

Entrepreneurship in Engineering Education

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The Entrepreneurial Mindset

“Individuals who exhibit the behavior of an entrepreneur where this behavior consists of the following characteristics: opportunity recognition and goal orientation, taking initiative and personal responsibility, persistent problem solving, realism and a sense of humor, internal focus of control and risk taking.”

Donald Kuratko, Ph.D.

Entrepreneurship: Theory, Process and Practice

The Entrepreneurial Engineer

“... today’s engineers . . . requires a more venturesome attitude and approach. Increased competition places enormous pressure on companies to continue to improve and innovate in creating new product lines, acquiring new customers, adopting new technology and implementing better business practices.”

David E. Goldberg, The Entrepreneurial Engineer

Entrepreneurial Engineers

- Recognize the opportunity and take appropriate action
- Demonstrate value to the organization by understanding the business and the corporate agenda
- Learns to apply technology effectively
- Listens to and understands the customer
- Effectively defines the problem or situation and provides leadership in reaching a solution
- Must be naturally curious and will to explore
- Recognizes that speed to market with products and a much shorter life cycle is reality.

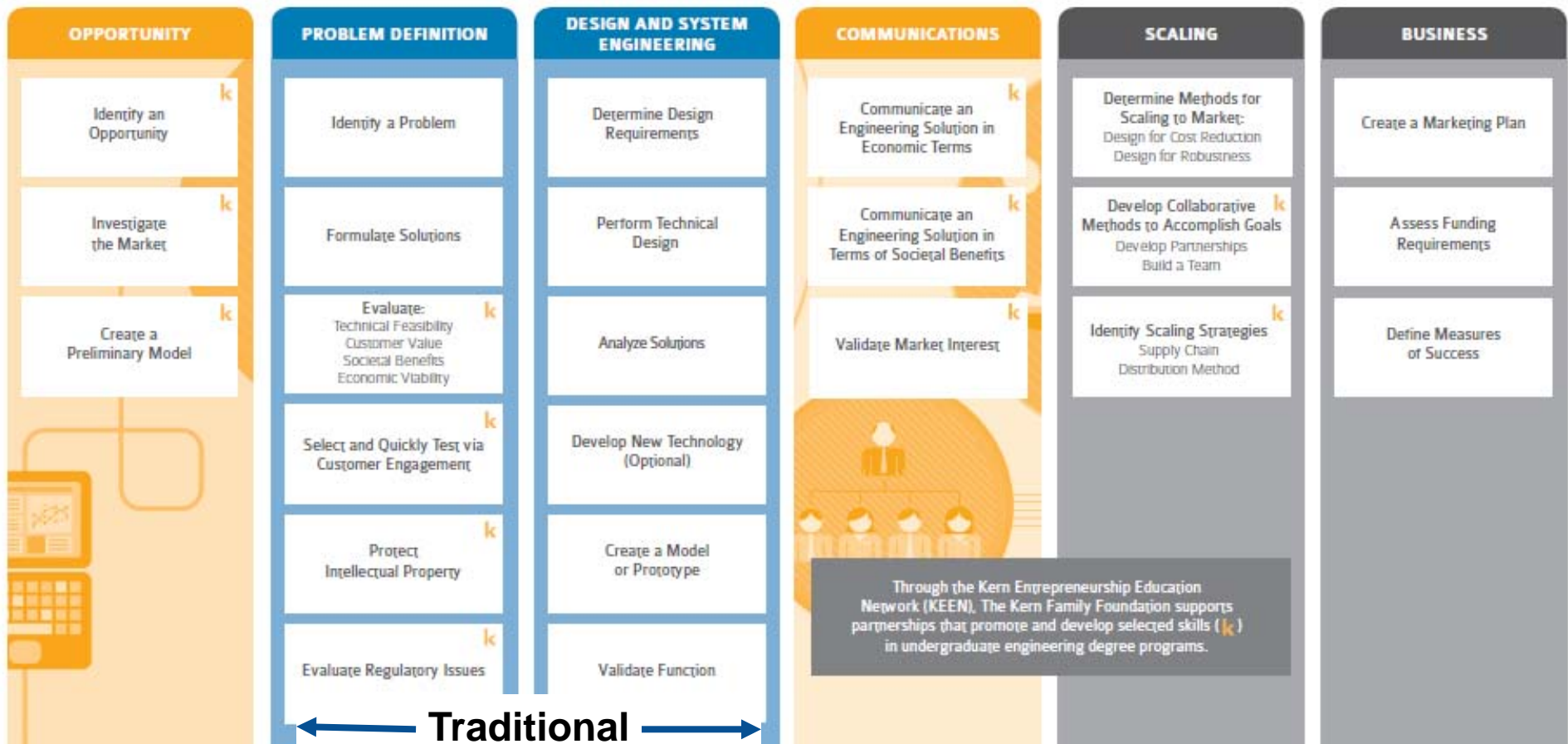
Dawn Tabat, COO, Generac Power Systems

Skills from Opportunity to Business

Engineering and business skills, when practiced within a culture of entrepreneurship, foster entrepreneurial thinking and the mindset of the Entrepreneurial Engineer

Skills from Opportunity to Business

ENTREPRENEURSHIP



← Traditional →

Entrepreneurial Mindset – Student Outcomes

<p>Entrepreneurial Mindset</p>	<p>Enterprising Attitude</p>	<p>Exercise curiosity about the surrounding world</p> <p>Define problems, opportunities, and solutions in terms of value creation</p> <p>Assess risk</p> <p>Persist through and learn from failure</p> <p>Demonstrate resourcefulness</p> <p>Anticipate technical developments by interpreting surrounding societal and economic trends</p> <p>Identify new business opportunities</p> <p>KSO 1</p>
<p>coupled with</p> <p>Engineering Thought and Action</p>	<p>Multidimensional Problem Solving</p>	<p>Apply creative thinking to ambiguous problems</p> <p>Apply systems thinking to complex problems</p> <p>Examine technical feasibility, economic drivers, and societal and individual needs</p> <p>Act upon analysis</p> <p>KSO 2</p>
<p>expressed through</p> <p>Professional Skills</p>	<p>Productive Collaboration</p>	<p>Collaborate in a team setting</p> <p>Understand the motivations and perspectives of stakeholders</p> <p>KSO 3</p>
<p>Professional Skills</p>	<p>Illuminating Communication</p>	<p>Communicate engineering solutions in economic terms</p> <p>Substantiate claims with data and facts</p> <p>KSO 4</p>
<p>and founded on</p> <p>Character</p>	<p>Resolute Integrity</p>	<p>Pursue personal fulfillment as a member of a profession that creates value</p> <p>Identify personal passions and a plan for professional development</p> <p>Fulfill commitments in a timely manner</p> <p>Discern and pursue ethical practices</p> <p>Contribute to society as an active citizen</p> <p>KSO 5</p>

Enterprising Attitude

- **Exercise curiosity about the surrounding world**
- **Define problems, opportunities, and solutions in terms of value creation**
- **Assess risk**
- **Persist through and learn from failure**
- **Demonstrate resourcefulness**
- **Anticipate technical developments by interpreting surrounding societal and economic trends**
- **Identify new business opportunities**

Multidimensional Problem Solving

- Apply creative thinking to ambiguous problems
- Apply system thinking to complex problems
- Examine technical feasibility, economic drivers, and societal and individual needs
- Act upon analysis

Productive Collaboration

- Collaborate in a team setting
- Understand the motivations and perspectives of stakeholders

Illuminating Communication

- Communicate engineering solutions in economic terms
- Substantiate claims with data and facts

Resolute Integrity

- Pursue personal fulfillment as a member of a profession that creates value
- Identify personal passions and a plan for professional development
- Fulfill commitments in a timely manner
- Discern and pursue ethical practices
- Contribute to society as an active citizen

Traditional Engineering Education

- Identify and Define a Problem
- Determine Design Requirements
- Perform Technical Engineering Design
- Develop New Technology
- Create a Model or Prototype
- Validate Function
- Design for Cost Reduction
- Design for Robustness

Non-Traditional Engineering Education

- Identify the Opportunity
- Investigate the Market
- Create Preliminary Business Model
- Engage in Ideation Process Toward a Solution
- Evaluate: Technical Feasibility, Create Customer Value, Societal Benefits and Economic Viability
- Select and Quickly Test via Customer Engagement
- Protect Intellectual Property
- Validate Market Interest
- Communicate an Engineering Solution in Economic Terms
- Communicate an Engineering Solution in Terms Societal Benefits

Creating an Engineering Entrepreneurial Curriculum

- Modification of existing courses – Engineering and Non-Engineering
- Applying Active Collaborative Learning and Problem Based Learning
- Engaging Entrepreneurial Alumni in the Learning and Coaching
- Creating a Certificate of Entrepreneurial Engineering Skills
- Imbedding Entrepreneurial Content in Senior Design Projects

Engaging Employers in the Process

- Entrepreneurial Internship Programs
- Speakers – Entrepreneurial Venture Series
- Review existing entrepreneurial and intrapreneurial curriculum
- Develop recommendation for new course material including Problem Based Learning exercises
- Identify alumni employee who have contributed to the development of new products and intellectual property

Engaging Entrepreneurial Engineering Students

- Entrepreneurial student organizations
- Funding prototypes
- Fostering intellectual property development
- Developing student competitions that include creative problem solving and innovative thinking
- Recognizing engineering students who are engaged in opportunity recognition
- Engaging an Entrepreneurial Engineer in Residence

Entrepreneurial Mindset

- New course to foster the Entrepreneurial Mindset for Engineers
- Problem Based Learning – Tires, Tires, Tires Everywhere – What shall we do?
- Corporate Support
- Alumni Engagement
- Entrepreneurial and Intrapreneurial Skill Development
- Individual Opportunity Recognition and Validation

Entrepreneurially Minded Engineers

“Being an entrepreneurial engineer in more than knowing engineering – it’s understanding customers and markets, how they behave and what drives them and know yourself.”

Thomas Nealssohn, Director
Research and Innovation
Masco Corporation

Why companies want to hire Entrepreneurial Engineers?

“Established companies have many subject matter experts that can teach you about how market behave and to see what customers really need- not just want.”

Entrepreneurial Engineering Education

- “Entrepreneurship education teaches engineering students in all disciplines the knowledge, tools, and attitudes that are required to identify opportunities and bring them to life.”
- Students who take part in entrepreneurship programs as undergraduates gain insights not available from traditional engineering education, such as understanding and designing for end users (empathy”) working in and managing interdisciplinary team , communicating effectively, thinking, understanding business basics, and solving open-ended problems (ABET 1995; NAE2004

References

- The Entrepreneurial Engineer – David Goldberg
- Entrepreneurship: Theory, Process and Process, Donald F. Kurakto, Eighth Edition, Southwestern
- Kern Entrepreneurship Education Network and the Kern Family Foundation
- Thomas Nealssohn, Director of Research and Innovation, Masco Corporation,
- National Academy of Engineering -2004
- ABET, 1995
- Lawrence Technological University, College of Engineering, Southfield, Michigan - USA

Thank you

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