

**Viability of the Proposed Solution**

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| IntroductionTo develop or not to develop the product – that is the question. Often, the decision not to develop a product is financial – based on a thorough analysis, it is determined that the anticipated income from the product cannot support the anticipated cost of development. However, if a financial analysis indicates that the sales of a new product (when compared to the cost of development) could potentially produce an acceptable profit, you must ask, “*Should* the product be developed?” But this is not always an easy question to answer. A designer or engineer has an ethical responsibility to his client, his profession, and to society. In light of these responsibilities, the designer should consider all potential consequences, good and bad, resulting from development of a product and then compare the benefits of product development to potential negative impacts. Do the benefits outweigh the risks? Is continuing with product development the right thing to do?The design, manufacture, packaging, distribution, and use of any new product will result in consequences, both positive and negative. These consequences are far reaching and wide ranging. For example, will the manufacture and distribution of the product consume nonrenewable natural resources or produce pollution? How will the development of the product affect the workers that will help produce, transport, and sell the product? What affect (intended or not) will the use of the product have on the consumer, the environment, and society? On the other hand, development of the product may create jobs, use abandoned facilities or discarded waste materials, and improve the lives of people. The considerations mentioned above assume that the product is well designed and functions as intended. However, another important ethical responsibility of the designer is to ensure that the product is well designed and does not suffer unintended failure. What will happen if your product does not work as intended or suffers a catastrophic failure? Will the failure cause harm? It is important that the designer has the knowledge and expertise, or seeks out people with that knowledge and expertise, to properly design the product in order to minimize the risks of failure.In this activity you will consider the consequences of your product design, compare the positive and negative impacts, and assess the ethical implication of continuing to develop your product.Equipment* Engineering notebook
* Internet access
* Access to trade journals, magazines, newspaper, and other printed material
* Product Lifecycle handout (from Lesson 1.1)
* Product working drawings

ProcedureWork together as a team to complete the following.1. Revisit the Project Proposal that you created and your design specifications. Consider the technical expertise and knowledge that is required to properly design your product. Has your team acquired the math, science, and engineering knowledge necessary to properly design your product? Have you contacted experts in order to gain the necessary knowledge or obtain assistance with the parts of the design that your team is not well equipped to perform? It is impossible to include an exhaustive list of math, science, and engineering principles that you should incorporate into the design of your product because each product design will require consideration of different concepts. The following list is intended only to get you thinking about concepts that you may need to investigate further.
	* Loads. How will loads be transferred from the environment to your product, and how will loads be transferred within your product? Will the loads be static (unchanging) or dynamic (changing)? How can you calculate the loads? Will the components of your product be able to withstand the magnitude of these loads?
	* Materials. Will your choice of materials withstand the test of time? Will the density/weight of the materials adversely affect your design? Will mechanical properties of your materials provide sufficient strength, stiffness, and abrasion resistance? Will the material be able to withstand repetitive loading without premature failure? Will the material operate well within the range of temperatures to which the product will be subjected? How will the material react to sunlight, temperature variations, chemicals to which it will be exposed?
	* Mechanical Engineering. Does your design require an input of heat or mechanical power? Are there moving parts in your design? What simple machines are employed in the design? Will all the components of your product interact effectively? Will the loads be efficiently transferred from part to part? Do all the parts move at an ideal speed?
	* Energy. Does your product require an input of energy? In what form is the energy supplied? How is it converted by your product to produce the desired output?
	* Chemical/Bio Engineering. Does your design involve conversion of raw materials to another form during manufacture or use? What chemical or biological transformations are involved in the process(es)?
	* Electrical Engineering. Will your design involve electricity, electronics, control systems, telecommunications, or computers? How will these systems be integrated into your design?
2. Have you researched laws, codes, and regulations that could potentially impact your design? Do you feel that your team has met its ethical responsibility for technical expertise related to the design of your product? If not, perform additional research at this time. Revise your product design as necessary.
3. Create a graphic to document your product’s anticipated lifecycle. Research the efforts necessary to take your product from raw materials to the end of its lifecycle (and potentially be reused or recycled into new products). Detail each phase of the cycle with information specific to your product. For example, in the Raw Material Extraction phase, indicate the raw materials that must be obtained in order to create your product. In the Material Processing phase, detail the processes necessary to convert the raw materials to usable substances in your product. In the Assembly and Packaging phase, detail the anticipated method of assembly (one-off, hand assembled, human assembly line in a large manufacturing facility, fully automated robotic assembly, etc.) and the anticipated type of packaging that will be used.
4. Consider the consequences of the development of your product at each phase in its lifecycle to people (designers, users, nonusers, employees of the manufacturers, distributors, sellers, etc.), the environment (including the use of nonrenewable natural resources; the potential release of toxins, waste, or pollution; the creation of visually unappealing facilities or noise pollution; the effect on animal and plant species, etc.), and society.
5. Compose an ethical justification for further development of your product by describing why and how the benefits of your product outweigh the negative impacts.

Conclusion1. What are some potential ways in which your product could fail? What design features have you included to minimize the chance of failure?
2. Is development of a product that knowingly causes harm to people ever ethically justifiable? Why or why not? Give examples to support your position.
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