Fabrication and Material Selection in a Developing Context

1. Abstract

Fabrication and material selection in a developed country can take on many different design criteria and requires numerous considerations. Cost, flexibility, rate, and aesthetic are valued highly and all contribute to the goal of getting as many perfect products out on the shelves as possible. However, in a developing country, the design criteria and manufacturing process must be looked at through a slightly different lense. Some critical differences for manufacturing in developing countries rely on the need for a smaller feedback loop as well as the availability of materials. Designing for a developing country means developing for a specific community with specific needs [1].

In addition to the obvious difference of material variations between developed and undeveloped countries, there are also community scale related differences that change the way that the manufacturing process works. For many reasons, design and manufacturing in these two different parts of the world leads to unique design decision making, that can only be made with the correct understanding of the region that product consumption and production will take place [1]. By looking at the three attributes of cost, rate, and quality, through the lense of developing countries as well as developed countries - we can better understand the complexity of these design criteria differences.
2. Cost As A Factor

![GNI per capita by Country](image)

**Figure 1:** Gross National Income per Capita by Country internationally. Data compares 2005 to 2006 GNI. Collected by The World Bank [5].

Perhaps the most clear difference out of these three manufacturing attributes between developing and developed countries is cost. In Figure 1, the Gross National Income from thirty-one different countries is compared. The more developed, industrialized countries have a clear advantage to the average citizen’s personal disposable income [5]. Design for cost varies greatly between developing and developed countries for this reason.

When looking into the design criteria of cost, it is apparent that in these developed countries, cost is not quite the issue that it is in developing areas [2]. As a company designing a product in the United States, the goal related to cost is to be appealing based on the competitors in the market. This can be interpreted in two ways. The first is to have a lower price than your other competitors on the market [4]. The company can achieve this by using cheaper materials,
designing for bulk to have less expensive manufacturing costs per day, or by using less material than the most similar competitor. The second way to interpret this is that in developed countries, there is something to be gained by having a higher price than your competitors to increase perceived value. For example, Apple marks their prices up higher than all of the phones on the market, but due to good industrial design and perceived value, they are still the top selling brand [4].

On the contrary, when looking at the concept of cost from a company with a market in a developing country, the concept of designing for cost shifts quite definitively. In developing countries, the goal for cost is to create a product that is so low cost that it can fit into the budget of the average citizen making minimal disposable income [5]. The material selection process must therefore take into account locally sourced materials as well as common, cheap materials that will not raise the cost of the product to out of the price range of the consumer. Manufacturing process selection must also take this into account. Manual labor is much more favorable than expensive die casting or injection molding, unless the product will be made in such bulk that the capital cost will be irrelevant in the long run.

3. Rate As A Factor

While cost is a clear difference in material selection and manufacturing method decisions, rate is one that is not quite as well understood. Rate is a factor of economics and access to the consumer market, and varies depending on what type of supply chains are available. In developed countries, the supply chains are international - products ship across the world for maximum speed and optimization based on extensive market research. When looking at the
figure below, it can be seen that said global supply chains do not access every part of the globe, leaving out many developing countries - forcing them to have a different approach on rate and supply.

**Figure 2:** 2011 Global Supply Chains Data collection showing global shipping routes and major port cities. North America and Asia are clear global leaders in the international supply race, while countries such as Africa have much less access [8].

In developed countries, rate is understood as a factor of economics and understanding the demand for the product in the market. As a general rule, higher rates are more ideal, as they reduce the manufacturing labor costs [6]. The faster the products roll off the line, the less money needs to be allocated to labor per unit. The higher the demand, the more rate matters off the manufacturing line. As a company develops new iterations of its product, it must reevaluate the market for the demand.

In contrast, for developing countries the question of rate is not as simple. As a company designing in a developing country, it is important to understand your market. This can be
difficult because of access to communication and rural groups while doing market research [2].

To make the most out of this situation, it is necessary to be able to iterate while manufacturing to ensure production of a product that the consumers actually want. This requires a small feedback loop with local manufacturers and smaller scales in order to make sure that the product matches the community need [3]. By creating a product using local manufacturers that are close to the consumer base, there is less of a chance of missing the mark with the need for the product, as the consumers can go back to the manufacturer with any complaints.

4. Quality As A Factor

The last manufacturing attribute to consider is quality. As in the case of cost, the difference between developing countries and developed countries is more clear. In a country like the United States, quality is about aesthetic, durability, and relevance to trends. To understand how companies in developing countries approach quality, we must dive into the interests of the consumer market. In most developing countries, the consumer market is driven by materialism. To feed this, companies must understand what the consumer wants and how to deliver the most high quality version of that need. Quality can be achieved using high quality materials, unique materials, and industrial design fueled decision making. Additionally, quality in developed countries means expensive machinery, machining, and manufacturing processes.

High quality materials include aluminum, stainless steel, granite, and gold. The expensive manufacturing processes can include die casting, injection molding, die cutting, and of course, precision machining.
Quality in developing countries varies from area to area. The consumer market is a very different place - focusing on survival rather than materialism. Quality in this market is about designing something with the intention of improving the lives of the consumers, that is worth the price. When designing a product in the developing world, quality is much more about durability and resilience than about the aesthetics. If the product looks nice, but breaks after 100 uses, it is essentially useless and a waste of disposable income. Material and fastener selection must take this into account, with the intention of increasing robustness and improving length of life. While aesthetic is not as important, a trend is on the rise in developing countries for products that look high quality and aesthetically pleasing. There is a push for financial movement among classes and owning nice possessions can be interpreted as a mark of status. Consequently, the ideal product for quality in developing countries, is one that is durable, can sustain many uses, and additionally is visually high quality.

5. Product Life Cycle - Length of Life

Manufacturing attributes aside, length of life is another key difference between designing for the two areas. When designing for a developed country, length of life and end of life plans are dependent on the category that the product falls under. Many products in industrialized countries are designed to be one use then disposable. For example, Keurig makes their entire business off of this concept. Keurig’s business model stems from the idea that consumers do not like the mess of cleaning out a coffee maker and coffee filter [6]. With this type of design in mind, the material selection process focuses on finding extremely cheap
materials that are ideally at least slightly biodegradable. There is appeal in clean and new over reusable and durable.

**Figure 3 and 4:** The “K-Cup” concept is highly marketed for its disposability. Both of these Life Cycle Analysis Diagrams show the appeal of the no mess, environmentally “sustainable” product [6] [7].

The Product Cycle in developing countries is unique, and differs from that in developed countries. Waste is a massive issue for most non-industrialized countries, without the infrastructure to have trash-collection programs. Therefore the disposable products just add to a ongoing waste epidemic that slowly is destroying the landscape of many major cities [9]. Consequently, designing for this market requires more thought into the products end of life. As was mentioned earlier in this paper, consumers in developing countries are more inclined to want a product if it will not break after only 100 uses [2]. Design for areas like this should take into account the ability for local maintenance and upkeep. Product lifecycle should be able to be extended with easily accessible replacement parts and tune ups by local mechanics or technicians. A good example of this is the company Whirlwind Wheelchairs, who design their
wheelchairs in workshops built in local areas, so that there is always someone around to be able to fix a broken wheelchair [10].

Reusable and maintainable products become much more appealing in the developing context, although the disposable products do end up in these markets as well [3]. Many products that are usually sold in bulk are sold in individual packets so that people can afford the product even if they cannot afford an entire container. For example - laundry detergent is sold in small one use packets instead of in large containers - so that packets can be purchased for a very small percent of one’s daily income.

6. Conclusion

Designing for developed markets and developing markets differs in many different ways. By analyzing the manufacturing attributes that are important to a product’s development, it can be seen what different considerations must go into creating products for both markets. While some components such as cost and quality can be viewed clearly for their differences, others such as rate and product life cycle are less clear. For adequate material selection and educated manufacturing process decisions, all of these differences must be understood [2]. There are many examples of companies that misunderstood these differences, and created products for the wrong market - only to see their product crash and burn. With an understanding of how all of these qualities affect the consumer, educated decisions can be made about appropriate materials and supply chains to create successful products in any context.
7. Bibliography


