

Stage 2 - Assignment Task 2

SWOT Analysis - Mascot Steel Fabrication & Welding Supplies

Tutorial Group 21 - Group 2

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Abstract

The following section highlights the intended audience and who exactly this document has been prepared for and a concise review of the emerging conditions making the 'Grand Challenge' problematic. This SWOT analysis focuses on the engineering entity known formally as, '*Mascot Steel Fabrication & Welding Supplies*'. Furthermore, this document is created for the use by the company, specifically with the formation of policies and projects that align with addressing the 'Grand Challenge' of the Climate Change Emergency (CCE). Similarly, this document may also serve a purpose for the company in identifying and monitoring businesses addressal of the CCE. At policy level for further analysis on the company in the future, this document can be utilized by external organisations such as shareholders as well as targeting the audience as being the administration of the company.

Engineering Entity

'*Mascot Steel*' is an Australian owned and operated family business established in 1978. Their focus is on steel products and fabrication services with a range of steel.

Existing Strategic Directions

The organisation has advertised a minimal addressal of consideration with relation to the CCE. The company presently denotes that revolving the spectrum of engineering operations around steel acts as a factor in addressing the CCE and the sustainability of materials, manufacturing and overall major engineering labour within the company.

Core Business Activities

Engineering & Non-Engineering Related

The business' engineering related activities include stocking a large range of steels; range of shapes and sizes - sheet, plate, mesh, builder's steel, concrete reinforcing and accessories. The organisation is concerned with cutting, fabrication, welding, drilling, prime painting, profile plasma, saw cutting, brake folding, bending, rolling and guillotining of sheet and plate steel. The business' non-related engineering activities include that of hiring staff, such as, sales estimators and providing services of quoting project/labour pricing to clients and customers.

Key Stakeholders

Clients

Clients of *Mascot Steel* include those requiring steel material processing and fabrication or supplies for projects. This includes previous projects of the company being commercially orientated and residentially orientated. Previous more specific operations of *Mascot Steel* include stagesets, such as the 2019 Australian Open in Melbourne, structural billboards and agricultural structures, such as wheat silos, entertainment quarters, such as FoxStudios Sydney.

Customers

The customers of *Mascot Steel* therefore, include private residential clients, commercial businesses concerned with construction, large scale commercial events and agricultural operations both government and privately funded.

Shareholders

The shareholders within the company include investors and steel groups such as, Smorgon Steel Group - integrated producer of steel. These shareholders include the community surrounding steel production, suppliers, employees and clients/customers. (Smorgon Steel – The Smorgon Way, 2021)

Companies Scale & Outreach

The Mascot factory is spread over 4000 square meters with overhead cranes - located near Sydney Airport or CBD region. A second site is present in Penrith for General & Structure Fabrication only. Applications of the company are delivered Sydney - wide, however, in the past have worked interstate on large scale projects.

SWOT Analysis

Strength

Mascot Steel does provide a wide range of stainless steel products, which are environmentally friendly. This is because stainless steel can be easily recycled, which reduces the CO2 emission rate. Moreover, it's production produces minimal CO2 emissions. By providing a variety of products in stainless steel with multiple customisations, customers are attracted to buying stainless steel over regular steel products that could do relatively more damage to the climate (Stainless Steel and CO2: Facts and Scientific Observations, 2021). This effectively tells us that Mascot Steel is inclined towards addressing the climate emergency challenge.

Although Mascot Steel is well established in Sydney, it has only one on-site steel processing unit. Hence, it is easy for them to adapt new policies and methods as a response to the climate emergency crisis, as compared to organisations that are established in multiple locations (Stainless Steel And Aluminium | Mascot Steel, 2021). This is a strength of Mascot Steel over other companies.

Weaknesses

Mascot Steel's primary business function, steel fabrication, is a highly energy and water intensive operation. As Mascot Steel does not possess solar panels for electricity generation, all of the electricity sourced by Mascot steel is supplied by Ausgrid energy distribution. 89% of Ausgrid's electricity is sourced from burning fossil fuels; 74% from coal fired power, and 15% from burning natural gas. Due to climate change placing an ever increasing emphasis on the transition to renewably sourced electricity, and Mascot Steel's lack of diversified electricity, their electricity source and consumption can be considered a

weakness. Additionally, as a core component of steel fabrication is quenching and tempering the steel, large amounts of water is key in the steel manufacturing process. The *Worldsteel Association* declares that “the average water intake for an integrated plant was 28.6m³ per tonne of steel produced”. This is a significant amount of water. Due to climate change and global warming specifically, water evaporation poses a significant threat to water supply around the world. As Australia is the driest continent on earth, with 70% of the country being arid or semi arid, the evaporation taking place has more significant effects in Australia than the rest of the world. As Mascot Steel relies heavily on a large consumption of water for its core business, and due to its scarcity in Australia, this water reliance can be considered a weakness for Mascot Steel. Lastly, the production of steel requires large amounts of iron ore as a raw material. The mining process (including the mining of iron ore) accounts for roughly 7% of global greenhouse emissions (McKinsey & Company, 2020). Mascot Steel then embodies this carbon used during the mining process, in their conversion of iron to steel. This further carbon use poses as a weakness for Mascot Steel.

Opportunities

There is a global push to reduce carbon dioxide emissions from steelmaking. Reducing carbon emissions from steel production is an agreed priority, followed by reducing greenhouse gas emissions over the life cycle of steel products.

The development of breakthrough technologies is essential to significantly reduce the overall carbon dioxide emissions from steel production. Several promising projects have adopted different approaches, which are generally summarized as follows:

1. Hydrogen as a Reducer - Using hydrogen to reduce iron ores yields water instead of carbon dioxide (carbon).
2. Biomass as a reducing agent - can be partially used as a substitute for coal, such as charcoal.
3. Carbon capture and utilization - through the production process of the symbiotic product gas as a feedstock for industrial production.
4. Use electrolysis - the use of electricity to reduce iron ore.

Each of these technologies will play a role in reducing CO₂ emissions. However, implementing these plans on a larger scale will require large quantities of hydrocarbon free, biomass and power supplies, implying a fundamental shift in the global energy system. But solutions cannot be achieved all at once, so along the way to achieving breakthrough technologies, there are ways to help mitigate climate change by improving process efficiency.

Threats

Mascot steel utilises too much unclean energy to vastly manufacture stainless steel and aluminium products. The Hall-Heroult process of smelting aluminium uses 15KWh/kg of power. Stainless steel on the other hand uses 13.6Kwh/Kg of power from the electric furnace. Hence, mass producing stainless steel and aluminium causes great concerns linked to the grand challenge due to the burning of fossil fuels.

(Hall, 2021) (Millberg, 2021) (T.E. Norgate, 2014)

Appendix

SWOT Analysis

Table 1 - SWOT Summary

Strengths	Weakness
<p><i>Mascot Steel</i> works on environmentally friendly products such as stainless steel. This means that there is already awareness of climate emergency in some aspects</p> <p><i>Mascot Steel</i> is has one on-site processing unit in Sydney, and hence recommending it policies can prove to be easy for them to adapt</p>	<p><i>Mascot Steel</i> relies on coal fired electricity with no electricity sourcing diversification in place</p> <p><i>Mascot Steel</i> has a heavy reliance on water for steel manufacturing processes.</p> <p>Mining is a core component of the steel manufacturing process. Mining is a heavily carbon intensive industry, under fire for its contribution to climate change.</p>
Opportunities	Threats
<p><i>Mascot Steel reducing carbon emissions from steel production is a consensus priority, followed by reducing greenhouse gas emissions during the life cycle of steel products.</i></p> <p><i>Mascot Steel can use the methods used in several promising projects to achieve the carbon reduction emission.</i></p>	<p>Mascot steel conducts high power usage activities that heavily rely on unclean energy sources such as fossil fuels.</p> <p>Operation of machinery to fabricate metal works produces greenhouse gases which can be detrimental to the ozone layer in large quantities. More manufacturing energy lowers efficiency and increases output of greenhouse gases.</p>

Strengths

One of the strengths of Mascot Steel is that there seems to already be some form of awareness with regards to the environment with regards to climate. Mascot Steel provides a large range of products in stainless steel with finishes as per customer's demands. In their "Stainless & Aluminium" page of the website, Mascot Steel claims that the use of Stainless Steel is good for the environment and provides a compelling case for using stainless steel products. Following this, they provide a wide range of products in stainless steel, and also do polishing for different grades to suit clients needs and styles. By providing customisations to environmentally friendly stainless steel products, they are effectively attracting customers to purchase stainless steel products.

The Stainless Steel industry aims to reduce the CO₂ emissions, thereby reducing Greenhouse Gases in the environment. A study done by the International Stainless Steel Forum (ISSF) has shown that the CO₂ emissions in the entire production process of stainless steel is minimum. Hence, Mascot Steel is doing great in this sector (Stainless Steel and CO₂: Facts and Scientific Observations, 2021).

Another strength identified from Mascot Steel is the fact that it has a single production site in South East Sydney in Mascot. Due to having only one site, Mascot Steel can easily adapt to changes in their processes in the steel production plant that might be needed, while responding to the climate emergency. In contrast, an organization that has several production plants spanning across multiple cities and/or countries around the world would face trouble in following a unified suggestive process for improving the climate status, given the government conditions and laws each plant would have to adhere to, and even the difficulty of propagating a change in the day-to-day steel manufacturing (Stainless Steel And Aluminium | Mascot Steel, 2021).

Weaknesses

Below is a table that outlines the energy usage involved in manufacturing steel. The figures in the table are given as Joules. For reference, according to the table, to convert Iron Ore to Pig Iron requires 156kWh of electricity per metric tonne.

Table 2 - Steelmaking Energy Use

Process	Absolute Minimum	Practical Minimum	Actual Average Requirement	% Over Practical Minimum
Liquid Metal "Pig Iron"	9.8	10.4	13.5	23%
Liquid Hot Metal: Basic Oxygen Furnace	7.9	8.2	11	25%
Liquid Hot Metal: Electric Arc Furnace	1.3	1.6	2.25	29%
Hot Rolling Flat	0.03	0.9	2.2	59%
Cold Rolling Flat	0.02	0.02	1.2	98%

Table 1: Steelmaking energy use (1×10^9 J / metric ton). [4]

As the average Australian household uses an average of 19kWh per day, it is evident that steel manufacturing is an incredibly energy intensive process. This presents itself as a weakness for Mascot Steel in the face of a climate emergency due to Australia's electricity sourcing mix heavily favouring fossil fuels. Additionally, due to Mascot Steel's lack of solar panels, there exists no other renewable energy source from which they can source their electricity. Mascot Steel's fabrication warehouse accommodates a roof area of roughly 4000m². If 200 Watt solar panels were to be installed on the entirety of the roof space, the maximum power generation that could be achieved is roughly 734 kW. This power would go a long way in offsetting the power consumed from fossil fuel resources. This example highlights just how much of a weakness Mascot Steel's lack of energy sourcing diversity, and reliance on fossil fuel generated electricity is.

A further weakness in Mascot Steel's operation is their reliance on large quantities of water. Currently, Mascot Steel sources this water from the town water supply. This weakness manifests itself in two different ways; their heavy reliance on large quantities of water and their dependence on the town water supply. This dependence means that Mascot Steel is subject to town rules and regulations regarding water usage and consumption. In order to

eliminate this weakness, Mascot Steel will need to establish their own unique water source and implement water reuse and recycling techniques to help preserve the water they are able to obtain.

Finally, an unavoidable weakness present in Mascot Steel's business function is their reliance on Iron Ore from Australian mines. As pressure applied to the mining companies due to the climate emergency ramps up, mining production in Australia is reducing. Without Iron Ore, Mascot Steel would not be able to produce their steel and thus would not be able to function as a business.

Opportunities

At the same time, in 2019, the World Steel Association Council launched the "Energy Efficiency Upgrade" project. These include energy input, process recovery, feedstock and equipment maintenance processes, which will bring the plant's energy efficiency up to the level of the best companies in the steel industry. The more important use of energy to efficiently reduce carbon dioxide has been a key work of the steel industry. Given that energy purchases account for 20-40% of basic steel production, cost will be the deciding factor.

Our goal is to make full use of all raw materials and ensure zero waste in steelmaking. And it ensures that most of the byproducts from the steelmaking process are used in new products.

The use of scrap steel in the production process will also increase in the coming decades. Scrap is produced when steel reaches the limit of its useful life. In addition, steel that cannot be reused or remanufactured will be recycled, which will play a key role in reducing carbon emissions.

According to statistics, compared with 1960 and 2020 grandma, the energy consumption of steel companies to produce crude steel decreased by 60%/ ton.

The efficient and reusable use of resources will be an essential condition for sustainable development.

It is an important issue of the United Nations Climate Change Conference to transform steel from a "difficult to cut carbon emissions" industry to a "net zero carbon emissions" industry. Ursula von der Lein, the new president of the European Commission, recently announced that the EU's new "green agreement" will include a carbon border tax adjustment mechanism that will focus on balancing the relationship between trade and environmental policies.

In the era of rapid technological development, how can the steel industry break through its limitations and get out of the predicament?

1. The homogeneity competition is becoming increasingly fierce and gradually spreading to high-end products. Most of the steel products manufactured by steel companies are mainly in high demand from society, and they have not predicted the changes in steel demand, resulting in surplus production and large amounts in the industry. Some steel companies produce similar types of steel products in large quantities. Therefore, the competition for low- and middle-end steel products is fierce.

2. Establish a steel mill-terminal sales model. Steel companies produce steel products and sell them to end-users. The process is complicated and the cost of capital is increased. To judge market trends more quickly and effectively, steel producers must directly contact customers to understand their needs before production, so that steel products can be sold through channels and avoid production surpluses.
3. The era of mass customization. Network intelligence technology integrates scale manufacturing and customization, which fully reflects user needs in product design, separates production and use, and forms a new industrial model. The Industrial Internet is applied to manufacturing, and the industrial form is changed from production-oriented manufacturing to service-oriented manufacturing.
4. A customer-centric service system is being established in a market economy environment. Enterprises should take the market as the centre and take customer needs as the starting point. Only by producing high-quality and low-priced products that customers need, can the enterprise obtain sufficient living space. Many internationally well-known steel companies have already begun to improve their sales services, provide customers with customized steel products, and extend after-sales service to customers' production, strengthen the relationship with customers, and enhance the competitiveness of their products.

Threats

Mascot Steel is the largest steel processing plant in southeast Sydney. Due to being a very large production company comes with a few drawbacks especially with regards to the grand challenge, climate emergency. Mascot Steel is a big manufacturer of both aluminum and stainless steel. However, the drawbacks lie in the production of these metals.

Aluminium is manufactured in two stages. The Bayer process of refining the aluminium ore and the Hall-Heroult process of smelting the aluminium oxide to obtain pure aluminium. According to "Aluminium for future generations.com" coinciding with "MrReid.org" states that the energy consumption to use the Hall-Heroult process consumes 15KWh/kg. Therefore, the big contributing factor to climate emergency is the heavy reliance of unclean energy, burning of fossil fuels.

(Society, 2021) (Hall, 2021)

Stainless steel manufacturing consists of 6 stages. melting and casting, forming, heat treatment, descaling, cutting and finishing. The most energy demanding process in the stainless steel manufacturing procedure is the melting and casting step. The use of an electric furnace is to melt metals for up to 8 to 12 hours of intense heat. Mascot metals uses the stainless steel type of nickel presented in Table .3 attaining a value of 49MJ/Kg which is 13.6Kwh/Kg. The bulk creation of stainless steel greatly increases the energy used to produce the metal.

(Millberg, 2021)

Table 3 - Energy use of different stainless steel types.

(T.E. Norgate, 2014)

Metal	Total energy (MJ/Kg)
Stainless Steel	
- Ferronickel	75
- Nickel	49
- Boustead & Hancock	80

The government may want to integrate more renewable energy to support the aluminum and stainless steel demand whilst using clean energy. However, this ideal situation presents difficulties in obtaining rights-of-way and environmental permits. Therefore, some of the existing power transmission and distribution lines are operating near their capacity and some renewable generation cannot be connected. Unless the government spends billions of dollars to replace some conventional generators to produce cleaner energy and to support the grand challenge.

(Communications, 2020)

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