.5 million direct jobs destroyed in the Eurozone in ten years.

3.6 MILLION EUROPEAN LOGISTICS JOBS TO BE REDEFINED

At least 500,000 direct unskilled jobs in France are directly linked to logistics (fork-lift operators, packers and other warehouse workers employed by companies and logistics service providers). Across the leading 15 countries in the Eurozone, that figure rises to nearly 3.6 million people. → [G](#)

A comparison between the robotization of the logistics and automotive industries shows that a little over 1.5 million direct jobs (40%) would be destroyed in the Eurozone in less than 15 years. The speeding-up of technological cycles would more than likely lead us to consider undertaking this transformation in a reduced timeframe of ten years.

Not surprisingly, the most heavily affected sectors would be distribution, the manufacturing industry and their logistics service providers, though the numbers vary from country to country, depending on the extent of outsourcing in each country. → [H](#)

Today, around 10% of warehouse workers are over 55, and retirements would only offset a small percentage of robotized jobs.

IS THERE ANY OTHER WAY OF OFFSETTING THESE JOB LOSSES? SURE, BUT IT WILL TAKE CONCERTED ACTION

While, the microeconomic rationale seems inevitably to be advancing the case for increased robotization, the macroeconomic interests in doing so are less clear. Will lost jobs be offset by new types of employment offering more added value or in sectors downstream/upstream of the logistical link? This is far from a new question. It has been asked during every industrial revolution.

A comparison with the transition towards robotization in the automotive industry can shed some light on the issue. **The turnaround can be very quick:** The productivity of major manufacturers doubled in the 15 years between 1975 and 1990, during which time workforces were downsized by nearly 45%, while production nevertheless increased by almost 40%. **A speedy development towards jobs offering increased added value then took place.** While workforces have been cut by 50%, supervisor numbers have remained stable and executives have increased in number by 45%. **Though the average total payroll rose by approximately 35%**, this rise is below inflation, which was particularly high over

this period. **Safety in the workplace improved**, with work accidents falling by 20% and their seriousness also decreasing. **"Relative" production costs decreased**: The share of added value in the automotive industry fell by two points (from 9.5% to 7.5% between 1975 and 1990). **The product increased in quality and became accessible to a wider customer base**, contributing to a growth in product volumes, with the number of vehicle-owning households rising from 64% to 76% over this period. **Finally, increased competitiveness allowed robotized players to export on a global scale**. For example, the increase in Renault's domestic production between 1975 and 1990 was almost entirely accounted for by exports. →!

Many parallels can be made between the automotive and logistics industries, with the exception of this last key point.

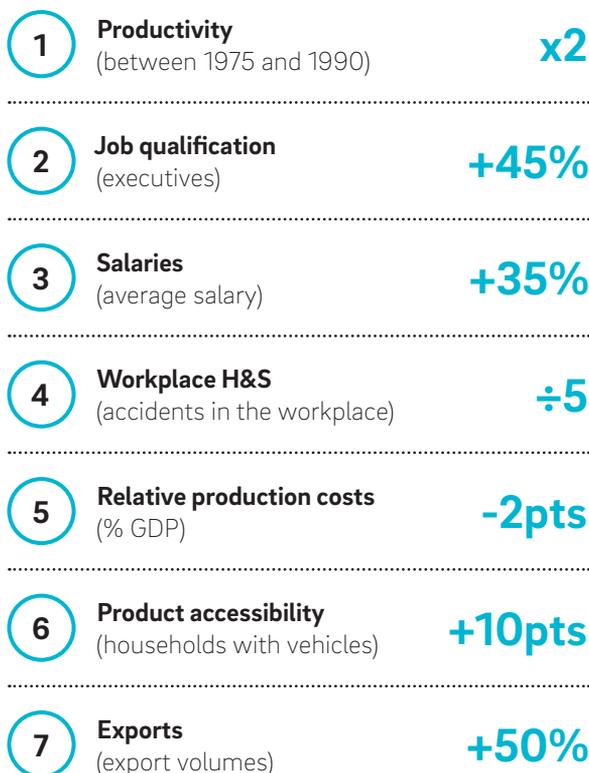
Offsetting lost jobs through exports is not possible in logistics.

Supporters of robotization like to highlight the fact that productivity gains related to robotization in the French automotive industry allowed it to remain competitive on the domestic market and compete on the export market at the same time, albeit for a certain period of time only. The elimination of production-cost differentials to the advantage of mature markets is occurring once again today in the manufacturing industry thanks to a fresh wave of robotization, which explains why China, which has to contend with steeply rising labor costs, is now the largest investor in this field (17% of the global base, twice as much as Germany). This principle of offsetting through exports is not directly applicable to logistics services themselves, which are local by definition and non-exportable.

Offsetting through quality of service is not enough.

The growth of robotization in the health sector is gradually widening the spectrum of treatable illnesses and improving healthcare accessibility. Similarly, the improvement in the quality of logistics services (faster and more accurate) can stimulate sales at the end of the chain or reduce the overall logistical cost. But while healthcare will make limitless progress, logistics will find itself faced with a physical barrier. Once supply chains are accelerated and fully optimized, there is little extra value to be derived from robotization.

SEVEN LESSONS LEARNED FROM THE ROBOTIZATION OF THE AUTOMOTIVE INDUSTRY BETWEEN 1975 AND 1990



Offsetting through increased logistical competitiveness on an international scale is the most tangible solution to offset lost jobs.

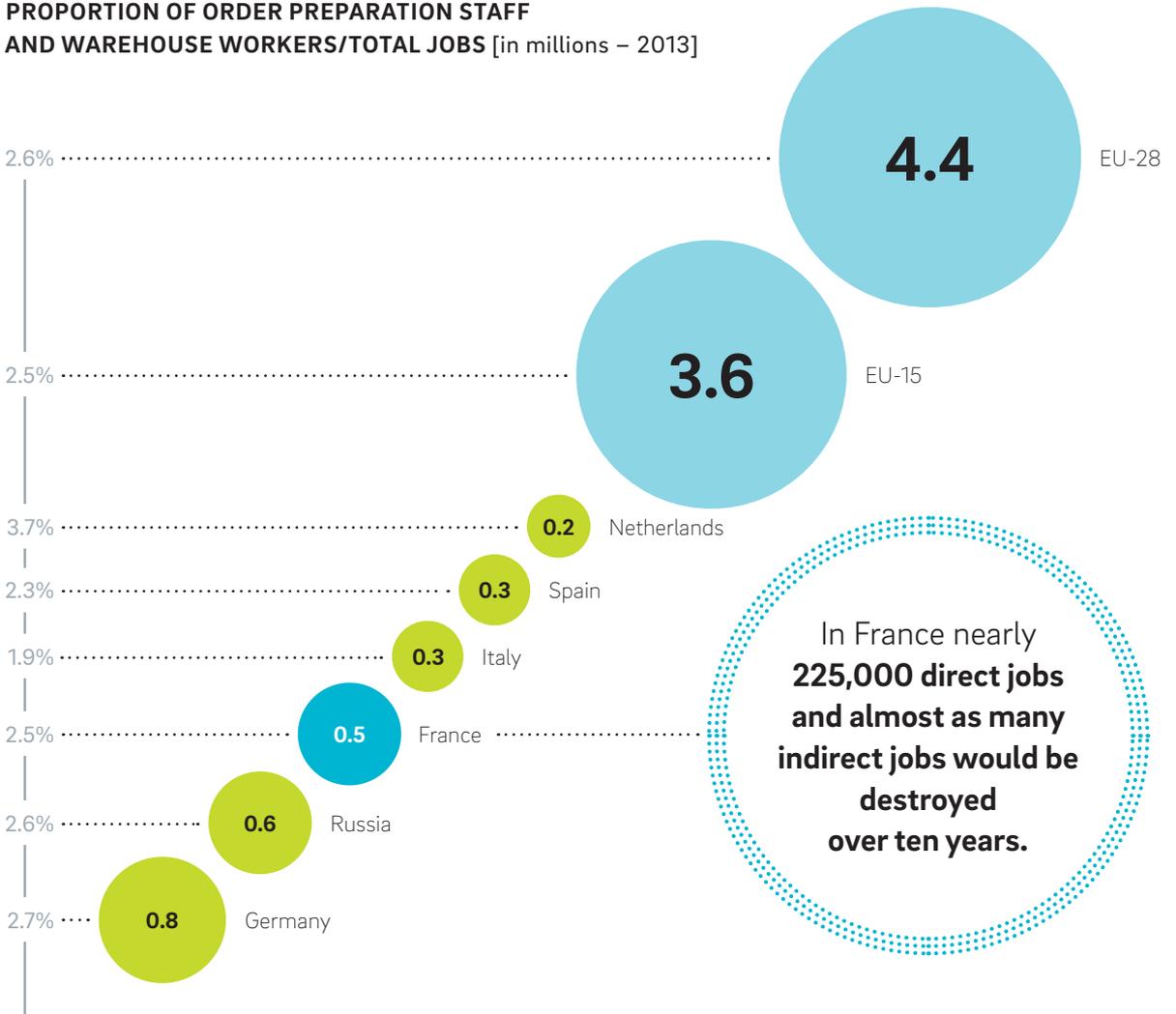
Faced with an inability to export or increase local added value, European logisticians will have to look to attract distribution centers covering all or part of the continent to their own countries. That is when the "problem" becomes the solution: It is by improving competitiveness – thanks in the main to robotization – that logistics service providers can gain market share in their home countries. Having developed this expertise locally and created a corresponding ecosystem of services and technologies, a second form of offsetting through the export of logistics robots then becomes possible.

G

IMPACT ON EMPLOYMENT

The comparison between logistic and automotive robotics reveals that a little over 1.5 million direct jobs (40%) would be destroyed in the Eurozone over the next ten years.

PROPORTION OF ORDER PREPARATION STAFF AND WAREHOUSE WORKERS/TOTAL JOBS [in millions – 2013]



ORDER PREPARATION STAFF AND WAREHOUSE WORKERS/TOTAL

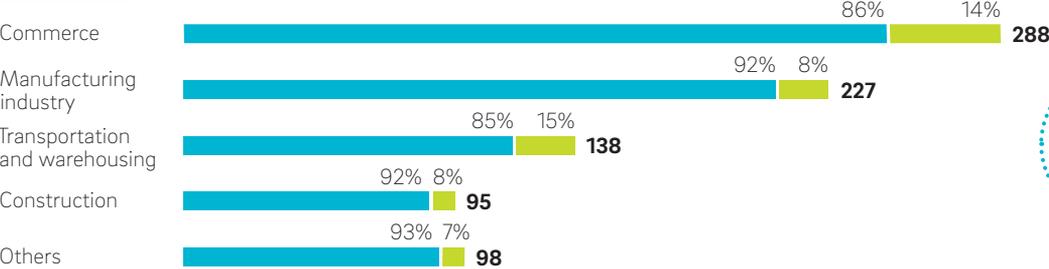
Source: Eurostat, INSEE corrected data, Roland Berger study

H

BREAKDOWN OF WAREHOUSE WORKERS BY SECTOR

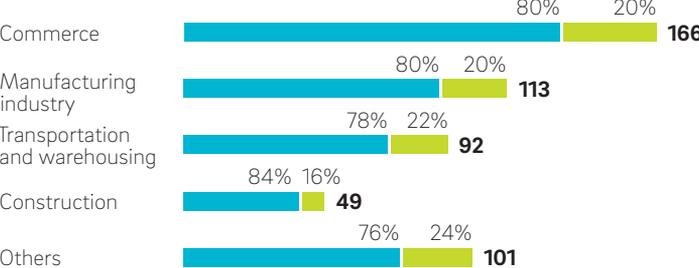
[in thousands]

GERMANY



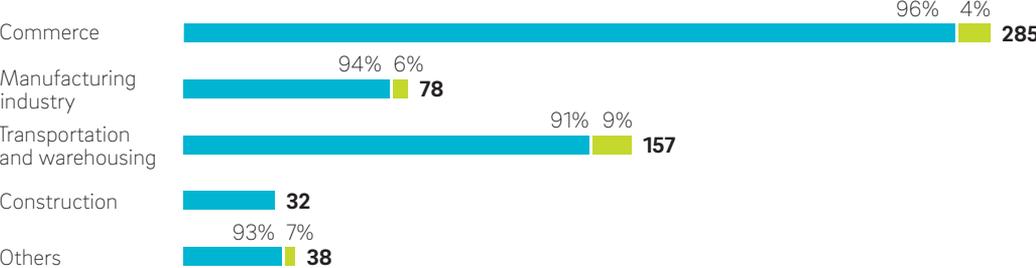
TOTAL
846

FRANCE



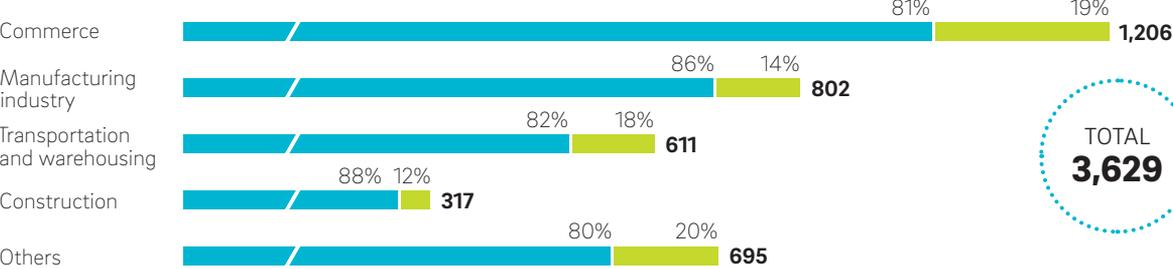
TOTAL
522

UNITED KINGDOM



TOTAL
590

EUROPE 15



TOTAL
3,629

■ Permanent ■ Temporary

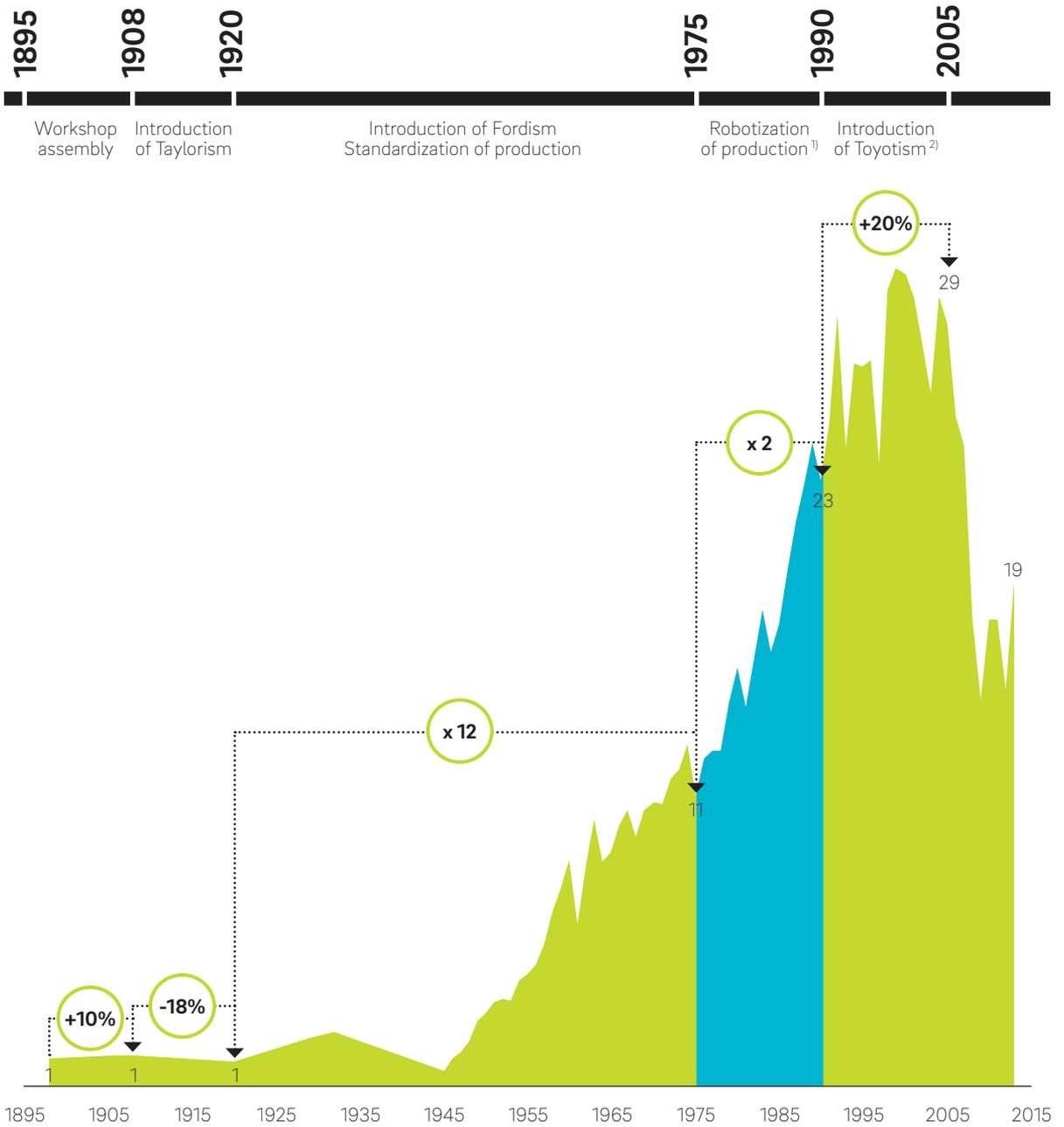
Source: Eurostat, INSEE, Roland Berger study

16 THINK ACT

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PRODUCTIVITY OF AN AUTOMOTIVE MANUFACTURER

[number of cars per year and per FTE]



1) Including painting robots (1979), machining robots and assembly robots in particular.

2) Zero default, zero delay, zero stock.

Source: constructors' data, press search, Roland Berger study

Managing a smart transition to the robotization of logistics.

WHAT ARE THE STAKES FOR LOGISTICIANS?

Defining a new business model.

Robotization-related gains will be significant enough to impact on the business model and the logistics value chain. Awareness of this is still limited, however, even though a certain number of players are launching trial projects with varying degrees of secrecy.

Unlike previous industrial revolutions, which favored players of a critical size, collaborative robotics could be accessible to smaller players. In practical terms, it will enable small logistic units to be more competitive. To achieve this, new professions such as "leasers", robot "integrators/trainers" or remote platform administrators will emerge to form the entire ecosystem underpinning the technology. The speed at which technology spreads will define the level of productivity gain passed on to end customers in the form of price decreases. This will pave the way for the emergence of a player "breaking" the rules of the logistics sector (price level, pricing model, service level).

In the United States, Quiet Logistics is one of the few, if not the only logistician with access to Kiva Systems technology, which was bought by Amazon in 2012 and which has preempted production for several years. Quiet Logistics has experienced impressive growth (doubling its turnover every year since 2009) in a highly competitive market. The company, which doesn't report its results, has chosen to focus on the flexibility of its solution rather than engage in a price war. The emergence of a troublemaker in the industry is not unthinkable, however, as more and more copies of the Kiva system are made.

In addition, given that **robotization minimizes and even negates social risk, it can also act as a catalyst for the total or partial reinternalization of logistics**, which is especially true for players handling large volumes of goods, such as Leclerc in France, which now operates four fully mechanized warehouses.

Most major logisticians are now paying close attention to the issue. As brands seek to increase their visibility, initiatives such as monitoring, automated forklift trucks, surveillance robots and inventory drones are increasing in number. Robotization is legitimately perceived as a vehicle for continuous improvement, and is not (yet) seen as a disruptive technology capable of ushering in a new generation of services. This is the way that it needs to be viewed, however, if job losses are to be offset at a macroeconomic level and if logisticians are to remain competitive.

WHAT RESPONSIBILITIES DO REGULATORY AUTHORITIES HAVE?

Careful management of the transition to ensure offsetting.

Two-thirds of the participants in the 2014 French national consultation on logistics said that the main obstacle to the development of a competitive logistics sector in France is the complexity of the country's regulations. Yet the increased complexity of social regulations in particular is a contributing factor in the increased pace at which robotization is extending. Attempts to overprotect employees from logistics merely succeed in putting these very jobs in danger.

Decisions as to the pace and method used in "managing" the impact of robotization will shortly have to be made.

If this pace is too fast, the transition will have a disastrous social impact. If it is too slow, it will limit access to technology for players that are sufficiently large to support medium-term investment, which would stifle the potential for value and job creation linked to the robotic ecosystem as a whole.

Supporting and financing research and training into these new robotics professions is essential and should be accelerated now. Otherwise, the robots will be Japanese, Korean or Chinese, they will operate all across Europe and lost jobs will be offset elsewhere. ◆

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FURTHER READING



MIDDLE CLASSES FACING DIGITAL TRANSFORMATION: how should we anticipate, how should we support?

Technological progress moves the frontier between the business we knew as potentially automated, and those thought to be preserved. Big data, learning machines, and the Internet of Things today transform intellectual activities. What is new is that the intermediate jobs are also at risk. These include administrative, legal business or supervisory functions, which have historically been providers of employment for the middle class. Digitalization could impact 3 million jobs in the horizon 2025.



DU RATTRAPAGE À LA TRANSFORMATION: The digital journey, an opportunity for France

Like other countries, France has seen digital technologies spread throughout society, leading to new behaviors and new expectations from users. As a result, the digital transformation of businesses is gaining traction. This transformation requires adaptation and anticipation as well as an evolution in terms of technology, equipment, usage, organizations and culture.

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