White Paper

Industry
Manufacturing

AI-Enabled Worker Assistance Solutions In Manufacturing

Manufacturers are looking for innovative ways to improve labour and equipment productivity.

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Overview

Competitive pressure has forced manufacturers to find ways to simultaneously increase output and reduce costs. Meanwhile, the complexity of assembly has increased, with products now comprising many parts as producers race to embed electronics in their wares. Error-rate induced stress and high employee turnover increase the importance of effective training and simple processes. Manufacturers are now looking for innovative solutions to solve these issues.

Industry 4.0 technologies are enabling manufacturers to digitise their production lines and transform the way they operate. The intersection of IoT and AI enables the implementation of Poka-Yoke systems, such as worker assistance solutions, which both speed up production and reduce error rates. Employee satisfaction increases as workers gain computer-aided training and worry less about making costly mistakes while assembling complex products.

Against this backdrop, this whitepaper explores:

- The key challenges that manufacturers and assemblers face today
- The capabilities that a robust worker assistance solution should have
- The benefits of implementing a worker assistance solution

This whitepaper, sponsored by AWASIN in partnership with Intel, leverages data from the global Ecosystm IoT Study, that is live and ongoing on the Ecosystm platform, and provides real-time market insights.

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Challenges to Manufacturers and Assemblers

Improving Productivity. With large capital investment in plants and machinery and high fixed costs, manufacturers target productivity as an important metric for improvement. Ramping up the speed of the production line, reducing bottlenecks, and increasing equipment utilisation are therefore the primary levers that manufacturers can adjust to increase output. Automation has played a major role in increased productivity, including tools that support workers to accelerate manual assembly.

Reducing Assembly Error Rates. Manufacturers strive to produce correctly assembled products on the first attempt and reduce redo rates. Assembly errors that surface during quality control slow down the production line and increase staffing costs when resources are dedicated to the correction process. Those errors that are not identified until the product is in the hands of the customer impact reputation and increase post-sales costs of repairs and returns. Reducing assembly errors rates therefore increases product quality and improves customer experience rates.

Improving Employee Satisfaction. The drive for increased productivity often requires the assignment of workers to repetitive tasks with little variation, making it challenging for manufacturers to deliver a positive employee experience. Moreover, the pressure to reduce error rates places undue stress on workers, who must ceaselessly focus to avoid assembly mistakes. Implementing programs to improve employee experience not only leads to more satisfied workers but also reduces costs. Efforts to reduce the notoriously high employee turnover rates in the Manufacturing industry result in decreased recruitment and training expenditure and ensure experienced, productive workers are retained.

Reducing Training Times. Modern Manufacturing requires the assembly of products consisting of many parts, particularly in the electronics and automotive sectors. This creates a challenge for new workers who, during their training period, are likely to both be slow and prone to error as they come to terms with the complex assembly process. Moreover, manufacturers that produce many variants or frequently add new products, face the ongoing difficulty of training both new and experienced workers each time the production line changes. Methods to reduce training times therefore result in increased productivity and product quality.

Ecosystm research finds that manufacturers are keen to adopt IoT and related technologies to mitigate some of the challenges they face − workforce optimisation emerges as the key driver (Figure 1).

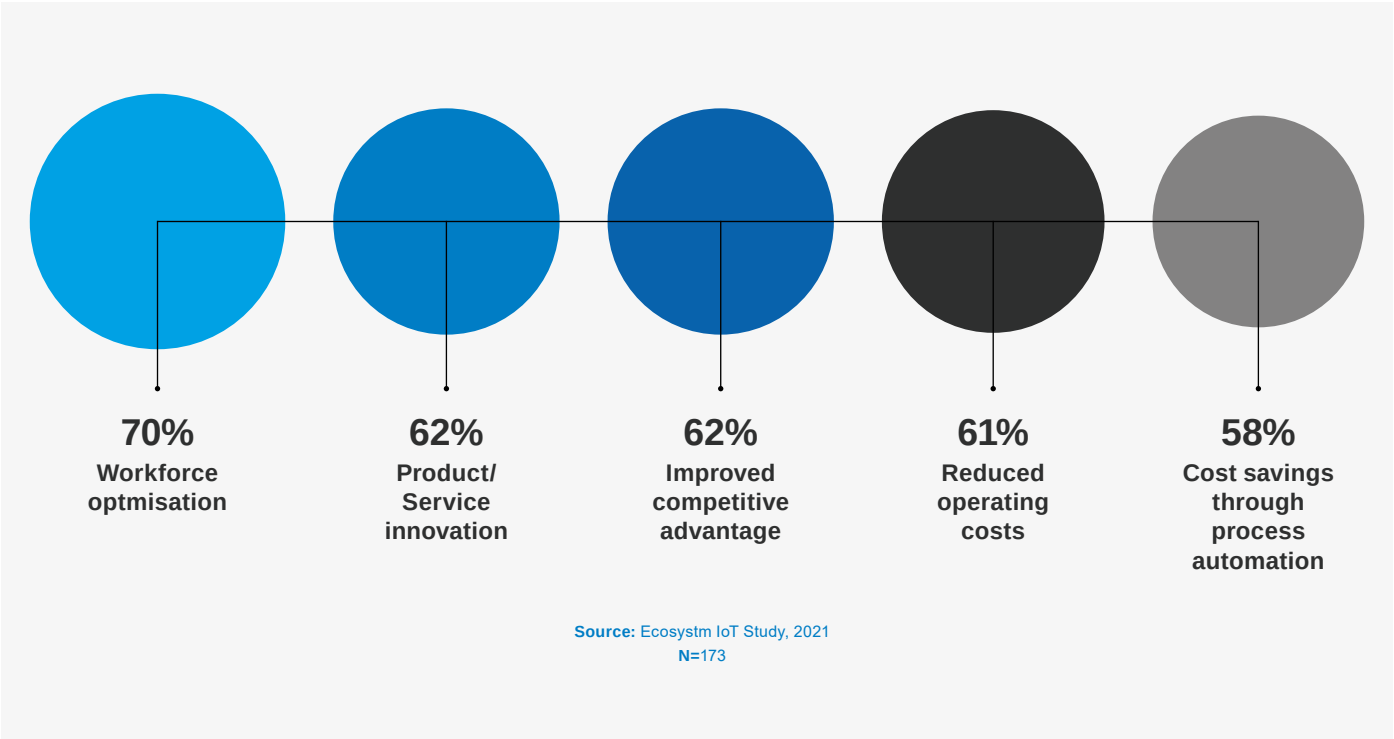
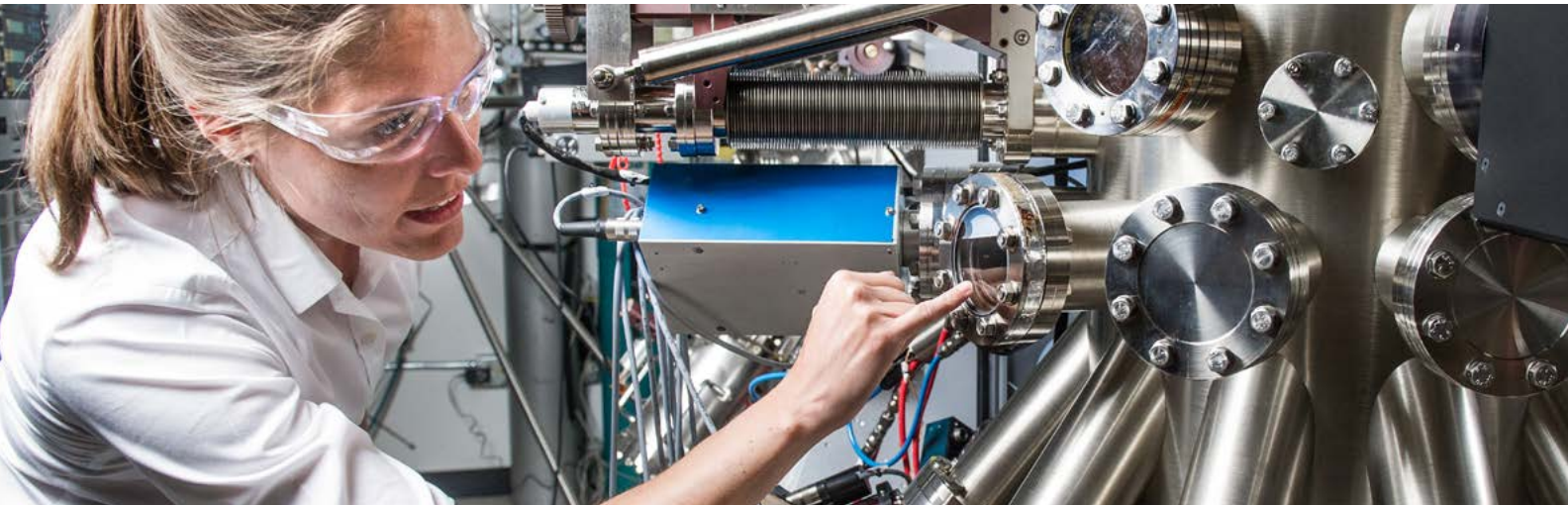


Figure 1. Key Drivers of IoT Adoption in Manufacturing



Assembly Worker Assistance Solutions

The advent of computer vision systems and deep learning algorithms have set the stage for the development of worker assistance solutions in the Manufacturing industry. For example, the AWASIN Work Assistance Camera employs the computer vision and deep learning capabilities of Intel OpenVINO to monitor and guide employees quickly and accurately through the assembly process.

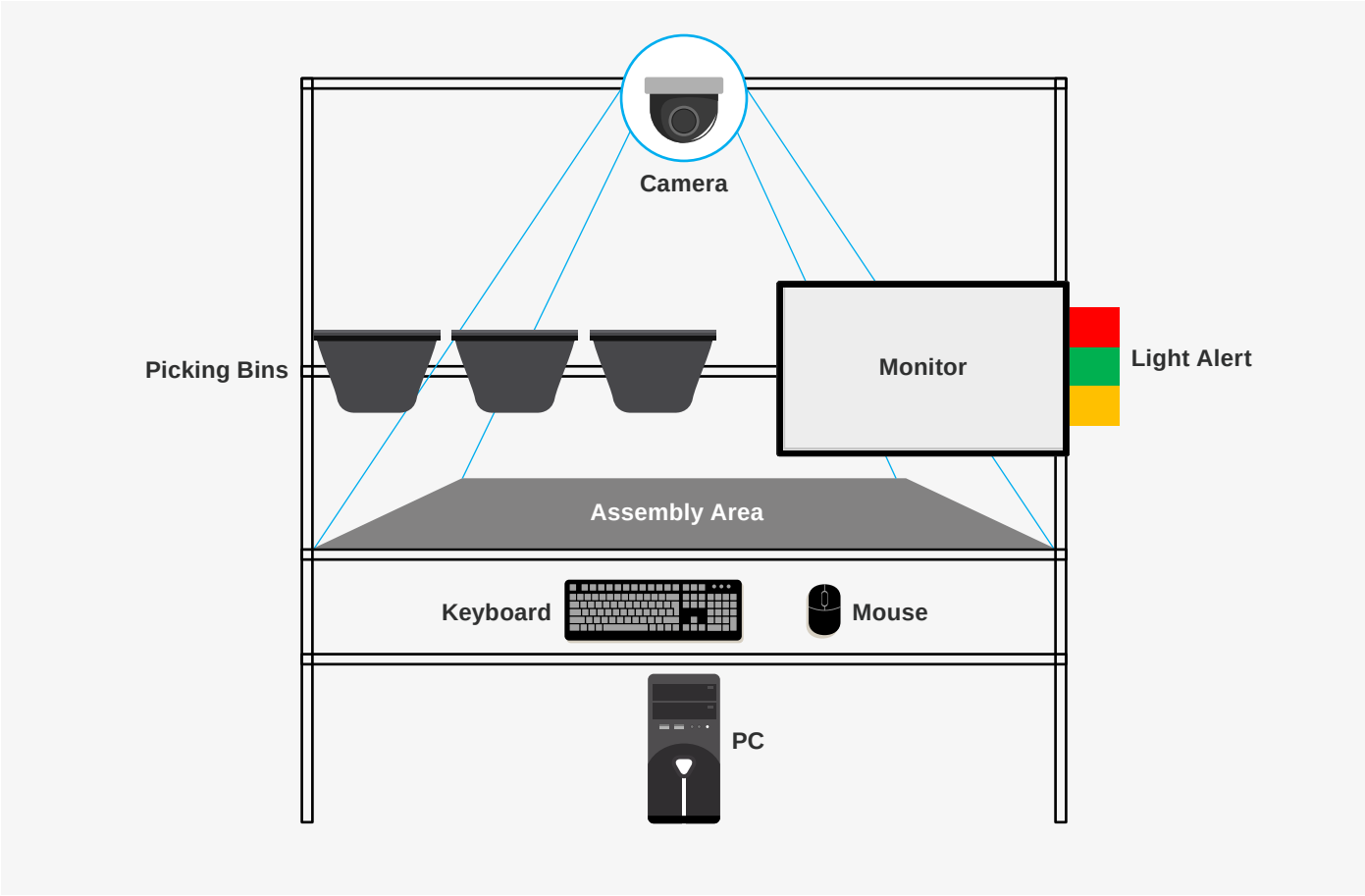


Figure 2. Assembly Worker Assistance Solutions - Components

Look for the following technologies in an assembly worker assistance solution:

- **Vision-based deep learning.** Training the system should be fast and effortless, using a combination of deep learning − to identify hands, tools, parts, and worker presence − and simple boundary setting around pick boxes.
- **Error detection and alerting.** Alignment of hands or tools with incorrect pick boxes or inaccurate part placement should be detected. Visual or audible signals alert workers to errors.
- **Modularity.** The ability to scale up base components or accessories with the increase in capacity needs or as field of vision requirements widen for assembly of larger items.
- **Third-party integration.** Compatibility with third-party bar code readers, laser and light projection modules, powered tools, physical buttons, and smart gloves.
- **Traceability.** Automatic document generation to feed into the quality control process. This demonstrates proof of quality, creates data to optimise workflow, and reduces time spent on manual document production.
- **ERP integration.** Data exchange with ERP systems either through API or XML to ensure parts and partially-complete products are tracked throughout the assembly process.
- **Multi-language support.** Simple input and selection of multiple instruction languages, which are particularly useful in factories with a diversity of employees.
- **Rollout/reconfiguration.** New assembly instructions and updates should be easily deployed either via the network or with SD cards.

Implications for Manufacturing CIO/IT Teams

Evaluate worker assistance vs monitoring. Smart assembly solutions should primarily be positioned as tools to assist workers by simplifying their tasks and reducing the stress associated with making errors. It is important to alleviate employee scepticism that these systems are designed as monitoring tools to identify underperformance. A challenge is presented, however, by the generation of worker productivity data, which could be used to reward high performers. IT teams should work closely with HR to evaluate the potential benefits and pitfalls of such assessment programs.

Calculate Return on Investment. To accurately calculate ROI of a worker assistance solution, it is important to fully assess the potential benefit. While greater productivity due to increased speed of assembly will be the primary gain, additional benefits should be factored into the decision. A reduction of errors decreases costs associated with quality control and product correction. Moreover, it can even reduce storage space needed to stow incorrectly assembled products. Improved employee satisfaction cuts expenditure tied to staff turnover. Finally, faster training shortens the time before employees are productive and provides the ability to shift employees between workstations to balance workloads.

Start small and scale up. Identify the assembly task with the most complexity and therefore potential for acceleration. Begin with a short pilot project to understand how the worker assistance solution is set up and integrates with the ERP system. Ensure workers are directly involved in the initial set up to understand any short cuts or difficulties that they have discovered on the job, which could be part of the official workflow. Solicit feedback from multiple workers as each may prefer a slightly different routine, e.g. step confirmation on the touchscreen or a physical button. Look for solutions that can be quickly rolled out, either independently or with a partner and then modified by the in-house IT team as the workflow is refined.

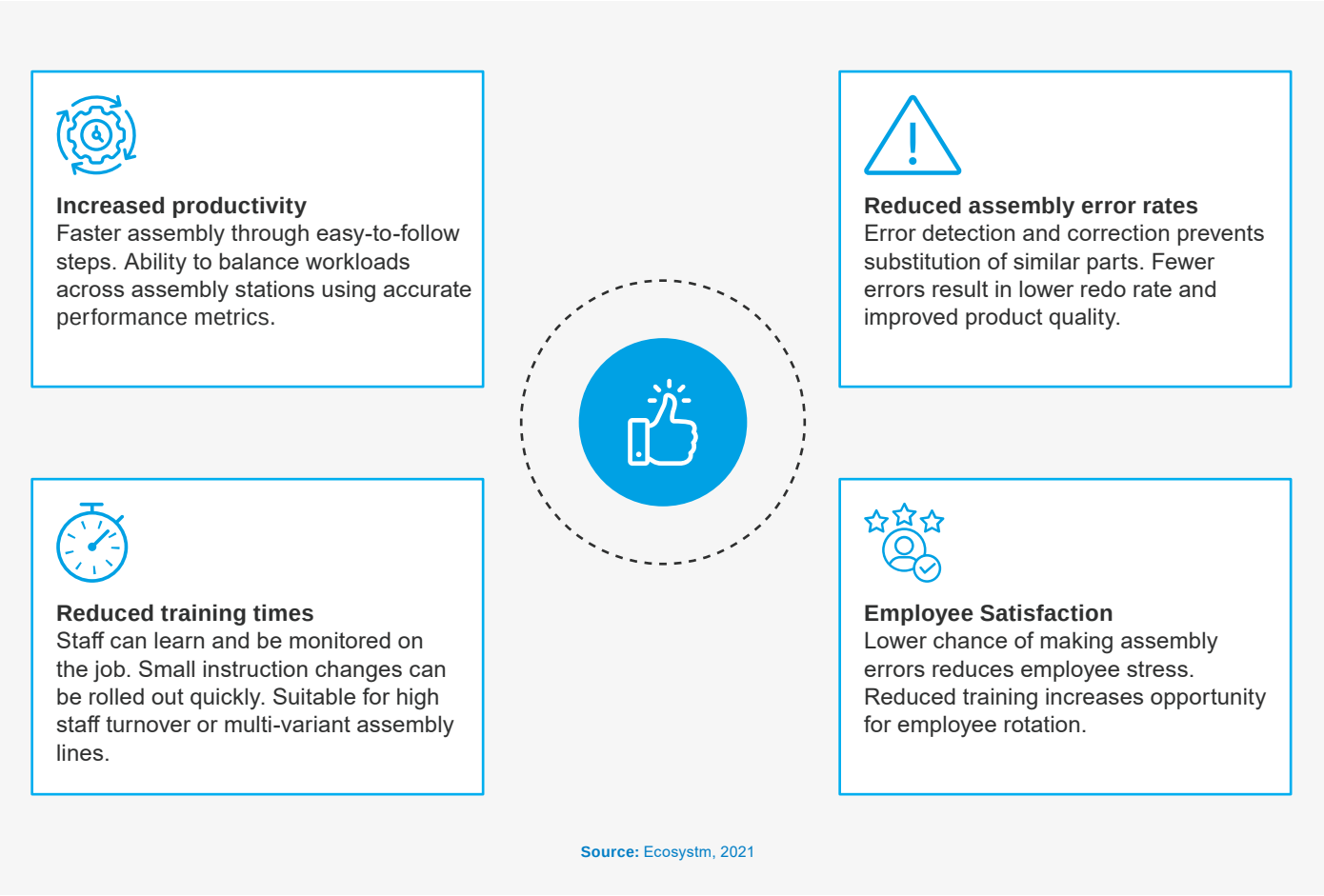


Figure 3. Leading Benefits of Smart Assembly Solutions

A robust assembly worker assistance system will provide the following benefits:

- **Faster assembly.** Visual cues to identify the correct picking box and assembly position enable employees to work more quickly.
- **Reduced training times.** With step-by-step assembly guides, workers can train on the job and become productive faster.
- **Reduced error rates.** Workers are alerted to incorrect item picking and assembly, ensuring errors are identified immediately rather than during quality control or after sale.
- **Lower employee stress.** Workers can relax knowing that they are unlikely to make errors, resulting in improved employee experience.
- **Staff rotation and multivariant assembly lines.** Faster training gives workers the opportunity to rotate between workstations. Moreover, quickly trained staff provides the ability to add new products to the production line.
- **Balanced workstation loads.** Accurate metrics that measure assembly speed, workstation utilisation time, and common errors help to balance loads between workstations and identify bottlenecks.

Conclusion

The rising cost of labour is driving manufacturers to increase levels of automation and implement Industry 4.0 technologies to boost output per worker. Furthermore, shifting consumer preferences, rapid product innovation, and trends towards customisation and personalisation all combine to put pressure on manufacturers to modify their product offerings often. This in turn compels manufacturers to find solutions that allow them to change their production lines and retrain employees quickly. Digital solutions that augment the worker's physical abilities are an important tool in tasks that still require a high level of manual assembly.

Manufacturers should invest in camera-based worker assistance solutions that speed up assembly by displaying correct procedures and alerting the user to any errors. These systems should use deep learning to easily identify hands, tools, and picking boxes without the need for intensive training periods. High levels of modularity and integration with third-party accessories allow the system to adapt when new product lines are introduced or scaled up as capacity grows. Finally, the integration with the ERP systems and the ability to monitor labour productivity and equipment utilisation ensure traceability and allow manufacturers to analyse and improve workflows.

About the Author

Darian helps businesses navigate the path towards digital transformation, providing insight into cloud, automation, cybersecurity, and outsourcing. He has spent two decades advising business leaders on using technology to enter new markets, improve client experience, and enhance service delivery.

Previously, Darian spent ten years at IBM, where he was a principal advisor for infrastructure services and hybrid cloud in Europe. Prior to this, he was a research manager at IDC, gaining emerging markets experience in Asia Pacific, Central Eastern Europe, Middle East, and Africa. In his final position, Darian headed up IDC's ANZ offshore research team based in Kuala Lumpur.

Originally from New Zealand, Darian is based in Prague, the Czech Republic. He holds a Bachelor of Business, majoring in marketing, from the University of Auckland. Outside of the office, Darian enjoys running up mountains, biking with his young daughters, and researching his family tree.

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Ecosystm's research originates from its custom designed "Peer-2-Peer" platform which allows Tech Buyers to benchmark their organisation in "real-time" against their industry or market. This bold new research paradigm enables Ecosystm to provide Tech Vendors access to ongoing and real time Market Insights in an affordable "as-a-Service" subscription model.

This white paper is sponsored by AWASIN and Intel. It is based on the analyst's subject matter expertise in the area of coverage in addition to specific research based on interactions with technology buyers from multiple industries and technology vendors, industry events, and secondary research.

The data findings mentioned in all Ecosystm reports are drawn from Ecosystm's live and on-going studies on the Ecosystm research platform. This document refers to data from the global Ecosystm IoT and CX studies, based on participant inputs that include decision-makers from IT and other Lines of Business, from small, medium, and large enterprises.

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