

The Engineering Entrepreneur

A Vision for the Future of Engineering

Dr. Mark Polczynski

Cell: 262-364-6609

www.technologyforge.net/mark.polczynski

Situational Analysis - What's Going On Here?

- Companies are striving to reduce tangible assets: buildings, machines, people – including high-cost engineering staff, and...
- Continuing development of **strong, accessible** technical capabilities in so-called “low cost counties” (LCCs) leads to...
- Outsourcing of high-tech, high-skill, high-value jobs to LCCs:
 - ~ Manufacturing (done),
 - ~ Services (done),
 - ~ Product design and development (in process),
 - ~ Technology development (next).

This is the future, so let's get used to it!

What Does This Mean For Engineers?

- Low cost countries (LCCs) provide “virtual global design-manufacturing-service factories” capable of providing almost anything at high quality and low cost.
- **So what’s left for non-LCC (e.g., U.S.) engineers to do?!**
- The global economy runs on a continuously-upward-spiraling produce/consume cycle (grow or die).
- The **winners** are the companies that continuously come up with **new** products and services for people around the world to buy (innovate or die).

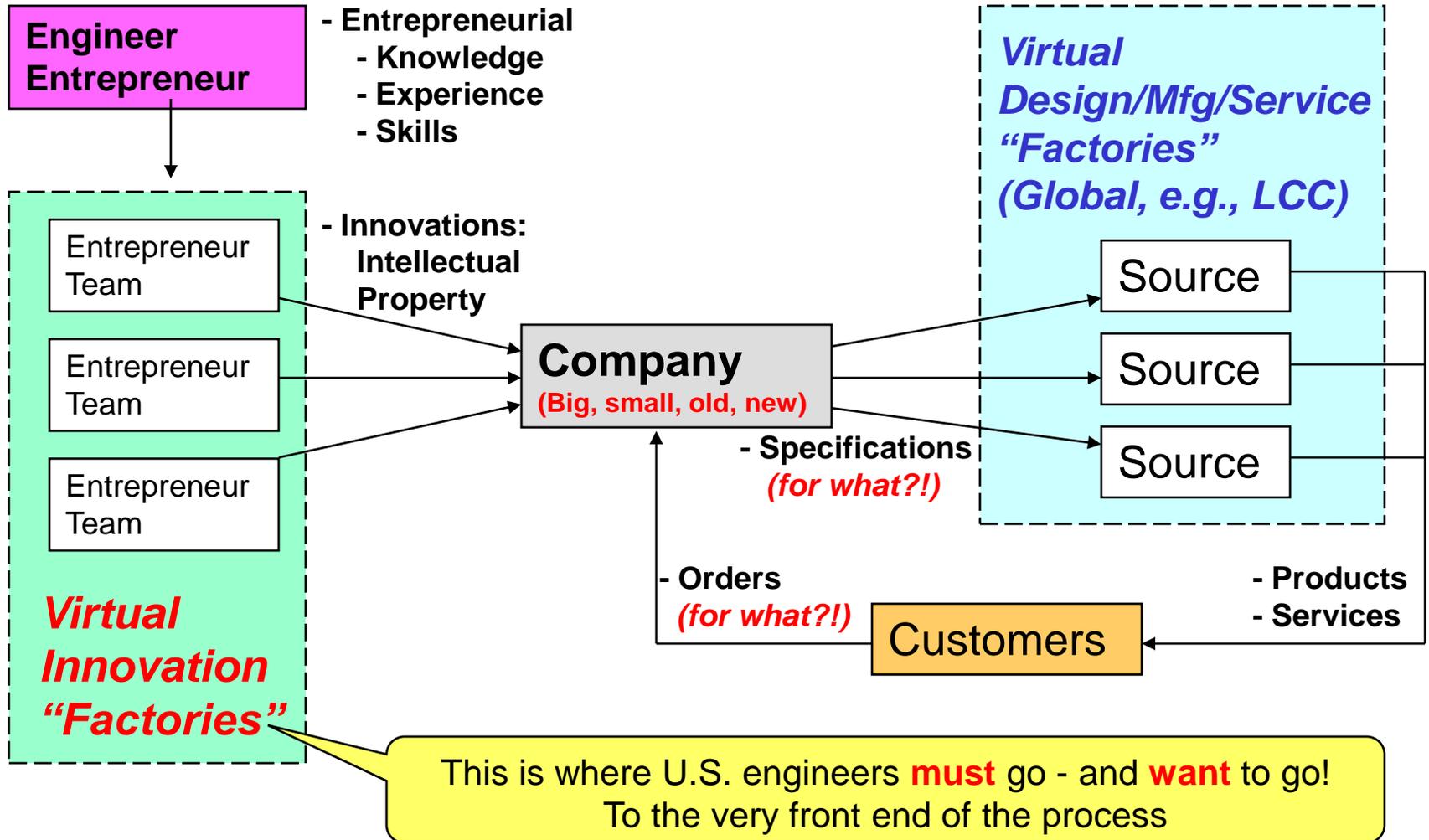
What Does This Mean For Engineers?

Question: **Who** is going to come up with all this wonderful new stuff?

- ~ People around the world are increasingly ready and able to buy it,
- ~ Suppliers around the world ready to design/manufacture/service it,
- ~ But what is **IT**?!

Answer (Partial): **Engineer entrepreneurs** will feed a continuous flow of new products and service **innovations** (in the form of intellectual property) into these “virtual global design/manufacturing/service factories”.

A Simple Model for The Future...



What is a “Virtual Innovation Factory”?

- Virtual, global, multi-function team, includes engineering entrepreneurs and other critical entrepreneurial functions, e.g., marketing, finance, project management, etc...
- Work **for** companies, but some or all may or may not be company employees -
 - Could be employees,
 - Could be contractors or consultants,
 - Could be self-employed entrepreneurs,
 - Could be part of an entrepreneurial agency working for the company
 - The point is that, in essence, **it doesn't matter** which particular company the virtual innovation factory feeds into.
- Responsible for feeding innovations into companies, who then secure the best “virtual design/manufacturing/service factories” (global, primarily LCC-based) to produce and deliver required products/services to customers.
- Primary product output of virtual innovation factory is clear, concise, complete specification describing products and technologies to be produced by virtual design/manufacturing/service factories.

A New Type of Engineer for Virtual Innovation Factories

- No more 30-year tenure-track jobs for engineers,
- Instead, engineers will be members of entrepreneur teams that form a key component in “virtual innovation factories”,
- Teams will be formed and then disbanded (3-12 month) as innovations are passed on to “virtual design/manufacturing/service factories”.
- Primary purpose of the teams will be to rapidly and continuously **fill the front end of the pipeline with innovations** that fuel local and global economies.
- To be effective contributors to these teams, **engineers** must become **entrepreneurs**, i.e., must know exactly:
 - What to invent,
 - Why it should be invented,
 - Who will actually buy the invention,
 - What to do with the invention after it is invented,
 - How to make money off the invention.

Which is the tail and which is the dog?

- As we said, LCCs provide “virtual global design/manufacturing/service factories” capable of providing almost anything at high quality and low cost.
- It seems that LCC production behemoths are capable of crushing any attempt to reverse the movement of high-tech, high-skill, high-value jobs.
- But when these production engines don’t have raw materials to digest, they starve and die.
- ***The most valuable raw material of all is innovation*** – viable new product, service, and process concepts.
- In this sense, the best miners of innovation are the big “winners” here.
- It is the role of the engineering entrepreneur to generate and transfer this most valuable raw material.

What is the impact on the education of engineers?

- No more on-the-job “osmotic” training to learn the new skills that allow engineers to remain viable in the job market.
- Assignment rotation and other development opportunities for the fast-track chosen few only. The rest are expendable (up or out – fill from the bottom).
- Employers are outsourcing engineer training/development, too!

-
- Engineers must be self-sufficient, self-sustaining lifelong learners responsible for expanding their knowledge, experience, and skills as ***entrepreneurial engineers***.
 - Engineers must be capable of ***immediately and effectively*** applying entrepreneurial skills as they join teams – must hit the ground running.
 - The engineer as entrepreneur:
 - Must learn how to ***run*** an innovative business,
 - Must learn how to ***be*** an innovative business.

Where Does the College Fit In?

- Just as LCC suppliers are becoming more and more difficult to compete with for design, manufacturing, and services...
- ...so too will **LCC universities** become difficult to compete with in terms of providing high-quality low-cost engineering education (and high-quality low-cost engineers)...
- ...in **fundamental** science, technology, and engineering disciplines (although prestige still gives U.S. universities the edge)...
- ...but the field of entrepreneurial engineering provides an area of **differentiation** for non-LCC universities.

It makes good business sense for U.S. engineering colleges to move into the engineering entrepreneur education market

How Can the MSEM Program Respond to the Changes in the Engineering Profession?

Focus more heavily on “***What-To-Do Engineering***”:

Filling the front end of the pipeline -

1. Combining ability to identify, acquire, develop, protect, and transfer technology (***engineering***)
2. With ability to generate new technology-based opportunities (***entrepreneurial***).

How is This Different Than What We Have?

- ***Entrepreneurs*** help ***build*** new pipelines,
This is the focus of entrepreneurship-oriented MBA programs.
- ***Engineering managers*** help ***run*** the pipelines,
This is the primary focus of the ***current*** MSEM Program.
- ***Entrepreneurial engineers*** help ***fill*** the pipelines.
This is the area that we propose to emphasize.

Who Is ALREADY Doing This?

A *partial* list of schools with entrepreneurial engineering elements (2004).

- University of Southern California
- Stanford
- Purdue
- Case Western
- Penn State
- Rose-Hulman
- Lehigh University
- University of Dayton
- Cornell University
- University of Maryland

A Step Toward Entrepreneurial Engineering:

COE Engineering Innovation (ENIN) Certificate (select four)

[ENMA 283](#) - Innovation and Technology

[ENMA 286](#) - New Product and Process Portfolio Management

[ENMA 287](#) - Front-End Engineering Product Development

[ENMA 288](#) - System Design, Modeling, and Analysis

[ENMA 289](#) - Intellectual Property Generation and Protection (proposed)

[ENMA 291](#) - Engineering Innovation and Entrepreneurship

Example of Entrepreneurial Engineering Curricular Element: The Technology Commercialization Prospectus

Primary deliverable for ENMA 291 Engineering Innovation and Entrepreneurship student team project. Purpose is to answer questions such as:

- If this is such a great technology, why aren't we using it now?
- Would you take a second mortgage out on your house to develop it?

Student team is presented with a promising technology and performs an assessment of whether the technology can support viable new opportunities. The TCP consists of three critical elements:

- What is the problem we are solving, and why do we need to solve it?
- How does the technology being assessed solve the problem?
- Why is it better than any current solutions?
- What are the challenges to creating solutions based on the technology?