

Module, ACPA7005
Introduction to innovation management
Assessment B
Tim Hunt
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This essay is a review of the innovation that took place to create what is now known as BMW Plant Oxford. Located in Cowley, Plant Oxford is the UK manufacturing centre for MINI. It was awarded Smart Factory of the year 2018 in The Manufacturer Manufacturing Excellence awards (MX). The first part of this review covers the drivers for the innovation, risks and barriers, determinants, processes and technology, reliance on external sources. Then I have expressed my own opinion as to the good practice of the development. With the final section critiquing the whole innovation process at Plant Oxford.

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Executive summary

In summary the development of the Plant Oxford had two key drivers; it was an old site in need of much development, the production of a new product and the need to future proof the manufacturing process. The risks experienced by the project, in short, were costs, the age of the infrastructure and the workforce reaction. The determinants that lead to the success of Plant Oxford are, the heritage of the Mini brand, the innovative workforce, and financial assistance from the government. The processes and technology used at Plant Oxford are, software based optimisation, robotic automation, collaborative robots, camera based quality checks and continuous improvement. With external resources required to achieve the development being software developers (Siemens), robotics manufacturers (ABB), camera manufacturers (Precepton), and operative based scanners (Proglow). Management overview of the project was good, with staff members moved to the correct geographical locations for the tasks they were assigned. This review has found the innovation practices to be good, through the selection of the project, site, and its subsequent innovative development. Finally there is a critique of the innovation through the use of toolkits from Goffin and Trott. Which highlight the areas of the initial and continued success of Plant Oxford.

Principle Drivers

There are several principle drivers that could be found from the desk based research that was conducted for this review. Firstly the Cowley site was in need of update, it had grown a reputation for being inefficient *'Cowley used to be a byword for the inefficiency of the UK motor industry, a factory plagued by creaking infrastructure and stuttering output.'*(Foy, 2014). Making it a clear choice for innovative investment. The team implementing the install had only a third of the time normally given to this type of work. Thus creating an additional driver for the innovative approach required to get the factory up and running.

The legacy of the traditional mini, which enjoyed 41 years of production, was that the cars were cherished family members. With a huge range of personalisation taking place. This needed to be

captured in the new MINI, resulting in a production line that needed to allow for a huge number of product variations.

Plant Oxford also needed to be future proof, machines, robots, layout and logistics all needed an innovative approach to ensure it could meet the expected demand for the new cars. Which were a divergent product for BMW. It was their opportunity to move into a new market segment, targeting younger customers, creating a playful brand image. A very different approach to that of the traditional BMW market.

Barriers and risks

A primary risk to almost every innovation is cost. BMW had planned to start production at a different site (Longbridge), where the original Minis had be manufactured. However *'All that changed when then chancellor Gordon Brown refused to grant BMW a relatively modest amount of aid to assist with the modernisation of Longbridge'* (Bremner 2019). This alone could have been the end of the project.

This resulted in the change to the Cowley site. The age and layout of the infrastructure at Cowley presented many issues, the MINI production line had been designed and tested for Longbridge. Thus giving the team at Cowley several barriers to over come in achieving the implementation of the production line. *'It was a real challenge. The line went up, down and around,' he says of the snake-like path it took'*(Bremner 2019).

These physical barriers were combined with organisational struggles. BMW were managing the implementation of the project, with teams of staff being flown regularly between the UK and Germany. Which will have caused barriers and friction points in the project through communication, and leadership difficulties. The cultural differences between the German parent company and the UK workforce will have been an additional barrier to the success of the project.

Key determinants

BMW were able to secure tax breaks and financial support for production at Cowley, clearly helping to relieve the pressure from the barriers experienced at Longbridge. The Cowley site is also geographically well placed for links to suppliers, with a rich history of automotive manufacturing.

Additionally the workforce at Cowley were highly experienced and knowledgeable being part of the BMW group producing Rover products. Reducing the potential training burden that is experienced with any innovation. And proving to be invaluable through achieving a full factory refit in only 9 months.

Mini has a strong brand heritage in the UK, the continuation of which was a further determinant for the project, as the workforce involved would become part of the legacy for the MINI.

Process and technology

Plant Oxford deals with the final assembly of the MINI. With sub assembly and engine manufacture being completed by Plant Swindon and Hams Hall respectively. The process at Plant Oxford begins with Body in White. Where 1000 robots *'are arranged around three-framing stages rather than the usual two, this body assembly method allowing a greater variety of body styles than was previously feasible'*. (Automotive council UK, 2013) These robots are responsible for welding together over 400 panels that make up the three model variations that are produced at Plan Oxford.

After the body has been assembled it moves into the Paint Shop which uses Integrated paint process (IPP). Through the use of charged particles, water-based paints and removal of the oven stage the IPP has reduced the emissions from the Paint shop by over 10%.

Next the cars move into the assembly shop, where a combination of Humans, robots and collaborative robots (cobots) are used. This enables highly efficient production, 1000 personalised cars per day. The robots here are deployed in the movement of parts in the just in time (JIT) managed system that ensures the correct items arrive for the car being assembled. The cobots

are used to aid the humans in the repeated tasks that are part of production. '*Working alongside and in parallel with a human operative, the RITA cobot rivets together three components for the car's crumple zone pre-assembly.*' (The Manufacturer, 2018). The human workforce are completing tasks that are complex or require constant reasoning to ensure the task is completed.

After assembly and painting is complete every car must pass quality control, which includes the 3D scanning of over 500 datum points to an accuracy of 0.005mm. Whilst ensuring the product quality, this also provides an invaluable source of data for review of production stages and calibration. Which forms the award winning industry 4.0 approach.

Plant Oxford could not operate without substantial planning and logistics this is in part managed by the SIMATIC IT Preactor software. Which manages the flow of materials and parts in all areas of the plant to allow for the flexibility required whilst ensuring the efficiency and quality needed for the MINI product.

External sources

BMW are a car manufacturer not a software developer, so they turned to Siemens when developing the SIMATIC IT Preactor software that enables Plant Oxford to operate in an optimal manner, minimising down-time, without the detriment to flexibility or quality.

There are several different makes of robots deployed at Plant Oxford, all of which are from external sources. For example ABB is a worldwide supplier of robotics, for many different industry sectors. Without these robots the innovative approach to manufacturing at Plant Oxford would not be possible.

The quality control area of Plant Oxford has heavy reliance on Precetron cameras for measurement and reviewing of the completed products. With the volume of production that is required it would not be possible to achieve the inspections required in the time given without the use of cameras and software analysis.

Proglow scanners are used by the associates on the assembly line to identify the product they are working on, ensuring the correct parts or processes are completed at that station. With the lean manufacturing, and agile management of Plant Oxford these small devices are vital. In addition there are links with academic institutions such as Oxford Brookes and Warwick. For research and development activity in the automation and control systems required in the plant.

Therefore in the development of the innovative production line at Plant Oxford a number of external resources and partnerships were required to achieve the Smart factory that we can see today. These partnerships continue today as the external resources are vital to the daily running of the factory.

Management overview

‘There were a lot of BMW staff. There were four teams: the Mini project team kept their jobs,’ says Jason Field, a senior IT specialist. “Cowley was paired with BMW’s Regensburg plant and there was a charter flight there to train from Monday to Friday.” The person tasked with overseeing the project is now boss of the Volkswagen Group Herbert Diess’ (Bremner, 2019)

The above indicates that management overview was achieved through the physical placement of the required staff in most optimal location. In addition experienced members of BMW staff were flown to the UK to ensure the project was a success. This will have enabled swift decision making on site to solve problems. Along with clear communication possible during face to face meetings.

‘What many people in industry misunderstand is that first you need to streamline, you need to make your process lean and then you can get on with digitalisation and Industry 4.0.’ (The Manufacturer, 2017)

The management continue to maintain overview of the innovative development of Plant Oxford, by ensuring processes are not pushed into having technology added. But undergo optimisation and streamlining before the step into digitisation. This will ensure that the development extracts the most value for the process and company.

Innovation Practice

When looking at the innovation process that was involved in creating Plant Oxford, I believe that overall it shows signs of good practice. BMW selected the MINI brand to move forward, and choose to sell off the other areas of the Rover group that it owned to minimise the financial risks. They also made agile decisions regarding the production site, selecting the best geographical location for manufacturing. Another positive decision was to create a flexible, lean production line that leveraged automation and robotics to achieve a personalised product whilst maintaining efficiency and quality. This is highlighted by the seamless introduction of the electric variant to the production line. There are also multiple examples of the continuous development that occurs at Plant Oxford, ensuring the process remains lean whilst making use of developments in technology. This is confirmed through the accolades that the site has been awarded.

Process Analysis

Comparing the innovation process at Plant Oxford with Goffin and Mitchell's Innovation Pentathlon (Figure 1). It can be seen that the ideas phase will have been dominated by the product development and research, during the first part of the development journey for Plant Oxford.

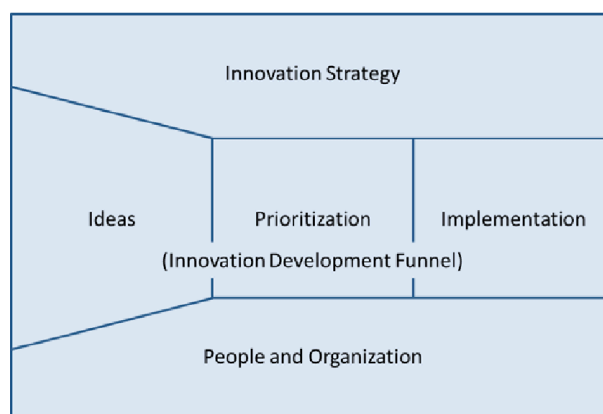


Figure 1, The Innovation Pentathlon Framework (Goffin, 2010, p. 27)

The strategy behind the development of Plant Oxford has lead to the innovative processes that can be found there today. It can be seen that they conduct research programs, established

strategic partnerships and targets for the ideas phase of the Pentathlon. For the Prioritisation phase the strategic location of Cowley enabled BMW to make use of the existing network of automotive suppliers. Making use of the existing Cowley factory will have reduced some of the risks associated with the new development at Plant Oxford.

When considering the People and organisation aspects of the innovation. The decision to develop the Cowley site can be seen as good practice when compared with the people and organisation element of the pentathlon. Leveraging the knowledge and experience of the personnel at Cowley no doubt ensured the overall success of the development. For the implementation section, BMW made good use of their resources. As previously discussed BMW placed the key personnel on location for the development and made use of existing training facilities to compress the development time. Also making use of partnerships to ensure the implementation was a success, such as the work with Siemens to develop the software required. During the time that the development was occurring Shilling notes, *'many organizations sought to form relationships with IT firms in order to access information and capabilities that would help them respond to—and benefit from—the rapid advances in networking technologies.'* (Schilling, 2015) Clearly BMW were one such company. Showing further good practice, though recognition of the limits within the business, and subsequent outsourcing of activities.

'The boss sets the tone, sets the structure, and their personal style and attitude largely sets the character of the culture' (Wynn, 2021)

Establishing a completely new manufacturing line, for a product that had not been released to market yet must have been a difficult task. Added to that the friction between nationalities, potential job losses and workforce training. Herbert Diess, the boss in Wynn's quote, must have utilised good tone and structure. Because the resulting development was realised on time and has continued to grow from strength to strength. *"Mini is a trailblazer for the BMW Group and this factory is at the cutting edge of that," says Frank Bachmann'* (Foy, 2014) also *'Ingenuity of the kind that made the original Mini famous is clearly flourishing at the factory'* (Bremner, 2019). Further

Organisational requirement	Characterised by
1 Growth orientation	A commitment to long-term growth rather than short-term profit
2 Organisational heritage and innovation experience	Widespread recognition of the value of innovation
3 Vigilance and external links	The ability of the organisation to be aware of its threats and opportunities
4 Commitment to technology and R&D intensity	The willingness to invest in the long-term development of technology
5 Acceptance of risks	The willingness to include risky opportunities in a balanced portfolio
6 Cross-functional cooperation and coordination within organisational structure	Mutual respect amongst individuals and a willingness to work together across functions
7 Receptivity	The ability to be aware of, to identify and to take effective advantage of, externally developed technology
8 Space for creativity	An ability to manage the innovation dilemma and provide room for creativity
9 Strategy towards innovation	Strategic planning and selection of technologies and markets
10 Coordination of a diverse range of skills	Developing a marketable product requires combining a wide range of specialised knowledge

Table 1, Innovation management and New Product Development 128 (Trott, 2017)

evidence that the innovation used at the start of the project continues today. Highlighting that the behaviours surrounding innovation have been embedded throughout the workforce. With further development and results still happening today.

Table 1 lists the key requirements that must be achieved for an innovation project to be accomplished. When using this as a review tool it can be seen that the development of Plant Oxford aligned to the majority of these. Growth orientation is evident because BMW moved into a new market sector, at the risk of short term profits being low. There are two channels of heritage and innovation, the heritage of the mini brand and manufacturing in the UK. Combined with the innovation values of BMW. Vigilance of the threats and opportunities can be seen with the decision to change the planned manufacturing site.

The commitment to technology and R&D is evident from the use of automation, robotics, live data feeds and continuous improvement of the facility. As previously mentioned launching the MINI brand was a balanced risk across the BMW portfolio, as it was a new product, launching into a market where they were not established. As discussed earlier the mix of teams from different

nationalities, were able to succeed in the goal therefore cross functional cooperation was successful. The space for creativity will have been evident in the early phases too, due to the approach needed when fitting equipment into a completely different site, that was smaller in size and of a different layout. The use of non automotive specific robotics indicates the receptivity and strategy that has been applied at Plant Oxford. Combined with very effective high level coordination it has been possible to create an innovative industry 4.0 ready manufacturing plant.

Conclusion

In conclusion the innovation development of Plant Oxford can be seen as a success. Overcoming barriers, leveraging determinants, applying technology where appropriate and nurturing an innovation culture. In the press recently BMW have announced that the new electric MINI's will be produced in China, this is due to a different product platform. With this announcement within the last 12 months it is difficult to understand fully what is to happen. Equally BMW have released further statements about development spending at Plant Oxford. With its rich history and embedded innovation behaviours, it can be expected that further developments will come from the site that progress the efficacy, reduce environmental impact and make use of next generation technologies.

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