

Case Study Title: Towards Modern Methods of Construction Using Lean Principles

Company Overview | ACB GROUP | acbgroup.ie

ACB Group is a 100% Irish owned Company who has grown and excelled both nationally and internationally, having more than 19 years of industry experience on a myriad of complex and fast-moving projects. Our aim is to be the 'go-to' data centre solutions provider in the global market, while being recognised for our commitment to Safety, Quality and Sustainability, benefitting clients and trade partners alike.

At ACB Group we deliver the complete design and build solution for your building envelope, including roofing and façade systems along with internal cladding solutions. We are accredited with ISO 9001:2015 (Quality), ISO 45001:2018 (Health and Safety) and are the only BIM Level 2 certified roofing and cladding subcontractor in Ireland. In May 2022, ACB Group were awarded a Silver Medal for sustainable business practices from EcoVadis. At the beginning of 2022, ACB opened the manufacturing arm of the business, ACB

Manufacturing (ACB-m) and uses modern methods of construction to help deliver off-site fabrication in its Cavan location.



Figure 1: Design image of the ACB Innovation Hub in Ballyjamesduff, Cavan.

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Overview & Background to the Lean Initiative

In 2022, ACB Manufacturing (ACB-m) successfully began trading, supplying off-site prefabricated solutions for data centre clients. As an organisation dedicated to lean initiatives and Modern Methods of Construction (MMC), ACB Group saw an opportunity to offer clients a federated external envelope solution using off-site manufacturing with the aim of controlling the data centre envelope components. This will ultimately get stakeholders a step closer to NZEB Building Envelope (Nearly Zero Energy Building). ACB-m will provide greater supply chain resilience by backward integrating the manufacture of 10% of the building materials currently purchased on the global market and facilitate future sustainable construction solutions.

ACB-m Hub will allow ACB Group to optimise design with standardised, modularised, and prefabricated building components using key principles, and practices of off-site manufacturing (OSM). OSM will help ACB Group in reducing programme times, improving quality and quality control, improving health and safety on-site, and achieving sustainability goals.

Just like all other operational activities undertaken by ACB Group, the introduction of ACB-m will adhere to the lean principle of "Pursue Perfection", seeking to continuously improve the way we deliver data centres and other projects.

Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

Lean Tools Used: PDCA

The face of construction is changing rapidly with the introduction of modern methods of construction and innovative ways to deliver projects. Mission critical infrastructure is adopting a smarter way of constructing data centres, with examples of prefabricated, modular units housing client data. Through the introduction of ACB-m to the market, ACB will migrate towards industry 4.0 through prefabricating 10% of all building finishes off-site (and on-site in mobile workshops) and utilise the 'Plan-Do-Check-Act' (PDCA) framework to proposing a change to the current way ACB

Contracting (ACB-c) procure material. The PDCA checklist will act as the roadmap to transition ordering from current clients to ACB-m, thus controlling the supply chain.

Just in Time (JIT)

Within the ACB-m suite of offerings is the deployment of ACB mobile workshops to selected data centre sites throughout Ireland and Europe. The JIT system set up on site allows ACB to ship raw materials to site for fabrication when needed, to the exact specification of the building. The raw material is cut and bended

on site in line with the measurements on the BIM model, meaning elimination of waste, streamlining of install, saving time on site and ultimately a data centre delivered “right first time”. The mobile workshops also allow ACB to make final adjustments on site and leave the company open to more flexibility in face of the ever-changing landscape of the industry.

Plan-Do-Check-Act

The Business Development Manager for ACB-m devised a plan for the success of ACB-m through use of the Plan-Do-Check-Act framework. The below figure illustrates the detail of the process undertaken.

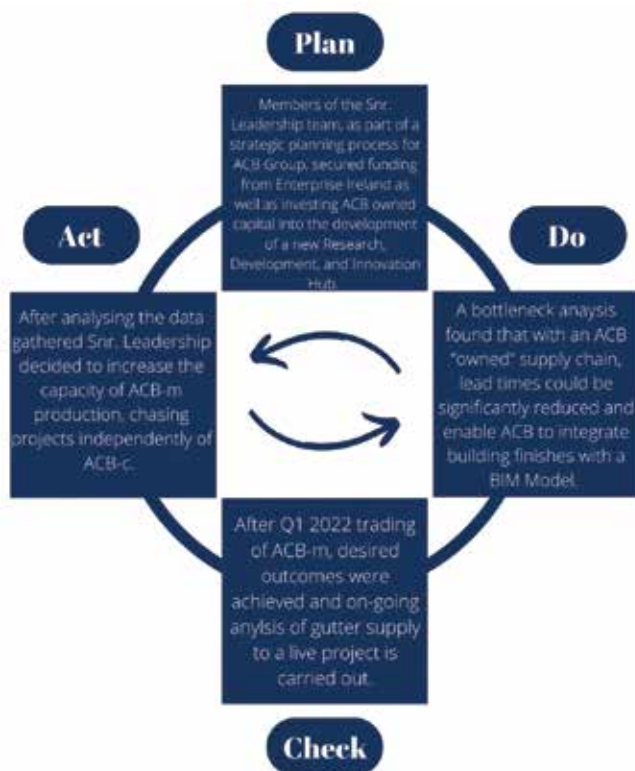


Figure 2: Framework used for ACB-m success delivery

Plan: Members of the Senior Leadership team, as part of a strategic planning process for ACB Group, secured funding from Enterprise Ireland as well as investing ACB capital into the development of a new Research, Development, and Innovation Hub. The Lean objectives are to:

1. Streamline delivery of the traditional last 10% of building finishes (flashings, gutters, louvres, roof boxes).
2. Control, manufacture and supply enabling ownership of supply chain.
3. Deliver sustainable building solutions for clients.

Do: A bottleneck analysis of the traditional workflow was conducted and it was found that in some instances, lead times were unrealistic, and deliveries to site were of the wrong dimensions or in some instances damaged. The analysis found that with an ACB “owned” supply chain, lead times could be significantly reduced and enable ACB to integrate building finishes with a BIM Model. Furthermore, ACB-m could own the delivery process, ensuring no damaged goods were delivered on-site.

Check: After the first quarter of 2022, ACB-m achieved the desired outcomes and ongoing analysis of gutter supply to a live project was carried out. It found that ACB-m could produce 50 gutters per day from the raw materials. ACB-m mobile workshop was on-site in Copenhagen, helping ACB have efficient lead times on site, supporting a JIT system for building finishes. The last mile fabrication using flat packed stock materials enabled manufacture of the final items to suit site conditions without delay or transportation and provided immediate value to all Stakeholders. This also aligned to the “measure twice, cut once” ideology of ACB-m delivering a ‘Right First Time’ project.

Act: After analysing the data gathered, the Senior Leadership Team decided to increase the capacity of ACB-m production, chasing projects independently of ACB-c, which subsequently resulted in the award of a tender for a high-tech manufacturer in Europe. ACB-m will use the tested lean principles applied to ACB-c contracts to deliver to the new client portfolio of ACB-m.

Cost-Modelling & BIM

Cost modelling is referred to as developing a model of the cost components and systems related to a specific project and structuring it in a way that can be constantly updated, either via benchmarks, metrics, or detailed estimates to provide the team with a constantly up to date cost model. The cost model should allow for a “What if?” scenario for decisions yet to be made.

Design Material Schedule (DMSL) is a shared file used by the project power team to track costs of materials, delivery dates, and variance to budget. All applicable components are shown on the DMSL to understand what is required per specific project. The cost model shared on BIM with the team allows “What-if” scenarios by using the target budgets and target procurement dates and allows teams to determine best value. DMSL displays “live” lead times, which aligns with ACB-m’s strategy of being able to own the supply chain, control lead times, and seek value engineering options comparing ACB-m OSM versus traditional suppliers. Using ACB-m rather than using external suppliers, ACB-m’s cost model allows for more detailed and accurate estimates of project delivery for stakeholders. This also allows ACB to plan projects better and offer competitive project delivery timelines.

BIM

BIM provides a federated approach and control from the start of a project to the finish. Having control through BIM allows for constant improvement, meaning that lessons can be learned on a project-by-project basis in a live environment. Collaborating with clients on BIM means that shared learnings can occur and be immediately applied through live collaboration. BIM Level 2 projects reduce time wasted through a collaborative approach to the project. ACB group delivers their projects in constant communication with their clients through the facilitation of document sharing on the software platform. BIM has enabled the use of lean principles as it works towards the principle of building projects with solid plans, on accurate timelines in the shortest time frame possible.

Using collaborative tools also eliminates waste as materials are ordered following approvals from the client and costly mistakes can be avoided. The move towards the use of integrated platforms allows ACB Group to bring the client on the whole project journey along with them, ensuring a built ‘Right First Time’ project. The use

of BIM also opens new opportunities for ACB as more and more integrated software packages can be used and data from previous projects can be collated and used for knowledge sharing in the business as well as creating a business case for more digitisation in

the build environment. ACB have built a standard set of models and documentation that allows sharing resources and materials across various projects to create efficiency within the full business and not just at project level.

Lean Initiative Improvements & Impact

From the implementation of the lean initiatives within the business, there has been significant improvements and impacts made on business processes.

Efficient order process from ACB-c to ACB-m:

ACB Group have visibility of the pipeline of orders for ACB-m, meaning that there are transparent timelines for ACB to communicate, with confidence, to clients that components will be delivered to site in time as outlined in the DMSL. This not only develops a more efficient logistics process, but also deepens the client relationships and builds brand recognition and trust. Cost modelling has effectively impacted the way ACB-m manage the process from order through to delivery on site for the client. This also feeds into the JIT system and reduces waste, as only what is needed is produced and used in the build. This is particularly evident in the set-up of the ACB mobile workshops, where materials are cut on site in these facilities therefore substantially reducing waste on site.

Ownership of Supply Chain:

The introduction of ACB-m has resulted in manufacturing core

products that are already available on the global market. The impact from the lean initiative means that ACB can reverse integrate into the ACB value chain, and in turn gives greater reliability of quality, installation, and safety to clients. With ACB-m, there can be assured lead times for clients, thereby ensuring there are no delays to program.

Integrated design with BIM:

ACB-m has been the first significant step for ACB in the journey of achieving its strategic vision. Using BIM technologies, components of the building envelope will be manufactured and assembled off-site in ACB-m and shipped in a "flatpack-style" to site, either in Ireland or Europe. BIM technology is already enabling this with ACB Group being able to utilise the existing capabilities of BIM to effectively design and install modular components such as gutters, flashings, louvres, and dog boxes at the time of writing. As the only Level 2 BIM certified roofing and cladding contractor in Ireland, ACB Group are perfectly positioned to capitalise on the industry shift to Construction 4.0, where digitisation will revolutionise the sector.

Summary and Lessons Learned

ACB Group and ACB-m specifically, have greatly benefited from implementation of lean initiatives in the way business is done as well as the brand reputation due to better delivery for clients. Lean initiatives have streamlined the supply chain for ACB group and allowed for the ACB-m arm of the business to grow and develop. As the industry is propelled to Construction 4.0, more and more initiatives are needed for companies to keep their competitive edge and win client trust and approval, which ACB are achieving through an innovative business strategy with ACB-m.

The lessons learned so far have been fast paced for ACB Group as a whole, despite initial planning using lean principles and practices. ACB-m has enabled ACB to not only service existing projects that

ACB-c are working on, but also allow new client relationships to develop. Pipeline opportunities have come to pass through ACB-m with a project secured, which will see ACB-m provide modular roof box solutions to a high-tech company in Europe.

Other high-level lessons learned include the ability to plan the manufacturing process efficiently, meaning quality and consistency are maintained while having the ability to control costs. Having a plan in place and being process orientated leads to reduced wastage of materials and resources. ACB-m aligns with the lean principles of pursuing perfection, mapping the value stream, and establishing a pull-based system in the manufacturing process.