



THE IMPORTANCE OF HUMAN FACTORS

in designing and modifying digital work
management systems in advanced manufacturing

Summary Report

SUMMARY

Digital work management systems – enterprise information management systems that connect business processes and systems – are the backbone of Industry 4.0 technology adoption and support opportunities for higher productivity and cost savings.

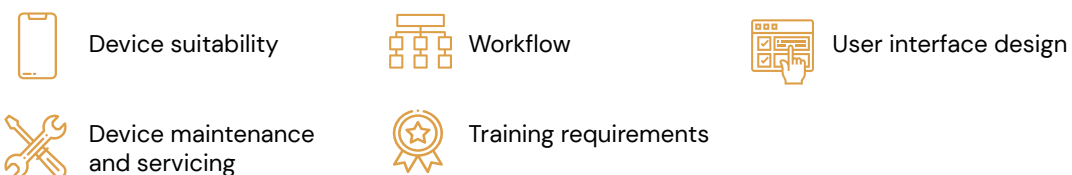
Consideration of Human Factors and Ergonomics (HFE) is critical to the uptake and success of digital work management systems. This represents a new approach to technology deployment – from putting emphasis on system functionality and specs to understanding how employees will interact with new technologies.

1 Digital work management systems enable manufacturers to move up the digital value chain



2 HFE needs to be considered at the outset when deploying digital work management systems

In digital work management, HFE considerations are largely assessed through the concept of usability. Usability testing helps to make determinations around a variety of factors involved in the deployment of digital work management systems, including:



3 There are clear actions Australian industry can take to incorporate HFE when deploying technology

1. Define what success for any new technology deployment looks like
2. Engage end-users in the design process
3. Conduct thorough usability testing
4. Treat deployment as a change management exercise
5. Redesign and adapt the organisation to reflect new ways of working

AUSTRALIA'S MANUFACTURING INDUSTRY FACES PRESSURE TO DIGITISE QUICKLY

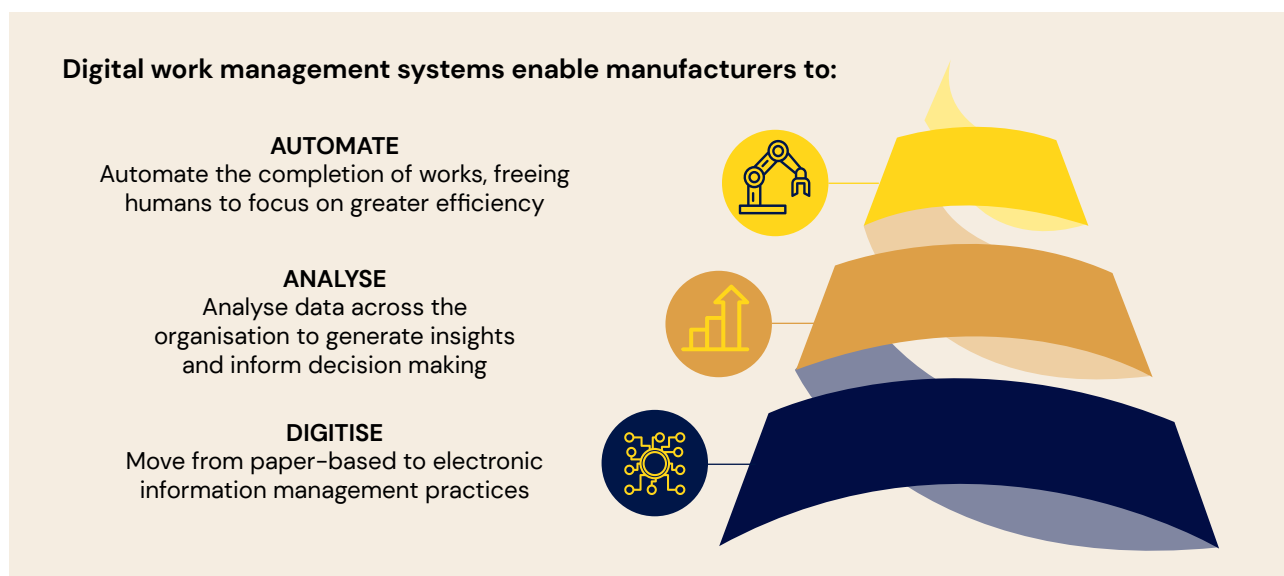
Australia's manufacturing industry is critical to the economy and can benefit significantly from digitisation. Digitisation has the potential to disrupt existing business models, processes and patterns of work, ushering in significant improvements in quality, reliability, productivity and efficiency in manufacturing.

Currently Australia lags behind other countries in terms of the pace of digitisation, most notably Singapore, the United States, Hong Kong and South Korea.¹ Manufacturing is no exception. Many of the processes and systems relied on in the manufacturing sector are manual and paper-based. This is particularly the case in labour-intensive and traditional sectors such as shipbuilding.

The future of Australia's manufacturing industry depends on its capacity to transform work practices and business efficiencies through digitisation.

DIGITAL WORK MANAGEMENT SYSTEMS ARE A CRITICAL ENABLER OF MANUFACTURING DIGITISATION – AND SUPPORT OPPORTUNITIES FOR HIGHER PRODUCTIVITY AND COST SAVINGS

Digital work management systems – enterprise information systems that connect business processes and systems – are the backbone of Industry 4.0 technology adoption.



Digital work management systems have become essential in a range of industries. In the healthcare sector, electronic medical record systems have reduced documentation time per patient visit by 70% and halved error rates by minimising manual transcription.² In the construction industry, information management systems have helped improve the flow of data between different vendors – streamlining communication and workflows.

Digital work management systems create substantial benefits for manufacturers including:

- Improved productivity by streamlining workflows and automation
- Cost savings as a result of reduced errors associated with manual workflows
- Improved safety by incorporating safety requirements into workflows and minimising the risk of missing safety-critical information.

¹ <https://hbr.org/2020/12/which-economies-showed-the-most-digital-progress-in-2020>

² Goldstein IH, Hribar MR, Reznick LG, Chiang MF. Analysis of Total Time Requirements of Electronic Health Record Use by Ophthalmologists Using Secondary EHR Data. *AMIA Annu Symp Proc.* 2018;2018:490-497. Published 2018 Dec 5.

Digital work management systems can also contribute to improved employee satisfaction by reducing monotonous activity such as data entry and repetitive workflows. The flow-on benefits are improved employee engagement, wellbeing and retention, which generate indirect economic advantages for employers.

HUMAN FACTORS ARE CRITICAL TO THE UPTAKE AND SUCCESS OF DIGITAL WORK MANAGEMENT PROCESSES

When deploying technology, organisations often put more emphasis on system functionality than how humans interact with these systems. Human Factors and Ergonomics seeks to change this. HFE is a combination of many disciplines such as social sciences (psychology, sociology), health sciences (medicine, physiology, biomechanics) and design sciences (engineering, industrial design, architecture, user interface design). More specifically, HFE is the science of designing a job to fit the worker, rather than expecting the worker to fit the job.

HFE is more than implementing the latest stretching program (although that may play a role in decreasing injuries) or supplying ergonomic chairs; it takes a holistic look at the tasks that are being performed and matches them with the capabilities of the worker to minimise injury risk and stress, and maximise quality and efficiency.

Key elements considered as part of HFE include:



In digital work management, HFE considerations are largely assessed through the concept of usability. Usability assesses the total experience of use, including the integrated performance of hardware with software. Usability testing has particular application to digital work orders (digital tools that guide workers through a work process with the aim of reducing complexity).

Usability testing helps to make determinations around a variety of factors involved in the deployment of digital work management systems / orders, including:



CASE STUDY:

Flinders University researchers conducted trials with staff in a range of roles to understand how human factors influenced use of digital work management systems

Flinders University researched the application and value of HFE methods in the development and initial capability testing of a digital work order for shipbuilding and manufacturing. Digital work orders make information available at the time and point of use, increasing productivity by reducing downtime and multiple handling of information, errors and miscommunication.

The research involved two trials:

Exploration of how different devices impact usability, productivity and worker safety when completing digital work orders

Users simulated activities involved in typical work processes (e.g. capturing photos, entering and retrieving data) in harsh environments, on both smartphones and augmented reality glasses. Feedback was gathered from participants about their experience of the tasks.

Evaluating the effectiveness of different measures for testing usability

Users completed a work order on a portable digital device (iPhone, iPad, rugged tablet and laptop) and performed a simple usability questionnaire that drew on common HFE methods for assessing system usability.

Results relating to the suitability of different devices:

1 Usability, productivity and safety are a fine balancing act

Smartphones were rated as more usable, faster and resulted in less errors. However, smartphones bring potential safety issues when working in harsh environments (e.g. smartphones are incompatible with gloves, need to be secured when moving, climbing and working, and need to be repeatedly picked up and put down).

2 Familiarity can fast-track acceptance of a device if it is otherwise suitable for the task

Smartphones have a high level of familiarity due to their popularity, meaning faster learning compared with the more novel augmented reality glasses.

3 The physical environment also influences the suitability of different tools

Readability was more difficult on glasses in darker environments and phones were more difficult to handle when working at heights.

4 Device selection needs to take into account individual characteristics

Some users struggled to ensure correct fit of the glasses on their face, whereas there is no fitting issue with a phone since it is not wearable.

Results relating to the usability testing approach

→ One usability measure / scale alone is not enough to inform continuous improvement:

Organisations should adopt multiple measures and approaches to identify clear design issues that can be built on and improved.

ADOPTION PRINCIPLES FOR INDUSTRY

Manufacturers at the beginning of their digitisation journey should start by identifying opportunities to improve workflows, communication and processes through adoption of digital work management systems. Every manufacturer has a different context, therefore the type of digital work management systems that suit them will vary greatly.

To support the deployment and use of digital work management systems, manufacturers and industry more broadly should:

1 Define what success looks like

Any technology deployment should start with understanding and streamlining the current process to form a view of what success looks like. Digitising an ineffective process will not yield the success expected. Defining success at the outset ensures those responsible for implementing technology work towards clear outcomes, and are able to track and measure impact. Key impacts that digital tools and systems should be designed to achieve in a manufacturing context include autonomy, task variety and efficiency.

2 Engage end-users in the design process

End-user engagement is a critical principle of HFE, given it is the end-users that will ultimately influence the success of new technologies in the workplace. Manufacturers should identify end-users, define their needs and understand the factors that will influence their effective use of digital tools and systems.

3 Conduct thorough usability testing

Manufacturing organisations should undertake a range of usability tests to provide clear visibility into design effectiveness and identify opportunities for improvement. Usability tests should be conducted in actual physical environments that emulate where tasks are likely to be performed to assess durability, usability, reliability and connectivity.

4 Treat deployment as a change management exercise

Manufacturing organisations should provide complete training and communication throughout the early stages of deploying digital tools and systems. Organisations should use this as an opportunity to also consider longer-term considerations such as device hygiene, maintenance and servicing.

5 Redesign and adapt the organisation to reflect new ways of working

Digital tools and systems can free up employees to work on new and higher value tasks. This can have ripple effects on the design of work, which manufacturing organisations need to consider at the start of any new technology deployment. New ways of working may need to be developed and new roles dedicated to supporting the effective uptake and use of technology may need to be established.

TAKING THE WORK FORWARD

and how Flinders University can help

Contact us to discuss how
we can help your organisation.

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BAE SYSTEMS

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