



PM Group manages the design, construction and commissioning of high-tech facilities. We are an employee-owned company with over 48 years' experience working for the world's leading pharma, food, data centre, and medical technology companies. We deliver projects across Europe, the USA, and Asia.

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**Overview & Background to the Lean Initiative**

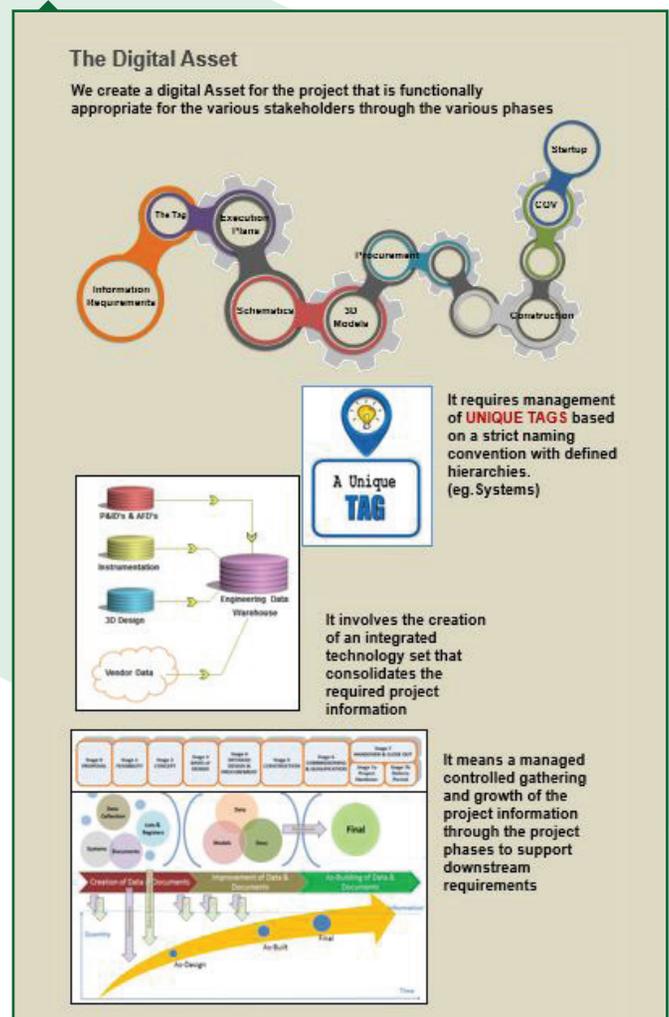
PM Group has an established reputation for developing and implementing innovations that solve our clients' business challenges and result in enhanced performance, flexibility, and competitiveness. Since our foundation in 1973, our products and services have been focused on providing design, construction, and commissioning services that deliver the physical assets that enable our clients, in turn, to provide their own products and services. Digital enabled Project Delivery (DePD) now enables us to provide a full digital asset in addition to the physical one.

This most recent DePD innovation expands our delivery capability further. However, what sets this apart from previous innovations is the fusion of Lean thinking and practices which has resulted in the following:

- Innovations in our products and services – we now couple the digital asset to that of the physical asset.
- Innovations in our delivery process – the elimination of non-value-added activity.
- Innovations in the way we organise and manage people – earlier and extended engagement of the entire project delivery community.

These DePD innovations, have exposed additional synergies in performance, flexibility, and competitiveness that extract further beneficial use from all the innovations on which this implementation of digital technology is built upon.

**Figure 1.** Digital enabled Project Delivery (DePD)



## Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

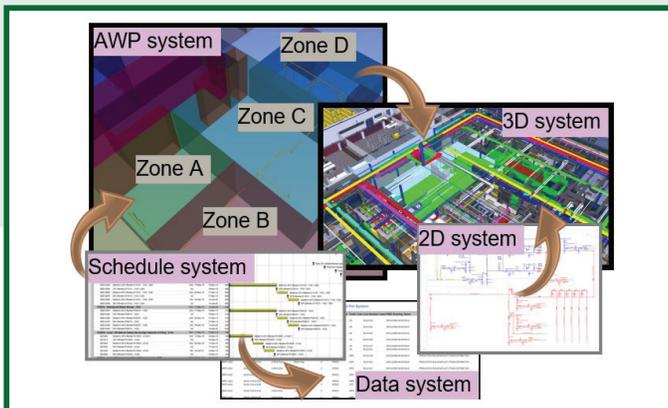
This digital asset has enabled us to innovate the project delivery process. Greater levels of trade partner involvement, off-site manufacture (OSM), and modularisation are now possible. This results in less waste, as well as simpler, safer, and higher quality construction. Commissioning starts much earlier in the virtual space of the digital asset and enables commissioning to influence design and construction. This avoids the waste associated with being constrained by a late start and fixed finish.

The ability to see the digital asset earlier has had a profound influence on quality and customer satisfaction. This front-end loading of design facilitates positive change at a point when the cost of change is minimal – a few keystrokes versus strip-out and re-fabricate. The DePD process exposed an opportunity to use the digital asset product created to support a number of Lean techniques for the construction group.

### Advanced Work Package Planning incorporating Takt Planning Methods

This technique involved the assignment of appropriate construction areas to the project. These construction areas were further divided by trade partner scope. Once assigned, the areas are integrated with the construction schedule. Analysis of the schedule and scope allowed for an appropriate sequencing of work across the trades and areas to support the agreed schedule. The digital asset was used to support this technique.

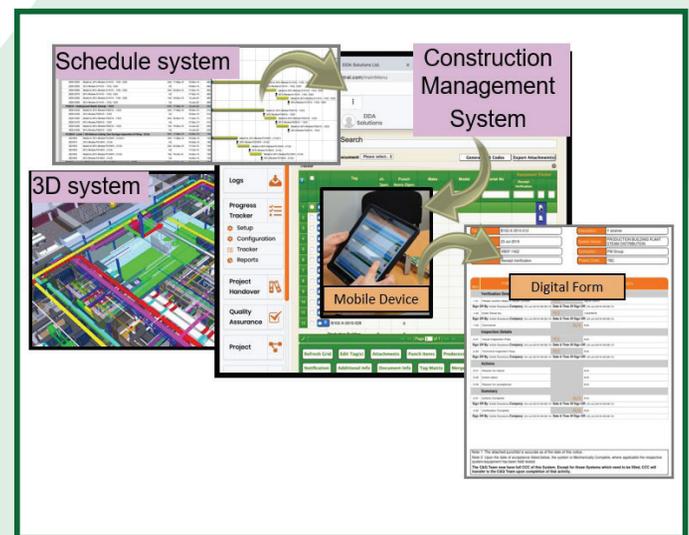
The intelligent 2D schematics of the digital asset is integrated with the 3D model of the digital asset. This allowed for the scope of construction area work to be identified early in the 2D phase so that the 3D model was developed in alignment with the work package sequences of the schedule. This in turn allowed the tagged item data of the construction areas to be delivered to the procurement system to support the required delivery of equipment on-site per work package area and as per the construction sequence. This phased delivery of information and physical equipment supported the progressing of construction areas by our trade partners in the agreed sequence.



**Figure 2.** Advanced Work Package Planning

### Paperless Receipt Verification

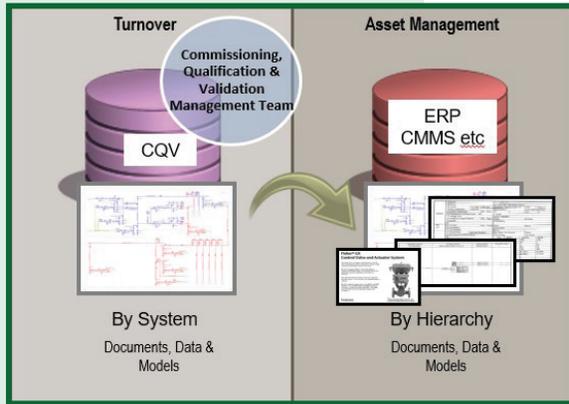
Coupled with the above initiative was the opportunity to use the information to support a paperless receipt verification process. The delivery of equipment and information was forecasted and executed based on the agreed schedule from the advanced work package process. The as-specified information moved from the design section of the digital asset to the construction management section. The construction management system supported our Lean process via the use of mobile devices configured to present the as-specified information for equipment to the user as a digital check sheet. The mobile device allowed for electronic signatures and photographs to verify the completeness of the paperless verification activity.



**Figure 3.** Paperless System

### Early Computerised Maintenance Management System (CMMS)

The DePD process allowed us to create datasets from the managed project data for loading into the client's maintenance management systems. This preloading of data followed the system release schedule from the commissioning phase and hence allowed for maintenance activities to be appropriately set-up and ready for start-up. This initiative has reduced the duplication of effort associated with CMMS build activities and increased the quality of the information available.



**Figure 4.** PM Group and Client Systems Alignment

These innovations in product and process have further enabled other organisation innovations such as:

- Greater outsourcing of design.
- Earlier and extended engagement of trade contractors.
- Commissioning staff and end users.
- Life-cycle package management.
- Greater integration of equipment vendors.

## Lean Initiative Improvements & Impact

The project delivery organisation has evolved from a series of mini siloes where project delivery is advanced and handed-off in large batches of activity in defined sequence. DePD has enabled the project delivery organisation to more resemble a community of practice. The organisation and people management are focused on enabling the multitude of relationships necessary to support the project scope being defined, designed, constructed, and commissioned in a way that minimises waste and fully leverages the entirety of the human potential involved. It thus replaces the traditional contractual and adversarial approach that often optimised the parts to the detriment of the whole.

The digital asset also extended the delivery process to customers beyond the traditional handover of the physical asset – the digital asset enables the competitive exchange of services to client operational business units. It has been quite typical for clients to expend significant waste in extracting information from handover documentation to transfer it to other systems. This waste can be virtually eliminated by appropriately using the digital asset to configure the information in the required format for an error-free transfer that can additionally preserve embedded meta-information.

Management commitment and endorsement of digital project delivery was agreed when PM Group bid the current project. This meant that the expectation of improved performance was built into the project delivery expectations from the start. Previous projects had demonstrated/piloted the potential of DePD, and the decision to comprehensively apply DePD to the latest project was fully supported.

The Project Execution Plan was supplemented with a full suite of Digital Project Execution Plans that described how the project would be delivered. These plans were used to engage and communicate with the full project team so that all design disciplines and all support functions such as procurement and project controls were on board with the change and aware of how it would benefit them and how they could support the implementation.

Additional benefits include:

- A Steering Team was put in place with senior management that met weekly to maintain the focus and ensure the levels of commitment were maintained, to address gaps or challenges, and also to communicate the benefits of digital delivery to the wider organisation.
- Weekly clinics were put in place to deal with specific 'digital issues' that arose. An example includes sessions with package engineers and vendor to align information delivery expectations.
- A comprehensive training program was introduced for all on-boarded project participants, and Department Managers were included to ensure support.
- The project organisation included two full-time roles: a Digital Delivery Champion, and a Lean Delivery Champion. The former to provide the technical transformation and the latter to ensure the changes in work practice and subsequent elimination of waste were realised.