

## Digital innovation strategy at a construction company's project business

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# Digital innovation strategy at MCC's project business<sup>1</sup>

**Eleni Papadonikolaki, Bethan Morgan and Issam El-Asbi**

## Teaching case<sup>2</sup>

### OPENING PARAGRAPHS

It was evening of July 29<sup>th</sup> in 2019. Ahmed Shalhoub, Chief Innovation Officer (CIO) at the Main Contractors Company (MCC) had just landed in Athens, Greece from San Francisco. Shalhoub had participated in a conference at Stanford University on the latest developments in digital technologies in construction and spoke about MCC's groundbreaking digital approach. He was ever-more committed to bring exciting new digital technologies to the construction industry. But a dark shadow was hanging over him, as his transformation strategy was under attack from the board.

The day before, Shalhoub got a call from the chair of the board who asked him to explain the details of his digital innovation strategy to them once again. The recent New Airport Terminal Building (NATB) in the Middle East that MCC had been awarded was the spearhead of MCC's digital innovation strategy. However, things were bleak; in a recent meeting with the MCC Chief Executive Officer (CEO) Shalhoub got yelled at: "We told you from the beginning that digitalization won't work for construction. You insisted that it is worth and now we have problems...". Shalhoub knew that he would be asked to lose or give back some of his department's achievements. He was trying to figure out what concessions to make to satisfy the board: either sacrifice resources, people or infrastructure, or digital processes.

Shalhoub was convinced that data and digital technologies could make MCC more competitive by optimizing construction, one of the most traditional industries worldwide and least digitized<sup>3</sup>. He had been granted resources for digital innovation in 2012 to support the Middle East project. That was a big success because in such a project-based business, research and development (R&D) resources are scarce and only through successful and

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<sup>2</sup> Although this teaching case is based on fieldwork, all names of companies, projects and individuals and roles are fictionalized. All permissions from involved individuals have been obtained.

<sup>3</sup> <https://www.mckinsey.com/business-functions/operations/our-insights/imagining-constructions-digital-future>

profitable projects could he negotiate for more power and independence. Now the New Airport Terminal Building was facing its own challenges that were affecting the digital innovation strategy he had developed.

## **BODY OF THE CASE**

### **Company Background**

The Main Contractors Company (MCC) has been on a journey towards digital innovation since its early background. MCC was a top construction company in the Middle East region as per the ENR list of top 250 international contractors, carrying out construction, engineering and procurement works (Exhibit 1). Founded in the early '50s, this privately held company offered commercial project management, engineering, procurement, construction services and investment activities internationally, according to Bloomberg<sup>4</sup>. MCC was among the largest construction company in the Middle East and ranked among the top 25 international contractors with a revenue of billions of USD. MCC had offices and projects in over 40 countries, and a workforce of more than 100,000 employees.

MCC is an example of a project-based firm and a significant player in the construction industry. As construction is a project-based sector, businesses in the sector develop their business models around projects, typically their only source of income. Top tier contractors in construction, such as MCC, typically rely on investing the free working capital from projects, together with other profits and loans to finance new project developments. In April 2020, MCC was engaged in 40 ongoing projects globally, including in the Middle East, Africa and East Asia from private capital and oil companies (Exhibit 2 and Exhibit 3). Some 80% of its sales were in the Middle East region<sup>5</sup> (Exhibit 4). Most projects of MCC were in mainstream construction, but they also worked on Engineering Procurement Construction (EPC) projects, which are common contracts for work on large-scale and complex infrastructure projects, such as oil and gas projects (Exhibit 5).

This temporary nature of projects, results in fragmentation in resources, social capital, knowledge and finances for R&D and innovation. Innovation is typically of secondary importance in the construction sector and often takes place through scarce budgets put aside by organisations from profit margins accumulated by projects. Very few projects have a dedicated innovation budget, depending on how innovative the client is. However, the interdisciplinarity of projects offers a fertile ground for experimentation, creativity and innovation.

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<sup>4</sup> <https://www.bloomberg.com/profile/company/0835047D:GA>

<sup>5</sup> [https://en.wikipedia.org/wiki/Consolidated\\_Contractors\\_Company](https://en.wikipedia.org/wiki/Consolidated_Contractors_Company)

The company has been a pioneer in digital innovation since 2012, focusing on optimizing construction, one of the least digitized industries worldwide. As a Chief Innovation Officer (CIO), Shalhoub was always tuned to the latest developments in digital technologies and always keen to bring new ideas to the company and test them. With his background in the early stages of digitalisation in construction in the 1990s and his important position in MCC, he could always negotiate with the leadership team as a champion for digital change. Shalhoub's belief in the potential of data and digital technologies to enhance MCC's competitiveness led to the allocation of resources for digital innovation in 2012, supporting the Middle East project. MCC invested various types of resources in been an innovative company, as early on, the directors saw the benefits of digital technologies in dealing with changes in design. "We needed a better way to manage change in projects. For every small change we needed to recalculate everything again" said Shalhoub explaining how MCC became an innovator and invested in digital tools.

### **Digital innovation in project environments**

Digital innovation in project-based industries such as the construction sector is distinctive. The construction sector shapes the built environment and surrounds all aspects of our life, work and recreation. The sector is one of the largest in the world economy. Construction forms consistently 7-11% of Gross Capital Product (GDP) in national economies globally. However, while other sectors, from retail to manufacturing, have transformed their efficiency, boosted their productivity, and embraced the digital age, construction still under-performs. The sector's poor performance is attributed to extensive regulation, dependence on public-sector demand, fragmentation, mismatches in risk allocations and rewards, poor project management, insufficient skills, and under-investment in Research and Development (R&D) and innovation.

For McKinsey, a major cause of this poor performance is because the sector is extensively regulated, is dependent on public-sector demand and is highly fragmented. Contracts had mismatches in risk allocations and rewards, and hence poor project management, insufficient skills and under-investment in R&D and innovation. McKinsey<sup>6</sup> identified seven ways to tackle the root causes of construction's poor productivity:

1. Reshape regulation and raise transparency;
2. Rewire the contractual framework;
3. Rethink design and engineering processes;

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<sup>6</sup> McKinsey Global institute report: "Reinventing construction through a productivity revolution", published in February 2017, p. 64, available at: <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/reinventing-construction-through-a-productivity-revolution> (Accessed April 2020).

4. Improve procurement and supply chain management;
5. Improve on-site execution;
6. Infuse digital technology, new materials, and advanced automation;
7. Reskill the workforce.

As the construction industry worldwide undergoes a transition from traditional and paper-based towards adopting digitalisation, there have been various efforts to induce change in the sector and push digital methods. Across various countries worldwide, such efforts come from clients and owners of built assets. For example, in the United States of America (USA), the use of intelligent building design methods, whose benefits would spill over to the asset maintenance started as early as 2007. Other countries followed this approach as well. This includes the United Kingdom (UK) where the public sector accounts for around 40% of the construction market and is the largest construction client. In 2011, the UK government set a task group and announced the mandated use of digital tools, such as Building Information Modelling (BIM) in all public projects from 2016<sup>7</sup>. Later the UK government developed the BIM Framework<sup>8</sup> to direct and assist the industry in both domestic and international markets to adopt the International Organization for Standardization (ISO) 19650 series, addressing a broader spectrum of information management.

A wealth of data can be generated, managed and shared through BIM applications, an ecosystem of digital platforms that had been gaining traction worldwide since early 2000. In many countries, such as the UK, the use of BIM in public sector projects has been mandated since spring 2016<sup>9</sup>. Although MCC was active in the Middle- East and not the UK, this trend was followed by many countries. While MCC does not typically working on public projects (Exhibit 2), they were aware of the developments and always wanted to be one step ahead. As opposed to the laggards who reactively addressed such mandates, MCC went beyond the mandated requirements for digital construction and investigated how to make the most of the opportunities that digital transformation brings to shape its digital journey.

The global trend of digital transformation across different sectors and also in the construction sector, includes the use of Building Information Modelling (BIM), a three-dimensional approach in designing built assets that uses and organizes a variety of data across various

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<sup>7</sup> Government Construction Client Group: BIM Working Party Strategy Paper, 2011:<https://www.cdbb.cam.ac.uk/Resources/ResoucePublications/BISBIMstrategyReport.pdf> Accessed January 2021).

<sup>8</sup> The UK BIM Framework is an overarching approach to implementing Building Information Modelling (BIM) in the UK: <https://ukbimframework.org/faq/> (Accessed April 2020).

<sup>9</sup> The UK Government Construction Strategy was published in May 2011 and publicly launched by the Cabinet Office, in July 2011: <https://www.gov.uk/government/publications/government-construction-strategy> (Accessed April 2020).

project lifecycle phases. Despite the industry's slow adoption of digital technologies, MCC has been an early adopter, investing in digital tools to become more efficient from early 2000s. The company's extensive experience in developing and using digitization workflows to share data and optimize their processes and projects has been a significant advantage.

In recent years, advanced digital technologies and data-driven analytics had started to become increasingly important in improving construction. Being early pioneers in this field, MCC developed capabilities in using digital tools and construction data smartly to become more efficient. MCC brought their extensive experience of 22 years in developing and using digitisation workflows to share data and optimise their processes and projects. This data was shared through Common data environments (CDE), digital platforms for storing, sharing and managing data generated by commercial BIM solutions.

### **Strategizing for innovation in a Project-Based Business**

In June 2019, MCC completed the New Airport Terminal Building (NATB) in the Middle East (Exhibit 6). In a Joint Venture with the Middle East Airports Company (MECA), MCC led in the digitalisation of the project. This landmark transportation project consisted of the construction of a terminal building with a capacity of 27 million passengers per year and a very complex form (Exhibit 7 and Exhibit 8). This terminal building had a massive scale, could accommodate 106 aircrafts, serve 8,500 passengers per hour, and 19,000 packages per hour. The baggage handling system, conveyer belt length was at the time of writing about 27 kilometres (Exhibit 7). Hanin Al-Zubi, was one of Shalhoub's mentees at MCC. Shalhoub had given the upper hand to Al-Zubi to act as an internal consultant at MCC and open the so-called BIM Centres integrated into MCC's strategy (Exhibit 9). In 1997, MCC completed their first BIM-based estimation project. This was a turning point for their digital approach and the development of digital evangelists such as Al-Zubi.

Al-Zubi's role in MCC was to manage the three BIM Centres in MCC in Europe, (the first one created) and two more in Egypt and Palestine. MCC was proud of their three BIM Centres in three different continents. He would also overview and supervise the implementation of digital technologies such as BIM in various projects concurrently and offer various digital services (Exhibit 10). Apart from the BIM Centres, Al-Zubi was the managing director of the BIM Academy, the educational arm of MCC. As Al-Zubi, explained: *"We were about to be awarded this project, and this is a huge, 8-year project, that was required to be delivered using BIM. Back in 2009, we could not find in the market orresources to answer our requirements and demands. The market did not have proper educated resources. We had to develop our own resources."*

Before bidding for the NATB project, MCC knew that as BIM was a contractual requirement for the client, they had to be very proficient in digital technologies and their competitive advantage in working from 1997 with these methods was invaluable. *“Actually, one of the reasons we were selected in that project, technically because of our capabilities with BIM, because we were the only contractor who had such BIM capabilities back in 2012 when the tender was open”* Al-Zubi stated. After winning this bid, MCC worked for 6 months to create their BIM Academy, which was ready 8 months before the start of the NATB project. They started teaching 40 engineers in the digital methods and workflows and continued during the project, when 204 engineers were trained.

Apart from their internal people, MCC was training their partners and collaborators in the NATB project. As the project was massive, MCC entered in the Joint Venture (JV) with 2 other companies. MCC was leading this initiative as they were the most experienced party in digital technologies in the JV. However, when the project started, MCC started to recruit subcontractors and vendors, and they realised that at that time only 2 out of 120 companies could really answer the client requirements. Al-Zubi stated: *“We educated them, and they managed to deliver the work. Some of them we had to sit with them for days and days to show them the process, and to write with them data exchange policies. Some of them we had to do all the work on their behalf.”*

MCC developed its digital innovation strategy to become a leader in the global market of digital construction and used the New Airport Terminal Building (NATB) in The Middle East as a vessel to unveil and test their digital innovation strategy. As a system integrator, MCC helped to upskill the entire supply chain and deliver the New Airport Terminal Building in the Middle East using digital technologies, without which it would have been impossible. Sarah Hamadani, Project Manager of the New Airport Terminal Building in the Middle East, stated: *“We don’t know how we would ever build this project without BIM.”* Like Shalhoub and Al-Zubi, Hamadani was passionate with digital technology, and believed that it was core for fast decision-making and knowledge-driven operation.

MCC took a risk in bidding for such a complex project. According to Hamadani, they managed to deliver because of the support from Shalhoub who drove a very clear strategy, including education, preparing resources, providing expertise, and educating the supply chain, so that everybody would be in total sync, in spite of the massive size of the project. After winning the bid, MCC started working on the NATB smoothly *“thanks to Al-Zubi who took an early decision to build the digital model six months earlier before the award, a high-risk decision to build a model of \$2.5m before even getting the award”* reflected Hamadani. After that they laser-scanned the whole site and consolidated the 3D point-cloud information

with the ready model (Exhibit 11). Hamadani continued: *“This gave us a kind of readiness of knowing how to build our early logistic plan, how to build a true reliable baseline schedule on true quantities and true figures that will give you the right key performance index to measure your progress.”*

## **A resilient digital innovation strategy**

Shalhoub, chief innovation officer (CIO) at MCC was trained as a civil engineer. As opposed to most of his fellow students, who quickly entered the job market, he chose to do further studies in the USA. He was thirsty for knowledge and was eager to keep learning. There he met his mentor and dissertation supervisor at Stanford University, Raymond Levitt, Kumagai Professor in the School of Engineering. Thirty years ago, in the '90s, Shalhoub, a civil engineering graduate, studied under Levitt on information technology (IT) modelling applications in the construction site. After his time in the USA, Shalhoub was only rising in the hierarchy of MCC, from graduate engineer, to site engineer, to project manager, to Head of IT and most recently CIO. In the USA, Shalhoub was influenced by value chain thinking, the manufacturing sector and operations improvement.

MCC's digital innovation strategy was resilient, driven by Shalhoub's leadership and vision. Influenced by value chain thinking, the manufacturing sector, and operations improvement, Shalhoub developed a strategy that included investment in BIM Centres, in-house applications, and state-of-the-art systems. The strategy emphasized integration between different functions, systems, and workflows on construction sites.

MCC's digital innovation strategy is exemplified in the NATB project. The project's complexity and scale necessitated extensive use of digital technologies, including BIM. MCC's experience in digital methods was invaluable in winning the bid and executing the project. The company established 'BIM Centres' around the world and a 'BIM Academy' to train engineers in digital methods. They also educated their partners and collaborators, ensuring that the entire supply chain was aligned with their digital approach.

Shalhoub's leadership and vision were central to MCC's digital innovation strategy. Influenced by value chain thinking and manufacturing, he developed a strategy that included investment in BIM Centres, in-house applications, and state-of-the-art systems. The strategy emphasized integration between different functions, systems, and workflows on construction sites.

During the transition to digital ways of working, MCC's Chief Innovation Officer (CIO), Mr Shalhoub developed a digital innovation strategy. According to Hamadani: *“We spent a long time investing in our BIM capabilities and BIM strategies, starting with, of course,*

*computerisation. When I say computerisation, I am including networking, robust networking, in-house application, fetching the latest market capabilities, and then drilling such new workflows, policies and procedures to the whole organisation, which is what we've tried to do actually since 1998. Showing the benefits as a cost, as time saving, as quality."*

The digital strategy included investment in state-of-the-art hubs of knowledge in the form of BIM Centres, where their expertise in Building Information Modelling (BIM) – a key digital technology in construction sector – was shared internally in the company and externally. The MCC BIM Centres have accumulated extensive experience and skills in the field of BIM and the relevant digital technologies. Through these hubs they manage to continuously innovate and be at the forefront of the industry. For Al-Zubi, Shalhoub's protégé, digital tools such as BIM are not just pretty 3-dimensional (3D) digital models: *"it is all the integration between the different functions, different systems, different workflows on a construction site with the model, with the scope generated from the model."* Apart from training for MCC staff and their supply chains partners, the BIM Centres were at the forefront of MCC's R&D, and were pushing the boundaries of existing digital applications and workflows.

In terms of investment in resources, MCC developed their own state-of-the-art systems where readily available commercial solutions did not meet their requirements. This document interface management system was designed based on MCC's business rules and their daily fashion of construction. Hamadani shared: *"We built a complete in-house application, which is basically a document interface management system that connects to the digital 3D models, where I can monitor various building elements and associated through every change either happening on design or construction, let's say up to construction. I received on daily basis tons of changes that exceeded 3,000 or 7,000 drawings."*

Hamadani's daily routine as a manager of the digital information in the NATB project, was that with the help of this automated system, she could leave the information to be consolidated from all different departments and partners overnight and then she and the BIM team received back the changes report in less than 24 hours. The changes were highlighted with red, green or grey depending on their importance. Afterwards, as a manager of the process, she had to monitor all the changes, decide on what the important elements to focus on were, quantify the changes and report it to the other departments if needed. These systems helped make informed decisions and also were a basis for communication with other collaborators.

Due to the enormous scale of the NATB project, this system gave the team visibility to the project. There were more than 2.5bn different elements that were completely tagged and thoroughly monitored, starting from the design, going through the procurement, up to

execution, and until the handover. Apart for the digital models that helped to visualise and design the work to be implemented on site, MCC also focused on creating a system to monitor the construction site, as it started to be developed. According to Hamadani: *“We built a complete BIM driven system to monitor disruption on site, any kind of disruption, coming either from design, environmental or whatever, and to scale it on a digital dashboard that was connected to our BIM models.”*

The connection between the construction site and the digital models was made possible through sensors and actuators of the Internet of Things (IoT). IoT devices expand internet connectivity beyond the usual standard devices like computers, laptops, smartphones etc. that can be used on the construction site. Instead, other devices such as smart fire alarms, smart locks and smart security system can communicate or interact over the internet smoothly and also be controlled remotely and wirelessly provide information about parts of the construction site using technologies such as low energy wireless and Bluetooth and Near-Field-Communication (NFC) protocol, as well as older technologies such as Radio Frequency Identification (RFID). These systems allowed every site engineer involved in this complex part to be quickly in a position to check whether the digital models comply with the construction on site model. At the same time, they used less sophisticated technologies such as Quick Response (QR) codes and included them in every, maintainable asset on site, that allowed the facility management team to have quick access to any kind of information regarding those erected assets to track and defects or liabilities.

With their robust network and their in-house document management applications, MCC had a smooth transition to the NATB project. Apart from their internal system, they created the e-Room – reminiscent of the concept of e-business or electronic business – to achieve a greater level of visibility and transparency within the BIM environment, by opening it up to the rest of the JV partners and collaborators through a common environment. Aligning to international standards such as the Industry Foundation Classes (IFC) and Digital Ground Model (DGM) standards was a priority for the e-Room platform as for each of MCC’s 65 different joint subcontractors, they had to communicate in a different Electronic Data Interchange (EDI) manner. Hamadani explained: *“Like every subcontractor, they had their own booklet, kind of abbreviation and levels of detail. We gave them a kind of space to use any kind of platform they wanted and then we assembled within international standard formats to consolidate their models.”*

This digital platform provided a basis for communication and negotiation among all these partners. Hamadani recalled: *“We were obliged to have a kind of centralised database to manage all that amount of knowledge and information, either static or dynamic coming from*

site, or coming from the designer in one port that is accessible to over 65 different joint subcontractors, over than 35 different consultants spread all over the world, and over than 170 vendors.” And she continued: *“But what happened actually, with the common environment platform and the model, with our technical reviews, we have discovered a lot of design errors, a lot of clashes, a lot of nonsense, let’s say, setup that forced the designer to continue with further changes, plus, of course, the market change and the client. The client got further ambitious and raised his demands asking for more and more changes to the original brief.”*

The e-Room as a digital platform provided also a basis for more digital technologies to connect upon and share data and information not only within the NATB project but also outside, e.g., by connecting to digital libraries. Eventually this even encouraged them to be wider and more ambitious to further develop and enhance their work style. By further standardisation, further flexible logistics and more modularisation, MCC also integrated their digital procurement system. E-Proc, MCC’s electronic procurement system was used to reinforce their local supply chain instead of facing such delays in importing overseas material, or fabricated parts from abroad.

The numerous contractors and sub-contractors involved created a challenge into addressing the nature of the work in a digital approach. While everyone agreed that digital delivery was the best way forward, it was hard to satisfy all different types of partners each with their different capabilities. Al-Zubi explained the contractual side of MCC’s digital strategy: *“We came up with a contract that consists of three main requirements. First of all, if they were capable in delivering information as per the quality procedure, following the digital delivery process, then there was no contractual obligation. If they were not digitally capable, then they had a contractual obligation to fill this requirement in three ways. They had to either consult one of MCC’s preferred suppliers for BIM and digital services. Or MCC would teach them in the BIM Centres for a period of time agreed in advance, or they would pay MCC to deliver digitally on their behalf”.*

MCC also invested in sharing knowledge with their project collaborators through human-computer co-location in the form of the i-Room or War Room (Exhibit 12). The War Room was inspired by NASA’s control room<sup>10</sup>, that would help bring together the multi-cultural and geographically dispersed team of the NATB project. The War Room as a human-computer co-location that helped the team to innovate, identify bottlenecks, negotiate solutions and meet project goals. Al-Zubi recalled: *“In the construction process, there is really a tremendous amount of time wasted in solving problems. So, we came up with a creative*

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<sup>10</sup> [https://en.wikipedia.org/wiki/Control\\_room](https://en.wikipedia.org/wiki/Control_room)

*idea at that time create this i-Room where people can sit together, visualise in a nice way the issues and the problems. This is very common now, but back then it was a novel and creative idea.”* All the stakeholders, subcontractors, contractors, designers and clients sometimes would sit in the same room and not leave until most of the issues, or at least the big issues, were solved. This helped MCC reduce their project review cycle from 28 days to seven days or sometimes two days.

Apart from timely decision-making, the War Room changed the culture of how people working in projects deal with mistakes and errors, which had been typically through litigation. The War Room created a more visual and transparent culture to encourage and invite people from all over the world, to sit on the same space on the same table with interactive computers, consolidating their problems. *“Inviting various specialists and decision-makers to take on-the-spot decisions is counter-intuitive but with the War Room it worked well as they had full insight on any event with the related capsules of knowledge, to take an instant decision”* explained Hamadani and continued that now people did not have to point fingers anymore. Hamadani continued how this has changed the culture *“On a daily basis it was always the black hole waiting for you at the corner, with a hell of challenges. But with the digital opportunities we took, of course we learned, and we are still learning. We learned how to talk to the engineering department, their language and how they practically think. Also, how to talk to people on the site, to the procurers even the top management.”*

The NATB project's complexity and scale required extensive use of digital technologies, including BIM. MCC's experience in digital methods was invaluable in winning the bid and executing the project. As MCC trained their engineers and partners in digital methods, this was a conscious strategy in investing in innovation resources, processes and capabilities that extended beyond the NATB project boundaries.

## **CONCLUSION**

MCC's digital innovation strategy provides an example of how a project-based firm in a traditional industry like construction can embrace digital technologies to enhance efficiency, quality, and competitiveness. This also illustrates the importance of business acumen, leadership, strategy, investment in technology, training, and a clear vision in driving digital transformation. It also underscores the challenges and complexities of implementing such a strategy in a fragmented and often resistant industry. Despite the successes, MCC's digital innovation strategy faced challenges. The board's skepticism and the industry's slow adoption of digital technologies posed risks. Despite MCC's innovation strategy, there were daily challenges in managing digital information in large-scale projects like the NATB. To this end, the dilemma of Shalhoub been asked by the board to make concessions in the

innovation strategy since the NATB project was struggling with various emerging uncertainties and MCC was losing money had important implications for MCC's future business. The construction sector is project-based, with businesses developing their models around projects, typically their only source of income. This temporary nature of projects results in fragmentation in resources, social capital, knowledge, and finances for R&D and innovation. However, MCC invested various types of resources in being an innovative company, recognizing the benefits of digital technologies in managing changes in design.

The morning of July 30<sup>th</sup> 2019, Shalhoub entered the large meeting room overlooking the Kifissia's Ring-Road, the busiest intersection of North Athens to meet with the board. He could not sleep the previous night, knowing that he would be asked to lose or give back some of his department's resources, but he had spent the last weeks preparing by discussing with his closest colleagues like Al-Zubi and Hamadani and his digital innovation team. Together, they explored different scenarios of how to adjust the digital strategy by sacrificing their key resources or processes. Given that MCC had developed mature digital capabilities over the last few years and mainly due to the NATB project that trained and created the bedrock of digitalisation in MCC, he decided with a heavy heart to let some of his people be redeployed in the company. MCC was ready for the change as he had created all the necessary capabilities by combining their skills, processes, technologies and human capital to differentiate MCC. And he knew that he could do it again with new people when the times would be more welcoming for innovation investment. Shalhoub explained:

*“Actually, I believe in the coming generation. The coming generation are so aggressive, so hyper, so intelligent, and they are more than ready.”*

## **DISCUSSION QUESTIONS**

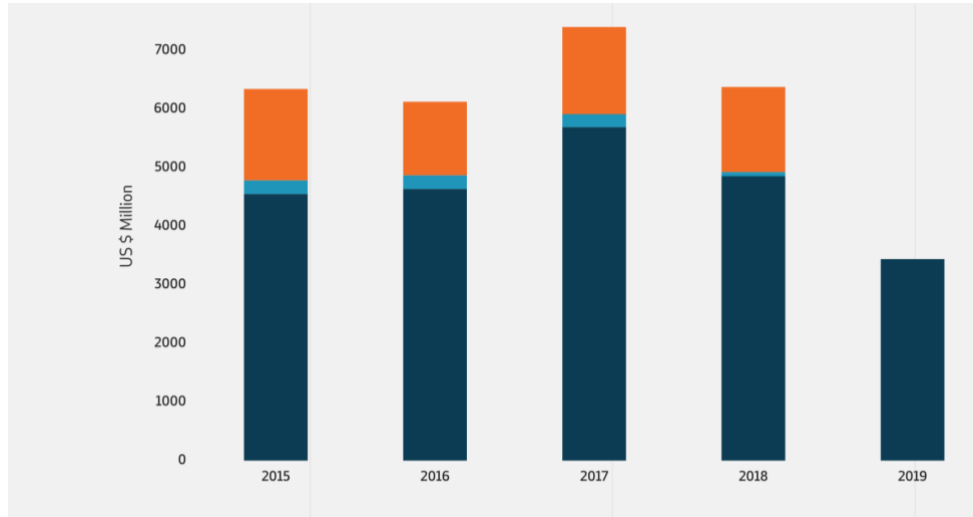
1. What are the differences between innovation in a firm that is project-based such as MCC and from other service or product development firms?
2. How does MCC's explore and exploit digital innovations?
3. What are the challenges of Shalhoub's digital innovation strategy developed in the NATB project and MCC's business strategy?
4. What were the MCC's digital innovation strategy, based on key elements of a (digital) innovation strategy, namely: (a) resources for innovation, (b) innovation processes and (c) innovative capabilities?
5. Do you agree with Shalhoub concessions decision and why?

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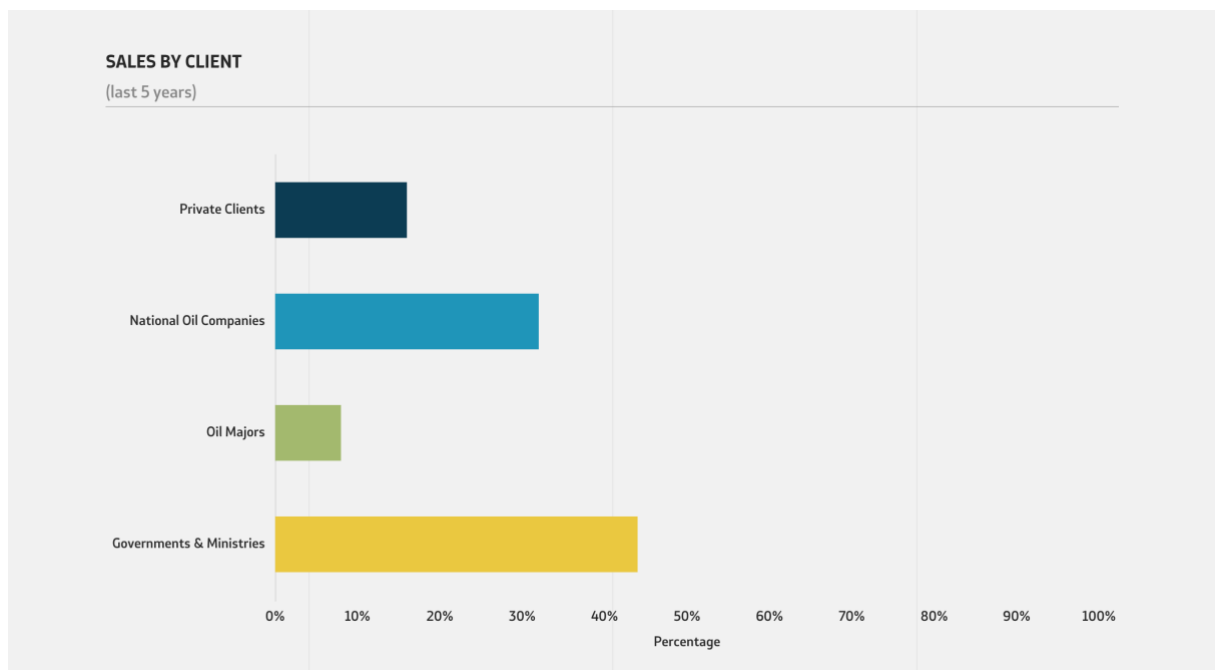
# APPENDIX

## Exhibit 1



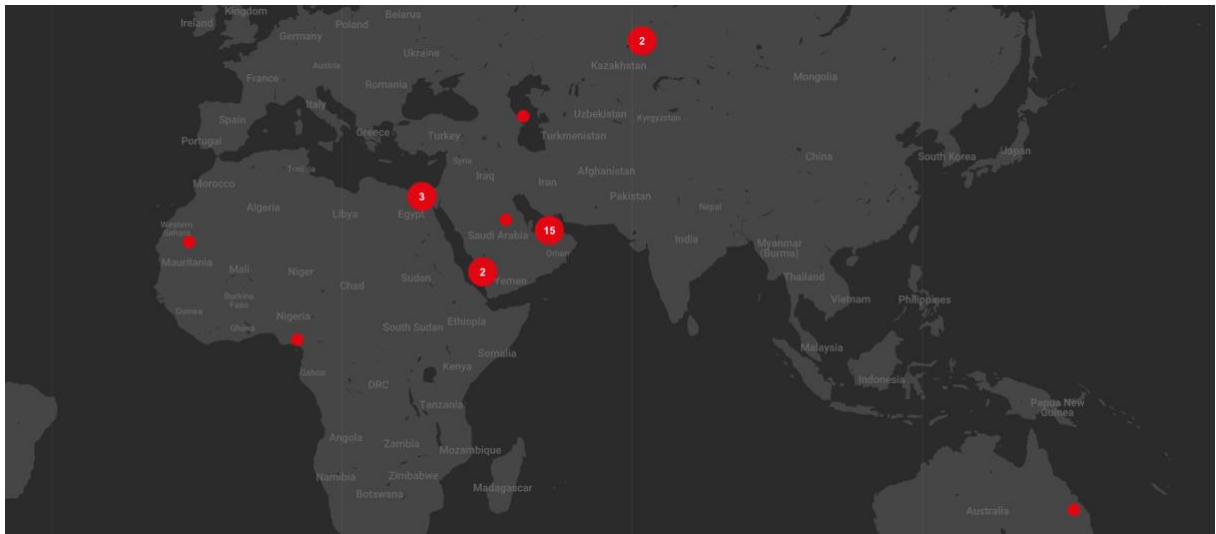
Total revenue of MCC (Source: MCC)

## Exhibit 2



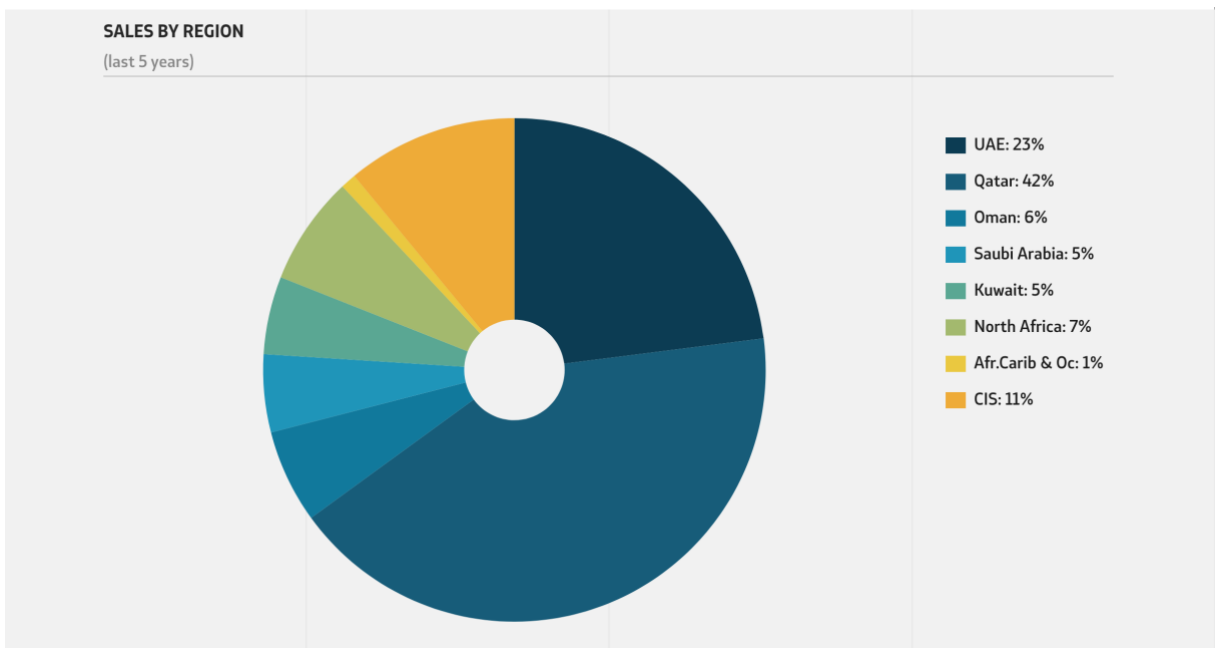
Sales of MCC by type of client (Source: MCC)

### Exhibit 3



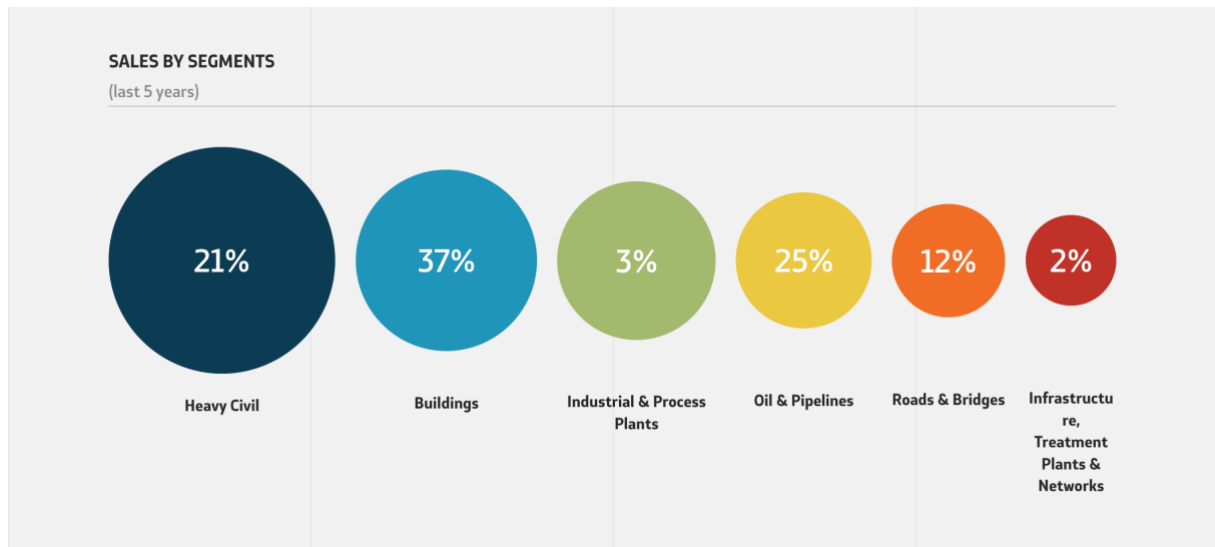
Major projects of MCC around the world (Source: MCC)

### Exhibit 4



Sales of MCC per country (Source: MCC)

## Exhibit 5



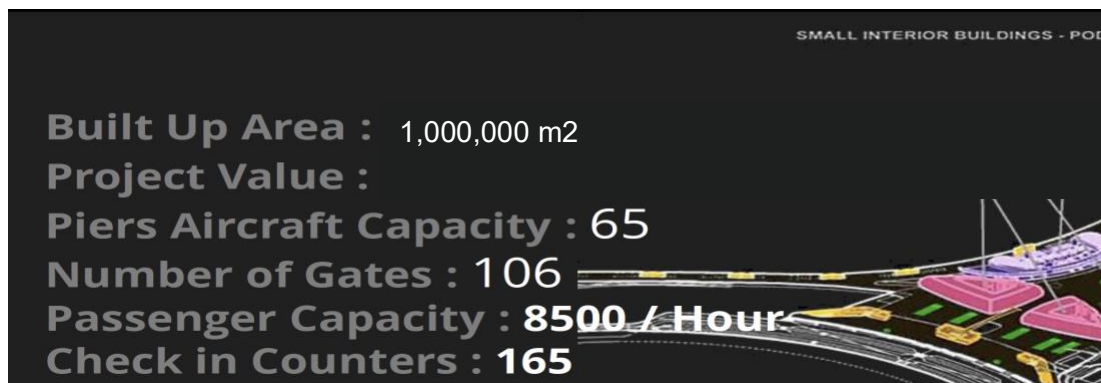
Types of projects undertaken by MCC (Source: MCC)

## Exhibit 6



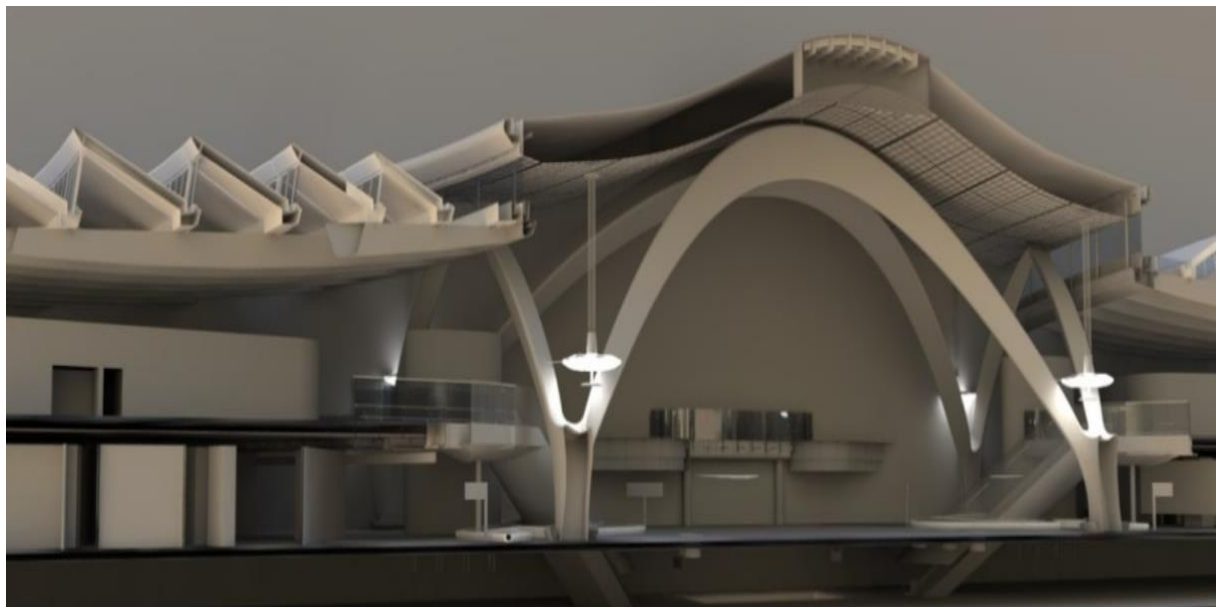
Overview of the New Middle East International Airport-New Airport Terminal Building  
(Source: MCC)

## Exhibit 7



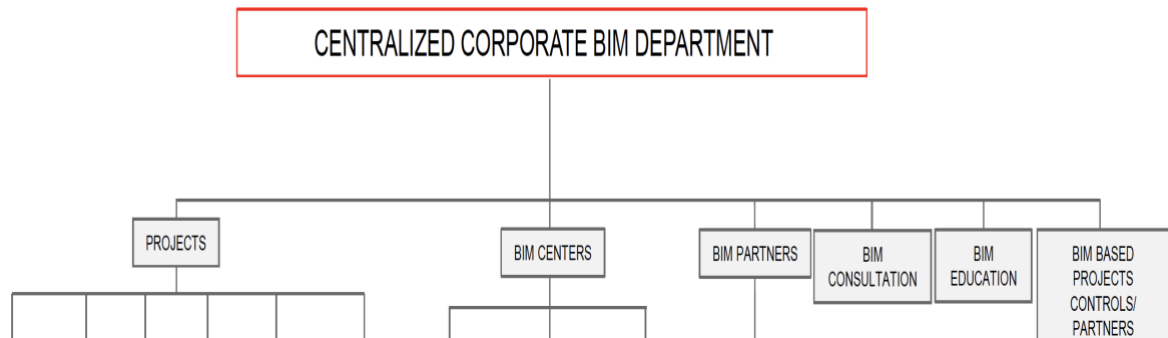
Basic information about the New Airport Terminal Building (NATB) project (Source: MCC)

## Exhibit 8



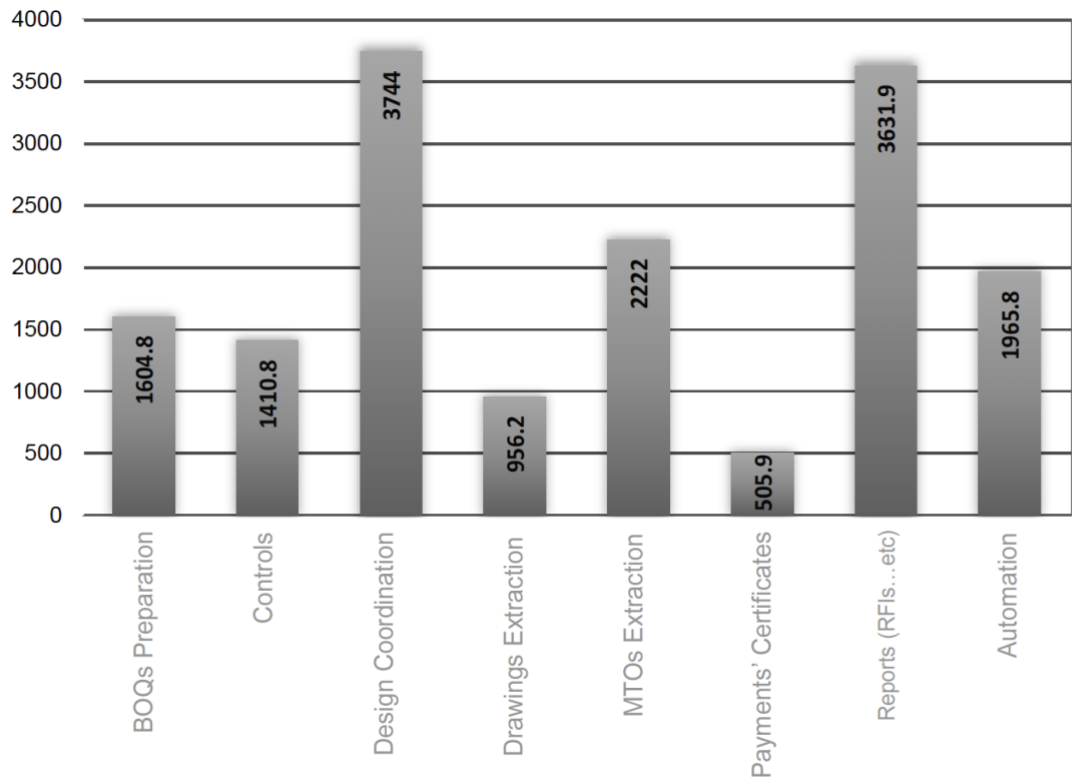
Close up of the The Middle East International Airport-New Airport Terminal Building gates (Source: MCC)

### Exhibit 9



Organogram of digital/BIM department (Source: MCC)

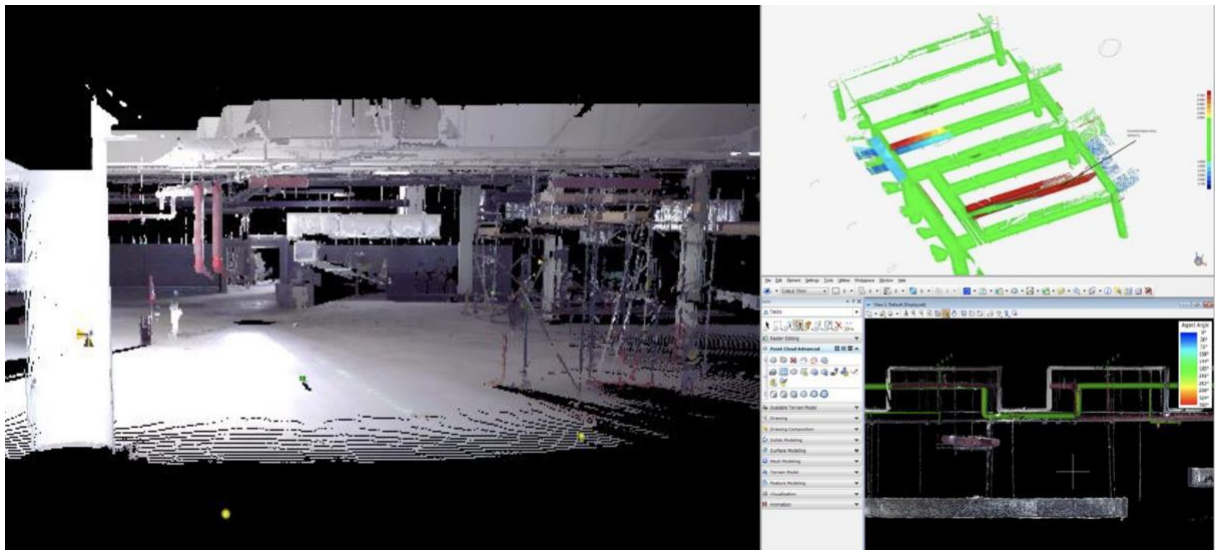
### Exhibit 10



**BIM hours allocation over services (Total 16098 hrs)**

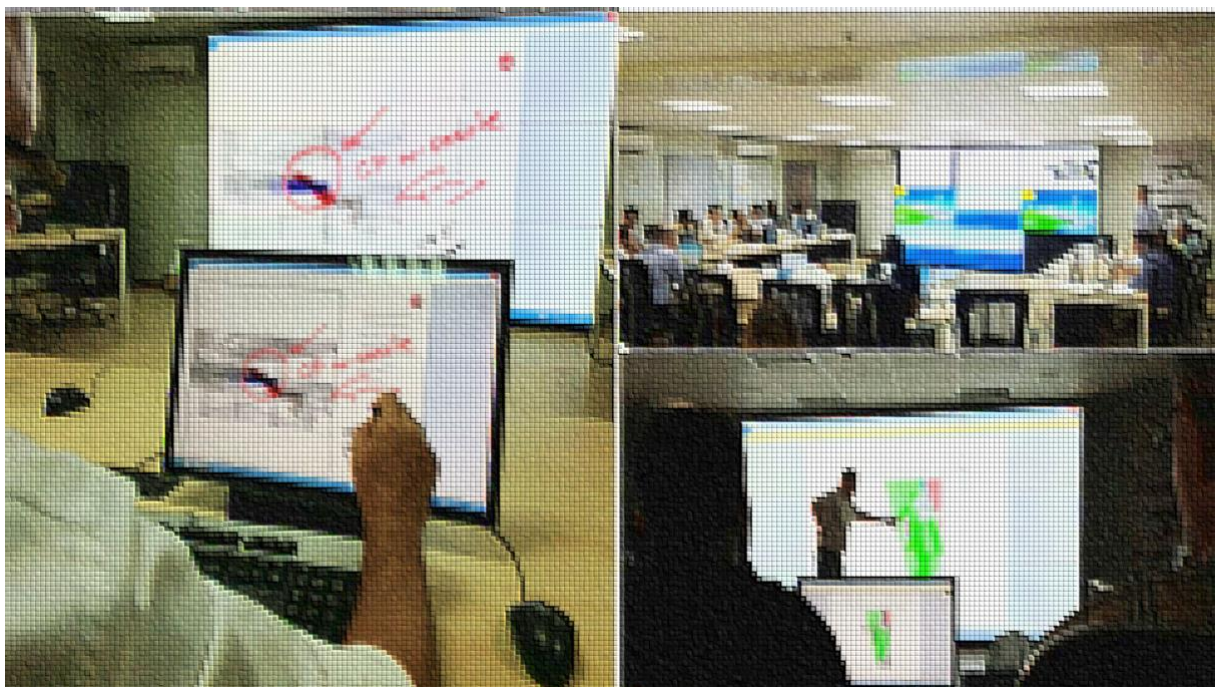
Types of services from the digital/BIM department (Source: MCC)

## Exhibit 11



Laser-scanning and colour-coding of deviations from design for as-built information (Source: MCC)

## Exhibit 12



Aspect and functionality of the i-Room in the New Airport Terminal Building (Source: MCC)

