

12.0 Conclusions

Mass production (also referred to as flow production, repetitive flow production, series production or serial production) is the process of manufacturing large quantities of a product employing computerization technology. In mass production, automation is used to achieve high volumes, organize material flow, and control quality standards. Mass production "...provides a rigorous way to monitor production resulting in lower costs, use of fewer resources, high levels of efficiency, quick assembly, prompt distribution and marketing creating a competitive advantage and higher profits" (Banton, 2020). Unfortunately, there are also disadvantages such as a significant upfront investment of time, money and resources. Therefore, it is imperative that a balance be obtained.

12.1 Before Mass Production Starts

It is recommended, before the MAIDS device is mass produced, that the following initial steps be taken into consideration and implemented:

1. **Market Research:** Attending industry trade shows will provide an idea as to the viability for product sales. It will provide an idea on which side of the market spectrum the MAIDS device will be placed successfully.
2. **Securing Some Early Funding:** It is imperative that production costs be considered. Providing the necessary capital for the first production run may include one or a combination of the following: personal wealth, find an investor or take out a bank loan.
3. **Implement a Non-Disclosure Agreement (NDA):** Implement an NDA (non-disclosure agreement) in place: Have people sign it to prevent people that know details of the MAIDS device from stealing the idea or telling others about it.
4. **Learn About Certifications Required:** In Canada, all products are regulated by some sort of federal, state and/or local agency that prevent the manufacturer from breaking any rules. It is imperative to learn about the certifications required for the particular product before starting the project. Implementing national standards assure consumers that the MAIDS device meets consistent and uniform rules but might prove too costly or unattainable.
5. **Licensing:** One major decision to make is whether to produce and sell the product yourself or license the idea to a company with the means and experience to handle it. The company handles everything – the manufacturing, marketing, distribution – and then pays you royalties based on sales. No upfront investment is required.

6. Setup a Formal Business Structure: A sole proprietorship is a business that is owned by one person and it is the easiest, least expensive type of business to start. It is advisable that MAIDS start with a sole proprietorship, but switch to an LLC before beginning to sell it.

12.2 Mass Production Cost Considerations

Most entrepreneurs drastically underestimate all of the costs required to develop, scale and manufacture a new electronic hardware product. This is one of the main reasons so many businesses ultimately fail. Therefore, one must give careful consideration to the costs outlined below.

12.2.1 Development Costs

Development costs for most hardware products are broken down into three categories: the electronics, the plastic and other mechanical parts, and the retail package. The electronics does all of the magic, the plastic and mechanical parts hold the product together, and the retail package protects and sells the product.

12.2.2 Electronics Cost

The electronics will usually be the most complex and expensive part of your product to develop, unless, one does their own product design. Prototyping the electronics is divided into two steps: production of the blank Printed Circuit Board (PCB) and soldering of all the electronic components onto the PCB. The PCB is what holds and connects all of the individual electronic components. So in most cases, it is best to use standard through-hole vias. In the MAIDS project, the ratio of electronic prototyping costs to board assembly costs were 1:2. So, it is recommended that small prototyping quantities are produced initially and then potentially increase the quantity through each iteration. Once functionality has been confirmed and bugs have been resolved it is recommended that prototype quantities be increased and samples shared with investors and potential customers.

12.2.3 Enclosure/Mechanical Development Cost

MAIDS will require an enclosure which is made of plastic. The appearance and ergonomics of the MAIDS device are critical for the product, and in turn, will increase design costs. It is recommended that 3D printing technology be used to bring down the cost of creating plastic prototypes, it provides fast turn-around time (less than 24 hours) and lower costs when small volumes are required, as is the case during the design phase of the project. Therefore, it is recommended that a 3D printer be purchased as the most cost effective strategy.

In regards to mass production, it is recommended that injection molding be used because it is the most economic option, due to mechanisms of economies of scale. Injection molding refers to the "...process of creating a components by injecting under pressure melted material into a die. The material fills the hollow cavities of the mold and when it cools it solidifies, taking the form of the die." (Varotsis, 2020) Injection molding can yield very high production rates.

12.2.4 Scaling Costs

From prototypes to large volume production there is a big difference. Mass production must take into account scaling costs but oftentimes it is one of the most underestimated steps in launching a new product. Scaling costs include: certification costs,

12.2.4.1 Manufacturing Setup Costs

For MAIDS, it is recommend to start the manufacturing process with a local manufacturer within Canada. When manufacturing volumes approaches more than ten thousand pieces, then migrate to an Asian manufacturer. It is also recommended that help from experts in Asian manufacturing is sought when the time comes to shift production to an

Asian country. Consequently, it is recommended that MAIDS use multicultural marketing resources, such as Expert's Directory (a resource that features a range of ad agencies, marketing, research, communications and PR firms, media companies, consultants and others), who are experts in outreach to all Asian segments. See appendix X for a partial list of Asian Market experts.

12.2.4.2 Certification Costs

Products require multiple certifications before they are release into the Canadian and American markets. Certification costs may be a few thousand dollars or as high as a few tens of thousands of dollars. It depends largely on the product and to a large extent how any wireless features are implemented. The main certifications required by the MAIDS system include:

1. FCC (Federal Communications Commission) Certification: It is required of all electrical products sold in the U.S.A. All electrical products radiate electromagnetic energy so governments want to ensure they do not interfere with RF communication. MAIDS is classified as an intentional radiator product (they intentionally radiate radio waves) and therefore will cost about ten times more than non-intentional radiator products. In order to reduce costs pre-certified modules (an electronic circuits developed to perform a single function and to be incorporated into other designs) will be used. At higher production volumes wireless module should be transitioned to a custom wireless design to increase profit margins.
2. Underwriters Laboratories (UL) or Canadian Standards Association (CSA) certification is required for any product that will be sold in the USA or Canada that

plugs directly into an AC electrical outlet. This cost can be removed by selling the product online. However, UL and CSA certifications will be required when sold in large retail chains. The recommendation for MAIDS is to start with online sales, wait to see if the product sells well, and if it does, move to retail stores (a step which will then require certification costs, not before).

3. CE certification is necessary for electrical products that will be sold in the EU (European Union). It is similar to a combination of FCC and UL certifications. Since California is a huge market, MAIDS should be CE certified.
4. RoHS certification guarantees that the product is free of lead and is necessary for any electrical product that will be sold in the European Union (EU) and California. MAIDS should be RoHS certified to instill on the customer the company's regard for the environment.

12.2.4.3 Landing Costs

No doubt about it, the landed production cost is the most important cost for the MAIDS project. The landed production cost is the total cost to produce and transport a single unit to the warehouse. MAIDS will always be striving to reduce this cost so the company can ultimately achieve greater profits. For most products, one can estimate the suggested sales price to be 3-5 times the landed production cost. The landed production cost will definitely be the most important cost since it determines the profit, sales price and inventory cost of the MAIDS system. Some of the many costs that make up the landed production cost include:

1. Electronic Costs
2. **PCB production and assembly**
3. **Injection molded plastic parts**
4. **Final Product Assembly**
5. Testing
6. Packaging
7. Returns
8. Freight
1. Duties

12.3 Retail Package Development

The retail package is just as important as the product itself. Sometimes it is even more important. One can have the greatest product in the world but if the retail package does not convey this point to the customer, the product will not sell. Since the MAIDS device is small it is recommended that clamshells be used. Clamshells consists of two parts: a custom shaped plastic piece to hold and protect the product, and a cardboard artwork piece to convey the sales message. A reduction in cost can be achieved by using a custom molded blister (the part of the clamshell that custom fits over your product). Blister packaging is an inexpensive option for creating packages that are durable, transparent, and tamper proof. In addition, the clamshell insert card can also be printed on regular paper prototypes to reduce costs further.

12.4 MAIDS Retail Price Determination

Choosing MAIDS retail price is a very important consideration that should be addressed promptly. If the price is too low, the MAIDS project would not make sufficient profit. If the price is too high, the MAIDS device will not sell. The strategy for the MAIDS device is to set the price high so that if need be the price could be lowered later on. This is a tricky situation because if the price is too high sales might not recover even after lowering the price. In order to estimate the optimal price for the MAIDS device it is imperative to know how much the device costs to make. Calculating the cost of the device is called Cost-of-Goods-Sold (COGS). In order to calculate the COGS all the costs to produce the MAIDS device are added up. These costs include the following:

1. Electronic components (sensors, connecting wires and pins)
2. Production of your Printed Circuit Board (PCB)
3. PCB Assembly (soldering of components onto the PCB)
4. Enclosure Plastic Parts (injection molded plastic)
5. Product assembly
6. Product testing/Quality control
7. Import and/or export duties and taxes
8. Warehousing and logistics

Estimation of the abovementioned costs allows one to decide if the MAIDS device will be profitable before spending money in development.

12.5 Product Positioning

The MAIDS device will target the elderly market. This demographic market includes elderly families that want a trained professional installing their alarm system in a large home with a substantial number of doors and windows and a secluded garage door. At the same time, one must not alienate the millennial and younger generation since they are the homeowners of the future.

12.6 Distribution strategy

Initially, the best distribution strategy for the MAIDS device is web-based. In other words, sell the MAIDS device via a website. Selling the product in this manner will increase profits more than selling it through a retail store because one can charge a lower price; the profit margin is greater without a retailer taking a cut. Eventually, MAIDS is likely to move up to selling in retail outlets and through multiple distribution channels.

A Family Security Blog (FSB) can greatly assist in building brand awareness and product audience. Within the blog, one can provide valuable free content, such as, MAIDS product information, discussions regarding the alarm industry and areas of expertise. The point of the blog is to present the MAIDS project as an expert in the field, collect email addresses for advertising and selling purposes, product validation and obtain feedback on the product.

12.7 Social Cost of Mass Production

There are political, economic and social costs that need to be taken into account as a responsible MAIDS device manufacturer. These costs include:

1. Misuse of natural resources
2. Pollution generated by factories and transport of goods
3. Pollution generated by plastic
4. Electronic Waste Created
5. Greenhouse gases generated
6. Water Pollution

These factors must be given careful consideration because of the political, social and economic problems that might arise.

Therefore, taking a responsible approach to MAIDS manufacturing the MAIDS project assumes an extended producer responsibility (EPR). ERP is a "...practice and a policy approach in which producers take responsibility for management of the disposal of products they produce once those products are designated as no longer useful by consumers. Responsibility for disposal may be fiscal, physical, or a combination of the two." (Surak, 2020)

12.8 Minimizing Risk

The MAIDS device is successful if the costs and time put into it are minimized from the very beginning. The MAIDS project minimizes risk by employing the following criteria:

1. Minimize complexity by using modules (i.e. sensors, LED module, etc.)
2. Use standardized communication protocols such as Wi-Fi or Bluetooth that require standard electronics
3. Use pre-certified and tested modules
4. Minimize Certification Costs
5. Review the MAIDS device with an independent engineer to mitigate issues.
6. Review it to make sure that there aren't any issues.
7. Simplify the Enclosure
8. Focus on minimizing the total cost you have to spend upfront