



Product Development & Sourcing

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- B.S. Mechanical Engineering, Clemson University 1995
- Machine Design (Mech. and Elec.), Product Design, Project Management

APTUS DesignWorks, Inc.

- Founded 2007
- Currently 2 full-time B.S.M.E.
- Maryville, TN
- Provider of Machine Design & Product Design/ Development Services



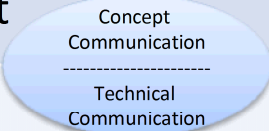

Product Development & Sourcing

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Stages of Product Development

The following stages will generally occur in all development projects. They will not necessarily occur in this order and will usually not occur distinctly from one another.

Stage	Contents	Profit Potential
Inspiration	"I have an idea..." 	None
Concept Development	Make it a <i>good</i> idea 	None
Specification	<u>Define</u> it so you can <u>Communicate</u> it 	Licensing (if it is patented)
Design	<u>Refine</u> it and <u>Document</u> it	Sell design (if it is documented)
Sourcing	<u>Make It!</u> 	Sell Product

Key Points:

- Know what stage you are working in
- Be intentional about effort at each stage to avoid backtracking (wasting time)
- Include time and \$ for each stage in business plan

Design & Engineering Resources

“Free” Design (design by potential supplier)

- There are no free lunches. Technical work is usually worth what you pay for it
(If design service is good quality, you will pay in the form of increased piece cost)
- Design biased towards advantages for supplier
 - Materials easy to work with, shape easy or fast to make
 - Design fits with supplier’s existing equipment or processes
 - Requirements allow for extra tolerance in manufacturing to avoid rejects
- Who owns the resulting documentation (Who has the documents)
- Future product changes or supplier switch is more complicated

Do-It-Yourself Design (design by non-specialist)

- Primary DIY cost is time, while contracting design costs \$ now
- Can increase schedule dramatically. Can increase manufacturing costs due to expensive design details.
- May be very educational and rewarding for inventor!

Contract Design (design by hired specialist)

- Individual designer may provide personal service, low cost
- Small design company may provide accessibility, flexibility, personal service
- Large design company may have best resources, specialists, industry contacts

Invention Promotion Firms (design contracted by promoter)

- Beware! Most IPF’s make \$ from inventor’s optimism, not from inventor’s success (profits)



How to Choose?





- Do you have more time or more \$?
- Ask about their experience with a product similar to yours
- Ask for References
- Talk to those References!

Engineer or Designer?

For protection of public from structural failures etc., TN law allows only state licensed Professional Engineer (P.E.) to use term “engineer”. Ask designers about education and experience.

Prototypes, Samples, and Product

Each has an important but distinct place in your product development plan:

Type	Characteristics	Purpose	How to Make	Example
Prototype	Mock-up or Concept Model	Evaluate Feasibility, Confirm ergonomics, Market test (external)	Wood, Cardboard, Glue, Erector Set, Rapid Prototype, Breadboard (for electronics), Modify existing products...	
	Functional Prototype	Prove technology, evaluate real-world performance		
Samples	Identical (at least externally) to final product	Attract interest of retailers or final customers. Refine marketing plan.	Volume manufacturing (RP with finishing, machine shop...)	
Product	Ready to ship or put on shelf (includes packaging, instructions, etc.)	To sell!	Volume manufacturing	

Tip: Think twice before sending prototypes to potential customers if there is a chance they will be misled about final product!

The Importance of Documentation

1. Record your Development History

- Critical for establishing date of conception if needed during patent process
- Cherished by your grandkids

2. Protect your Intellectual Property

- Technical Documents (written specification)
- Technical Drawings
 - Identifying # including Revision Level (rev 0, rev A, rev B...)
 - Drawings in multiple files formats (.dwg and .dxf for CAD, .stl for RP, .ai for graphics, .pdf for others)

3. Improve your Efficiency

- Avoid costly errors (it's amazing how fast \$ can be wasted in volume mfg)
- Avoid delays due to confusion and lost information

APTUS Tip for Engineering Documentation

Mark every piece of paper at top with:

- Project name or number
- Your Name or initials
- Date (including year!)
- Subject of page

Discipline is all it takes to avoid errors and time wasting!

Documentation Value

Ranked from Lowest to Highest:

- Napkin Sketch
- Loose pages
- Loose pages, marked & labeled
- Bound book of labeled data
- Technical drawing (electronic)
- Provisional Patent
- Patent

Selecting & Managing Suppliers

1. Local Advantage

- A local supplier will be more readily accessible and can reduce shipping and logistics costs
- Supporting your local community and generating new contacts can help your business in unexpected ways.

2. Foreign vs. Domestic

- Foreign manufacturing almost always has pc cost advantage for high-volume products
- Foreign source will generally take more time to achieve 1st acceptable shipment
- Good communication and clear documentation is key to successful offshore sourcing
- Many small companies spend more in scrap, delays, logistics, and lost customers than they save

3. Quality, Price, Service balance is always a compromise in any purchasing decision.

- The key is to know which one is least important to your business (based on your abilities and sophistication before you decide it is service or quality)
- If you must have all 3, then go back to the drawing stage!

Schedules and Lead Times

In general, a development process will take 2x as much \$ and 4x as much time as originally estimated. Why?

Not because engineers are liars or incompetent at estimation. This is usually due to “scope creep”: the tendency for work volume to expand throughout a project due to lack of a good specification from the beginning.

Quality Control

Quality must be defined in documentation (spec. or dwgs) and communicated to supplier in contract (T&C or PO).

- What is requirement?
- What is the tolerance?
- What is measurement or judgment method?
- What to do if product fails test?

Materials & Processes

Certain materials and manufacturing processes lend themselves to a particular production volume level or cost point. *The following is offered as a rough guide only:*

Materials		Process	Quantity	Tool Cost \$	Piece Cost \$	Example
Metal	Steel	Stamping, Forging	10k – 1M+	\$10k - 100k	\$0.10 - \$5	Auto exhaust bracket
		Machining	10 – 1k	\$0 - \$1k	\$1 - \$100	Precise machine component
		Welding	10 – 1k	\$0 - \$1k	\$10 - \$1000	Dune Buggy frame
	Aluminum	Die Casting	10k – 1M+	\$10k – \$100k	\$1 - \$10	Water pump housing
		Sand Casting	100 – 1k	\$1k – \$10k	\$10 - \$100	Transmission Bellhousing
		Extrusion	1k - 100k	\$1k - \$5k	\$0.10 - \$10	Aircraft spar
		Billet CNC	10 – 1k	\$0 - \$1k	\$10 - \$50	Auto bling
Plastic	ABS	Molding	1k – 1M+	\$1k - \$50k	\$0.10 - \$5	Toy, Camera housing
Composites	Fiberglass	Chopper gun	100 – 10k	\$10k	\$100 - \$1k	Boat hatch
	Carbon Fiber	Hand lay-up	100 – 10k	\$10k	\$1k - \$2k	Car hood
Natural	Wood	Saw, Glue, Screw	10 – 1k	\$0 - \$1k	\$10 - \$100	Chair frame

Summary

My observation:

The 3 most important ingredients to your success as an individual inventor:

1. Focus – knowing what you are trying to do and not being distracted by other opportunities
2. Perseverance – consistent effort over an extended period of time, probably longer than you're thinking
3. Investment of time and \$ – yours and others

Recommended Reading:

The Mechanical Design Process by Geoffrey Boothroyd

Any Questions?