

University of Wales Saint David

Wales Institute of Science & Art

Engineering Project Technical Report

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1 Introduction

This report is focused on the formation of the engineering team for the development of a new product. In order a new product to be successful, the steps that have to be followed have to be well considered and the members of the teams that will be used for the development of the new product have to be carefully selected.

Usually, the idea of introducing a new product in the market is initiated after identifying the needs of the market. If a product is unique and satisfies the needs of the market then has good chances of being successful.

Prior to the development of a new product various teams have to work together in order the new product to be successful. First the management team has to introduce the idea of the new product, then a market research team has to identify the potential of the new product, the engineering team has to design the product considering competition the cost and the effectiveness of the product, the health and safety team has to consider the health and safety regulation and other legislations associated with the product, the financial team has to consider the costing of the whole process from production to sales and the marketing team has to consider ways of introducing the new product to the market. The expected organisation chart with all the main teams required to introduce a product in the market is shown in figure 1.

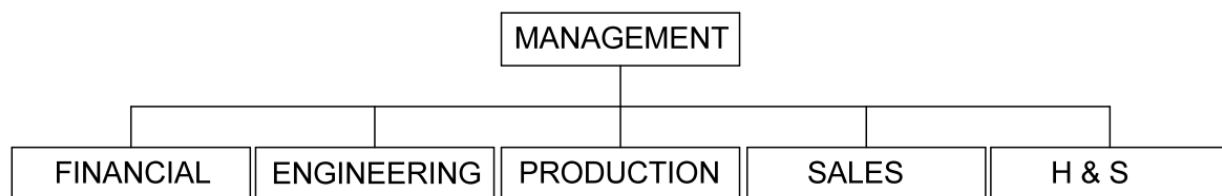


Figure 1 – Company organisation chart

As it previously mentioned this report will only focus on the setting up of the engineering team for the development of a new product.

The new product that will be developed by the engineering team in this report are the batteries for cars. The reason for selecting this product is because EU countries have a target to reduce the CO₂ emission by various ways. The use of renewable resources to produce electricity is one way and the production of hybrid and electric vehicles are some other ways of reducing the CO₂ emissions in the environment. The use of batteries is a necessity for these systems and since according to (*Global automakers gearing up to produce more electric vehicles: Analysis - BusinessToday*, no date) the car manufacturers are planning to invest large amount of moneys for the production of electric cars, this will result in a considerable increase in the production of batteries. The key to success of the new car batteries is to produce batteries that can store considerable amount of energy in respect to their mass. This is the challenge that the engineering team will face.

2 Research - Engineering team Structure

Prior to the formation of the Engineering team structure, it is necessary to carry out research as to how the batteries for the electric vehicles are made and what materials are used for the manufacture of the batteries.

2.1 Research

The car batteries are mainly made from lithium, Cobalt Nickel, Aluminum and graphite. It was proven that with these materials, batteries with higher energy density, longer life and better charge performance can be made. (*The Truth About Tesla Model 3 Batteries: Part 1 - YouTube*, no date) Research showed that lithium batteries with cathode made from sulfur can be made. These batteries cost less weight less and have better performance characteristics. (*New Electric Car Batteries - Breakthrough Science - YouTube*, no date)

The weight of the batteries that are used for the cars is about 300 to 550kg. (Perry, 2019) This is an extra weight that the electric cars have to carry in relation to the petrol cars consuming more energy. That is why it is important the ratio of the electric energy which is stored in the batteries in respect to the weight of the batteries to be as high as possible.

Before a decision is made about the setup of the structure of the engineering team it is also important to investigate from what parts the vehicle battery packs consist. Mainly the battery pack for cars consist of the following parts: (*MG Electric Car Batteries – How Are They Built? - YouTube*, no date)

- a. Battery module array (small batteries connected together with cables),
- b. Battery management systems, which checks the charge of each individual battery in order to achieve uniform charge of all the batteries,
- c. The thermal management systems which is responsible for keeping the batteries in an optimum temperature,
- d. The battery electrical system (this is way the batteries are connect together and the way they are getting recharged),
- e. Structural parts are materials which are used for the casing where the batteries are stored which ensure the watertightness and dust free environment for the batteries.

A schematic diagram of a battery pack is shown in figure 2 and the location, the battery pack is placed in a car is shown in figure 3.

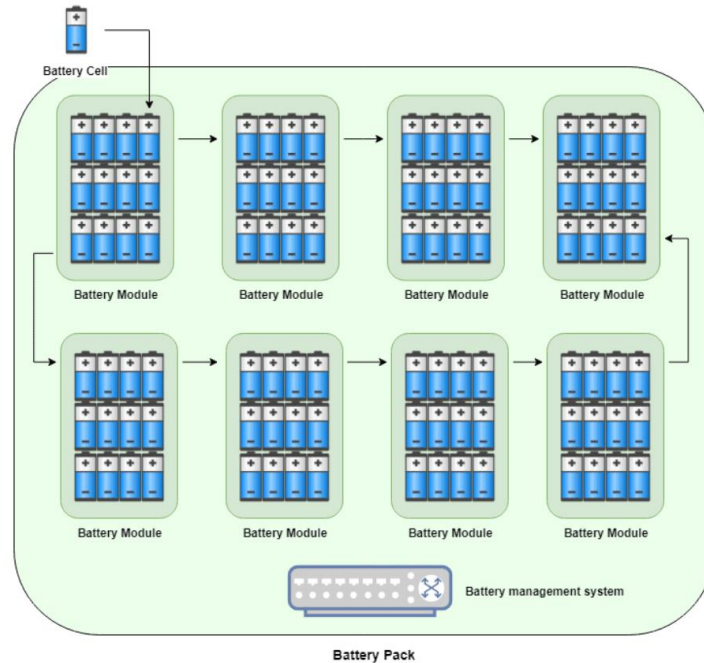


Figure 2 – Schematic diagram of battery pack of BMW i3 (Perry, 2019)

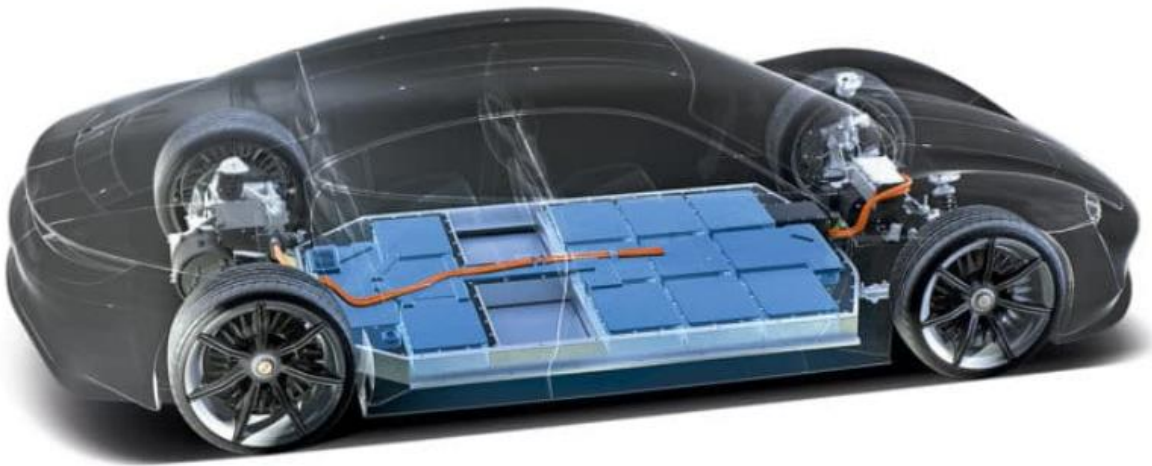


Figure 3– Battery Pack of Porsche Taycan (Malewar, 2019)

2.2 Engineering team Structure

Having in mind the materials which are used for the production of car batteries and the parts of the which the battery packs are made it is important to have persons in the engineering team with the following expertise. These persons will work together under the guidance and supervision of the engineering team leader, considering the engineering ethics to produce a product that is safe for the public and the environment. (*Engineering Council*, no date)

- a. Automotive Engineer (Team Leader) – The team leader will give guidance to the engineering team and will supervise to works for the development of the new product.
- b. Chemical Engineer - The chemical engineer will be responsible for using the materials for the construction of the batteries effectively and will also be responsible for evaluating the use various materials for the construction of the batteries.
- c. Computer engineer – The computer engineer will be responsible for the design of the software and hardware required for the battery management system and the thermal management system of the battery pack.
- d. Electrical engineer – The electrical engineer will be responsible for the design of the electrical system of the battery pack and check the performance of the battery.
- e. Mechanical engineer - The mechanical engineer will design the cooling /heating system of the battery pack, the casing of the batteries and ensure that this casing is watertight and dust proof.
- f. Technician(s) – The technicians will assist the engineers in manufacturing and testing the prototype of the new battery pack.

The set-up of the engineering team is shown in figure 4.

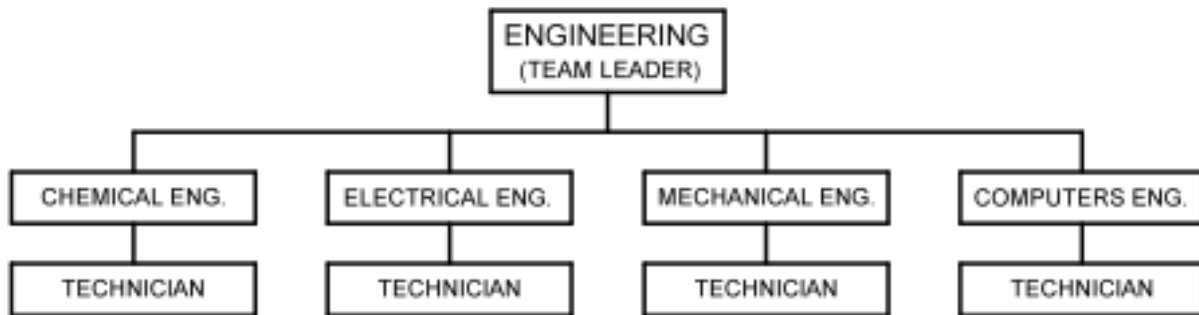


Figure 4– Set-up of the Engineering team

3 Methodology – Product development

Having in the engineering team the persons mentioned above, every member of the engineering team has to work in the field of their expertise in order to develop the new product successfully.

The chemical engineer has to select the materials which will be used and has to design how these materials how will be assembled together in order the battery cell to be formed.

The electrical engineer has to design the electrical part of the battery pack so that the battery pack can be safely use and charged.

The mechanical engineer has to design the cooling/heating system and the casing of the battery pack.

Finally, the computer engineer has to design the software and hardware associated with the battery management system and the thermal management system.

Because the work that one engineer does affects the design of the other engineers, all the engineers have to work closely together under the supervision and guidance of the team leader. The assistance of the technicians is also important for achieving the best results.

It is important to note that the product which will be produced has to comply with the current EU standards (*ISO 19453-6:2020 | Download PDF or Next Day Delivery | British Standards Online*, no date) and the engineering team has to work according to the Health and safety regulations. That is why it is important during the design of the product the engineering team to seek the advice and supervision of the Health and Safety team. This is required in order to ensure that the new product complies to the relevant standards, it can be produced safely, it is safe to be used and that it can be recycled at the end of its life.

Once the prototype is produced, it has to be tested and if some corrections or adjustments are need, the product has to be redesigned and rebuilt by the engineering team until it comes to an acceptable standard.

The financial team has to advise about the cost of the and a report about the new product has to be prepared and presented to the management team for comments and approval. From this point onwards is up to the management team to decide about the way forward. The processes with which the engineering team will be working is shown in Figure 5.

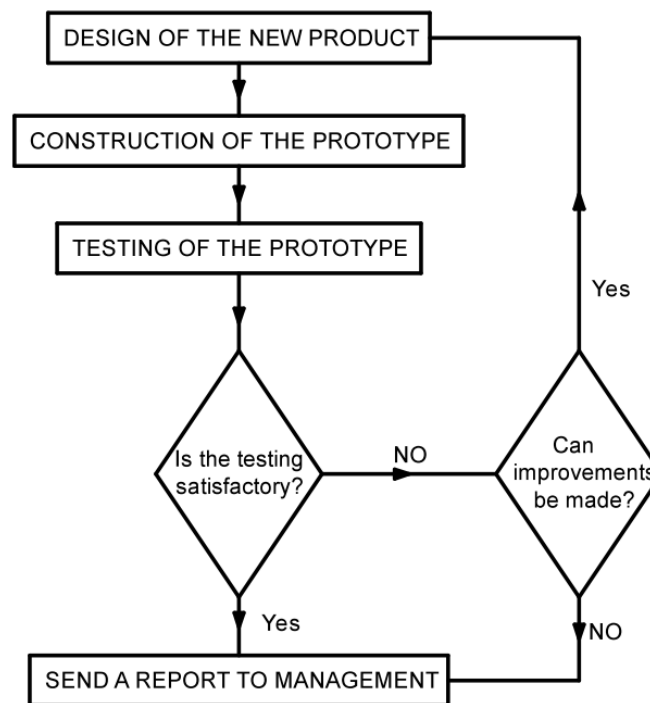


Figure 5 – Process Map

4 Discussion, Issues, Legislations and standards.

As it was previously mentioned Lithium, Nickel, cobalt and aluminium and graphite are the main materials for the production of the batteries. Even though the electric cars do not have CO₂ emissions

the manufacturing process of these batteries create CO₂ emissions. Also the mining of the above-mentioned materials contaminate the environment. (*Electric Cars Aren't Green: Myth Or Truth? We Take A Look!* - *Green Car Future*, no date) This where the countries have to enforce strict restrictions in order to control the contamination of the environment from the mining of these materials.

Also, after the end of their life these batteries have to be recycled reducing in this way the amount of waste that contaminates the environment and at the same time reduces the amount of mining for the rare metal required for the construction of the car batteries.

The use of new materials like sulphur for the production Li- S batteries (Simmonds *et al.*, 2014) improves the charging characteristics of the batteries. This is an example of research that has to be made in the field of the materials which are used for the production of the batteries in order to limit the use of the rare materials which are presently used in the batteries and use cheaper and more effective materials if this is possible.

5 Conclusions

The production of a new successful product is a difficult process and it involves the engagement of various teams. Even though the engineering team is the team responsible for the development of the new product is not the only team which is required in order a product to be successful. The success of the product it depends though on the sales and therefore the engagement of a market research teams at the initial stages of a product is necessary and the engagement of a marketing team after the production of the new product is necessary as well. The quality of product and the after sales service are factors that affect the sales and contribute to the success of the new product. The team work between all the teams involved in the development of a new product is the key to the success. During the development for the new product great consideration has to be given to the current product standards and to the current H & S regulations.

It can be considered that after the completion of our degree, we will be “new products” that will be available in the world’s market. The main reason I decided to study motorcycle engineering (apart from the fact that I have great interest in motorcycles) is the fact there are not too many people in the world at the engineering level specialised in motorcycles and this makes the motorcycle engineers’ “unique” product in demand. I believe the complexity of the new motorcycles create a demand for motorcycle engineers in the design and in the after sales service.

By the completion of my studies this will not be the end of my academic development and training, since the technology changes continuously and therefore the continual academic development and training is necessary for every engineer in order to achieve his/her goals.

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