COMPANY OVERVIEW

JACOBS

COMPANY WEBSITE
www.jacobs.com

Jacobs leads the global professional services sector, providing solutions for a more connected, sustainable world. Headquartered in Dallas, Texas, with approximately US$12Billion in revenue and a talent force of more than 50000, Jacobs provides a full spectrum of services including scientific, technical, professional, construction and program management for business, industrial, commercial, government and infrastructure sectors. Marking 45 years in Ireland, Jacobs established its first international office in Ireland in 1974. Today, the company employs more than 1100 people across Dublin, Cork, and Belfast and is one of Ireland's largest firms.

OVERVIEW & BACKGROUND TO THE LEAN INITIATIVE

AUTHOR

Karl Page

The Charter

Jacobs' offices span several continents, time zones, and different lines of business (LOB). Traditionally, this meant that each office and LOB operated to their own standards using a variety of software systems. However, as this presented challenges to multi-office execution, Jacobs invested a significant amount of time and resources into standardising these software systems.

This investment required significant upskilling to implement new software systems. As with any standardisation initiative, a program that initially presented challenges has since afforded the broader group opportunities to mobilise resources from several offices to support large-scale project delivery.

The standardisation of software systems has allowed each office and LOB to also standardise elements of design that were traditionally specific to them such as "Revit" families, e.g. pipes, lights and equipment, with master cloud-based libraries used by each LOB. It is on the back of this strategic improvement across the operation that Jacobs have been afforded opportunities to dramatically change and improve how we design projects.

As a centre of excellence, the Irish operation over the past number of years has been given a charter to 'pave the way towards a leaner digitised solution for project delivery'. A disruptive mindset across the Irish operation has enabled this charter, and this approach has been encouraged and supported by Chair and CEO Steve Demetriou and his senior management team, including Ireland's management at local level. Without this support and the drive for innovation, the ask may have been too great.

In parallel to project delivery, over the past number of years the Irish operation has also focused on this charter by enabling a Digitised Solutions Group (DSG) to focus on areas across our project delivery which could be optimised by digitisation and automation. This case study is a summary of the areas where we have optimised our execution strategy and project delivery.

LEAN INITIATIVE UNDERTAKEN – LEAN THINKING, TOOLS, TECHNIQUES

Revit

As the new standardised software across the LOBs, Revit afforded the DSG a platform upon which to build a digitised delivery foundation. In comparison to its predecessor "AutoCad", Revit is a much more advanced system based on a 3D environment. As a 3D design tool in its basic form, Revit allows engineers to co-ordinate and gain an appreciation for the scale and complexity of the projects that we deliver.

However, this is just one element of the benefits of using this Autodesk product. The DSG focused on other capabilities available and discerned that a much greater focus was needed on the data entry into the model. It is based on this data entry that the Autodesk suite is a truly powerful project delivery tool. Through other software add-ons to Revit, the data can be managed, mined, controlled and used as a lean delivery tool, providing quality assurance as a biproduct.

Single Source of Truth

To get an appreciation of the potential to digitise elements of design, the DSG initially focused on data entries and areas of duplication. Across all the disciplines, we found that Jacobs had a vast amount of data which was duplicated in some format. Different forms of data were recorded on decentralised storage locations and on a multitude of different software programmes.

This meant that the data had no reference point and was open to inconsistent entries, leading to potential errors across the data. A further deep dive into the documentation presented single points of failure across the discipline design co-ordination, presenting the potential for errors to occur. To mitigate this potential issue, Jacobs developed robust quality procedures. However, as project schedules become more aggressive and the complexity and scale of the projects increase, these procedures would be stressed tested. Quality assurance

became a focal point, and the DSG set about establishing a Single Source of Truth (SSOT) to mitigate these potential concerns.

An SSOT, as the name suggests, is where all supporting data in a design is referencing a master document or database for information. Inputting design data is done once, at source, and duplication is removed. This is relatively straightforward for an individual discipline to manage, however in a multi-discipline sphere, changes made by one discipline can have a compounding impact on others.

The SSOT focus, therefore, had to be based on leading factors such as the equipment lists for process and mechanical, and that data being referenced by other disciplines. In its ideal state, the SSOT system has a multitude of layers of truth which need to co-ordinate across the layers. This means that the data entry inputted can be manipulated by the other layers or discipline data. For example, changes to room size have an impact on air conditioning, which impacts electrical, which impacts plant rooms sizes. Once an SSOT had been developed, the DSG looked to areas where digitisation could improve design efficiencies.

Figure 1. Single Source of Truth

Digitised Design

Without an SSOT, it would not be possible to automate elements of design as multiple sources, and potentially conflicting data, could exist. Once in place, and in conjunction with Revit and associated add-ons, the DSG were able to write programming code and scripts to automate design functions such as locating electrical services within the model with the click of a button.

Elements of design that would have previously taken weeks to design are now being produced within much shorter timeframes. Documents that would have previously been developed manually with limited functionality, have now in-built scripts to mine data from the model to extract reports, such as Material Take-Offs. The data inputted and extracted from the model is being managed in a much more efficient manner.

Separate to Revit, smart functionality has been programmed into a multitude of other deliverables, all referencing back to the model and the SSOT. This means that when changes are made to the SSOT a full suite of updates takes place across the design, which leads to programmed updates taking place. For the example used previously, when a room changes in size and the air conditioning changes – which leads to an automated update to the air flow diagrams – then the equipment lists would automatically be updated. This in turn automatically updates the electrical load list, which updates the single line diagrams and cable sizes.

Figure 2. Digitised Design

LEAN INITIATIVE IMPROVEMENTS & IMPACT

Quality Assurance

The introduction of the SSOT and Revit has afforded Jacobs the ability to programme in quality assurance measures such as error checking and design functions that are in compliance with regulatory standards. The programming of all the scripts and code has the engineering element built in to automate the design in compliance with the regulatory standards and specifications that we operate to.

A pertinent example of this would be our automation of the fire alarm design for the building: code has been written to locate fire alarm devices in compliance with IS3218 and EN54, with variable elements inbuilt. This means that if a heat detector is used as opposed to a smoke detector, the design accommodates to suit inputting said detectors in an unlimited amount of rooms at the click of a button.

This is but one example of how digitised engineering can provide quality assurance while also reducing the time to check a design. Traditionally, quality procedures require all drawings to be checked and updated, but our robust programming functions are providing the opportunity for Jacobs to check the code written and trust in the quality of deliverable. With the removal of multiple entries, the engineering teams have been afforded more time to focus on the engineering side of the project.

Figure 3. Quality Assurance

Big Data

As Peter Drucker said, "If you can't measure it, you can't manage it", and the DSG are focused on data mining the models and information from past projects to ensure that Jacobs are understanding the metric data. This data is essential not only to winning future projects, but also to bench-mark project delivery against the key performance indictors which we are judged upon. Programs have been written that automate the extraction of data from the model in a consistent manner. This makes the overall review of the project data easy and less time-consuming. Material take-offs, Builders work opes, data sheets and schedules are easily extracted from the model where traditionally this data would have been hugely time-consuming to generate.

Figure 4. Data Mining

Looking to the Future

Jacobs DSG are constantly looking at opportunities to innovate and improve the systems utilised in the design, with a focus on the future of engineering. Artificial Intelligence (AI), Machine Learning, and Neural Networks are all providing these opportunities. It means that this is a truly exciting time to be involved in engineering.

Figure 5. What's next?

JACOBS®