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# Challenges and Benefits of Digital Workflow Implementation in Aerospace Manufacturing Engineering

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**Abstract**

Companies who operate in highly regulated industries have further challenges to the usual competition, continuous cost reduction and product development challenges. To address these requirements companies optimise their business processes and change their applications and information systems to support their evolving way of doing business.
Workflow management technology eases the achievement of these necessities by providing methodologies, software and tools to support business process modelling, reengineering and workflow automation. Business process mapping is necessary in order to capture business processes as workflow specifications. Then, these systems allow business process reengineering, helping the optimisation of specified processes, and workflow automation, in order to generate a lean digital workflow from the specifications.
There are many opportunities to benefit from this technology in aerospace applications, however these bring several implementation challenges in large global companies operating in multiple markets and need to be carefully managed.
This research provides an overview of the benefits that digital workflows implementation can potentially bring to aerospace companies, together with a detailed description of significant challenges, regarding both the implementation of digital workflows and risks related to human factors. The study increases industry awareness on the importance of driving a digital transformation through implementing digital workflows, and where to start this implementation in a manufacturing business, highlighting the success factors.


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*Keywords:* Digital workflows, Workflow management, Business process optimisations, Digitisation, Complexity management

## 1. Introduction

Industries with technologically complex products and highly regulated environments such as aerospace, nuclear and defence, have several requirements that drive complexity to the way they do business [1]. Additionally, these companies have a wide set of tools and systems, and their supply chain and organisational structures are intricate. All this gets reflected in these organisations business processes and management systems, which are very comprehensive to be able to manage the many requirements. Large manufacturing companies require a higher cross organisational collaboration, leaner digitised processes and increased visibility and interaction between management layers and production, while continuing to meet customer requirements.

Effectively managing this complexity is a key objective for aerospace manufacturing organisations, and management are looking for solutions to simplify their business processes, with Workflow Management Systems being one of the preferred options. In similar industries, such as marine engines manufacturers or power systems, companies have realised great benefits [2] after implementing workflow solutions.


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*1.1Workflow Management Systems*

Workflow Management Systems (WfMSs) are software systems that help support collaboration and coordination among company members, assisting them in the completion of complex business processes [3].

WfMSs support the operation of digital workflows, which describe business processes in a way that allows a certain degree of automation and focus on automating parts of the process. They represent the business process as a sequence of activities, with tasks that can be either fully automated (hence executed exclusively by a computer) or assigned to employees, who might carry out the task supported by a computer.

The workflow system controls and tracks the progress of processes by pulling and supporting all the activities, and after completion of each task, it checks that it has been correctly performed. Therefore, these management systems help the achievement of the business goals with greater efficiency [3].

**Nomenclature**

| | |
|---|---|
| WfMS | Workflow Management System |
| LDW | Lean Digital Workflows |

Also, workflow management systems usually allow the creation of key metrics, helping to measure and analyse the efficiency of the business process, facilitating the practice of continuous improvement.

In addition, these systems are often integrated with other company tools and systems, such as e-mail, databases, project planner, communication tools, etc. Integrating these capabilities gives structure to the business processes, which usually employ several different independent systems [4].

Manufacturing companies require a high level of flexibility, scalability, reliability and interoperability coming from their management systems, and digital workflows can help efficiently meet these requirements. Figure 1 shows how digital workflows, with a goal to automate tasks and integrate tools, are linked to business processes, which are at a higher level, as a business process can comprise several workflows.

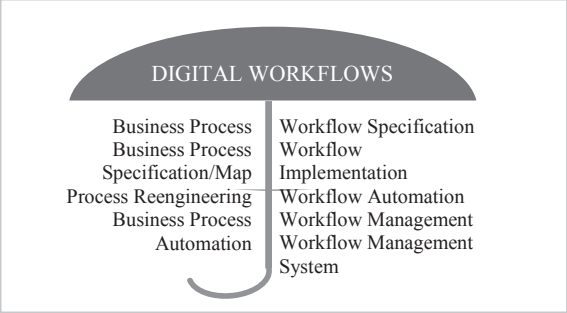


Figure 1: The workflow umbrella. Source: [5]

The next chapter outlines the major benefits of digital workflows for large companies, and highlights the challenges that are present during the implementation process and system service.

## 2. Benefits for aerospace companies

Introducing digital workflows and workflow management tools is an opportunity to improve, automate and streamline the underlying processes in a business.

Since workflow management systems demand examination and definition of a manufacturing company's business processes, it is a convenient time to optimise these processes. In fact, it is vital to conduct an analysis of the underlying process and improve it where necessary, prior to digitising the process, so the organisation can avoid embedding bad practices on the system [6].

Aerospace organisations can realise several benefits by implementing appropriate digital workflows. Some of these benefits come from the workflow automation while others from the process mapping and business process optimisation that has to be carried out prior to workflow automation. This review highlights the most relevant benefits, which have been collected from one to one interviews, industry workshops, literature review and digital transformation themed conferences. The outcome is gathered in the following list:

- Improved efficiency

Automation of parts of the business process helps in reducing the number of unnecessary steps within a workflow, thus improving the overall efficiency of the process. A properly implemented digital workflow does the same job as an employee, but faster and without human errors, which leads also to lower operational costs.

- Improved accountability and visibility

Digital workflow solutions are very helpful for management. Most WfMSs include a tool that helps visual tracking of the workflow status, as well as role assignment for each task. The system clearly shows which tasks are required, the employee responsible for its completion and when the task should be completed.

Managers are capable of understanding who is accountable for each action. Additionally, accountability and employee approval hierarchy are clearly stated, promoting improved transparency. These workflows solutions usually assign the task to a role, as shown in Figure 2.

Figure 2: Role assignment in workflow automation. Source: [7]