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Engineering Leadership Course

Case Study Instructions and Guidelines

As a group, for the case study at the end of the chapter do the following activities:

1. Each student individually read the case study
2. As a group, discuss
    a. Determine the challenge/problem that was facing the engineering leader in this case study
    b. What is the context of the problem
    c. What principles of engineering leadership are demonstrated in how the challenge/problem was addressed?
    d. What key facts or factors should be considered?
    e. What alternatives are available to the decision-maker/Engineering Leader?
    f. What would you recommend — and why?
3. Prepare a written response to the items above and submit it at the end of class today
4. As a team, share the items above in a presentation to the class during the next class period

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Engineering Leadership Book Notes: Chapter 2

THE ROLE OF CREATIVITY AND INNOVATION IN LEADERSHIP

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Introduction

- Innovation is widely heralded as essential for successful competition in the increasingly global economy.
- However, to enhance innovation in education, organizations and countries require transformative thinking.

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Evolution of Innovation

- The principles associated with innovation can be applied to organizations, individuals, and product development.
- These three categories of innovation can also be applied simultaneously to create a "culture" where individuals are continually seeking to be innovative and create enhanced product outcomes.
- The meaning of innovation has evolved with U.S. Federal funding agencies as well.
- The quick transition of the NSF's innovation core and its desire to swiftly convert new knowledge into new products and services is solid evidence of change.

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Discussion of I-Corp program and related NSF initiatives

- America's affluence grew in part from the capability to profit economically on groundbreaking developments from science and engineering research.
- At the same time, a well-informed, imaginative labor force has maintained the country's international leadership in significant areas of technology.
- These essential discoveries and competent labor force resulted from substantial, incessant investment in science and engineering.

NSF I-Core Program

- The objectives of this program are to encourage translation of fundamental research, to facilitate collaboration between the academic world and business, and to train students to comprehend innovation and entrepreneurship.
- The rationale of the NSF I-Corps program is to spot NSF-funded researchers who will obtain extra support—in the form of mentoring and funding—to hasten the conversion of knowledge derived from essential research into up-and-coming products and services that can attract successive third-party funding.

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About NSF

- The NSF is an autonomous federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75).
- The act states the function of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering" [7].

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Public Attitudes Towards Federal Funding of Scientific Research

- All indicators point to general support for government funding of essential research.
- In 2001, 81 percent of NSF survey respondents agreed with the following statement: "Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the Federal Government" [13].
- The level of agreement with this statement has consistently been in the 80 percent range.

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Evolution of Innovation

- Definitions of innovation differs but the general thread among these definitions is that innovations present a new or better product, service, or resource that adds "value" to those seeking it.

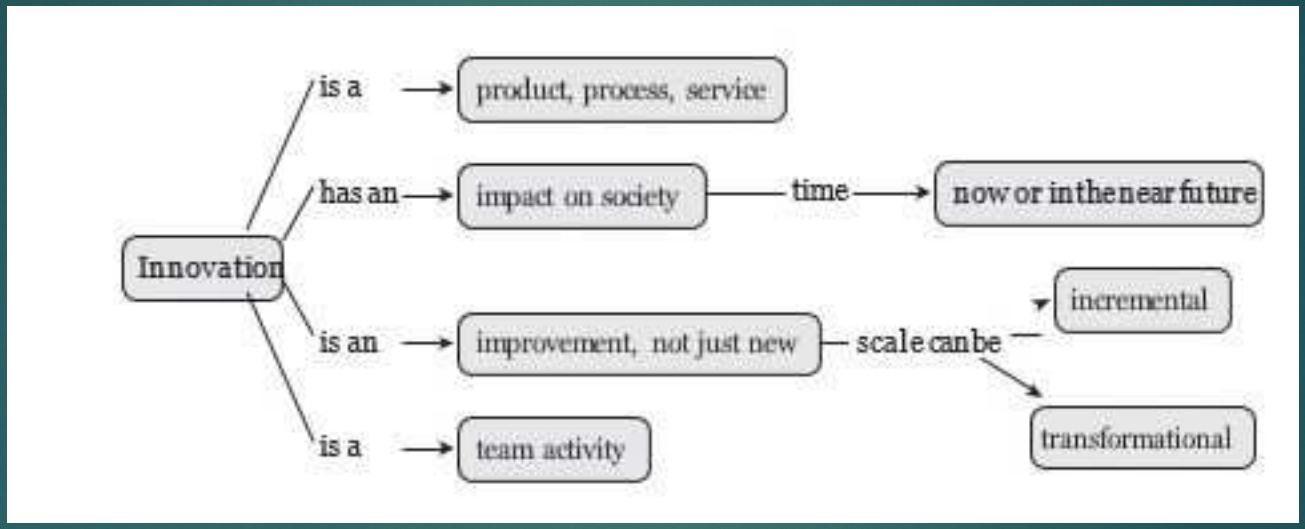
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Characteristics of Innovation

- Innovation Provides Societal Value
- Innovation is an Improvement
- Innovation Occurs at the Interfaces of Different Disciplines
- Teamwork is Important to the Process of Innovation
- Innovation is Part of an Invention-Value Continuum

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Characteristics of Innovation



Characteristics of innovation. (From National Academy of Engineering, *Educate to Innovate*, National Academies Press, Washington, DC, 2015, p. 11)

Innovation Provides Societal Value

- The innovation must be supportive to society.
- It's great if one makes an invention, but it's even better if the invention can be used to develop individual lives.

Innovation is an Improvement

- Innovations are naturally seen as “something new.”
- Nevertheless, all the interviewees and workshop participants accentuated that innovations are improvements, not necessarily just new.

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Innovation Occurs at the Different Faces of Discipline

- Innovators in all the areas represented, that is, academia, large companies, small businesses, and the arts acknowledged that innovation occurs at the edge of disciplines and necessitated the synthesis of knowledge from dissimilar fields.

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Teamwork is Important to the Process of Innovation

- Innovation is the effect of joint effort, a point frequently made by the innovators.
- And it relies on the work of the team as a whole, not the work of one key innovator and other "supporters."

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Innovation is a Part of an Invention Value Continuum

- Innovation is part of a field between invention and worth.
- Innovators may start with a discovery and then innovate to generate value from it, or start with a problem and solve it innovatively.

Types of Innovation

1. Product innovation
2. Process innovation
3. Service innovation

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Product Innovation

- Product innovation is about making valuable changes to material products.
- Interrelated terms that are frequently used interchangeably comprise *product design*, *research and development*, and *new product development* (NPD).
- All of these terms proffer a particular viewpoint on the degree of alteration to products.

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Product Development Process

a. Ideation
b. Preliminary investigation
c. Detailed investigation
d. Development
e. Testing and validation
f. Market launch and full production [26]

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Key Performance Criteria in the Design Process

a. Time to market
b. Product cost
c. Customer benefit delivery
d. Development costs [27]

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Product Innovation Approaches

a. Phase Review
b. Stage Gate
c. PACE

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Phase Review

- This technique splits the product development life cycle into a sequence of different phases.
- Every phase encompasses a body of work that, once finished and evaluated, is dispensed over to the next phase.
- No consideration is paid to what may or may not occur in the succeeding phases, principally for the lack of knowledge or exclusive focus on the job in the existing phase.
- The phase review technique is a chronological rather than a simultaneous product design method, that is, each phase is accomplished and concluded before the commencement of the next phase.

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Stage Gate

- This technique is a simultaneous product design procedure that follows a prearranged life cycle from idea creation to market commencement [26].
- The stages in this technique are first and foremost cross-functional. Stage gates appear at the end of each stage, where a design evaluation takes place.
- Each stage gate evaluates the decided deliverables for completion at the conclusion of the stage, a checklist of the standard agreed for each stage, and a choice about how to advance from a particular stage.

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PACE

- This method is concerned mainly with enhancing product improvement strategies [27].
- The technique connects product strategy with the general strategy and goal of the organization.
- A key element is positioning of the voice of the customer all through the product design procedure.
- Strategies are divided into six product strategic thrusts: expansion, innovation, strategic balance, platform strategy, product line strategy, and competitive strategy.
- Product innovation methods and processes are one element in an organization's mission to create value for customers.

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Process Innovation

- Process innovation can be observed as the launching of a new or considerably enhanced method for the construction or delivery of production that append value to the organization.
- The term *process* refers to an interconnected set of actions designed to convert inputs into a specific result for the customer.

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Service Innovation

- Service innovation is concerned with making changes to intangible products. Services are frequently linked with work, play, and recreation.
- Examples of these types of service consist of education, banking, government, recreation, entertainment, hospitals, and retail stores.

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Categories of Service Operations

a. Quasi-manufacturing (e.g., warehouses, testing labs, recycling)
b. Mixed services (e.g., banks, insurance, realtors)
c. Pure services (e.g., hospitals, schools, retail)

Innovation and Entrepreneurship

- If innovation is successful, the expected outcome is the transitioning of these new products, processes, or services into useful products that people are willing to pay for in the United States and globally.
- Although innovation and entrepreneurship are related, many caution the intent of focusing too much on entrepreneurship in the initial stages of the creative aspect of innovation.
- This perspective believes that entrepreneurship should be a natural outcome of entrepreneurship but should not be the initial focus.

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Innovation and Entrepreneurship Cont.

- It's really important to lead with "innovation" and have it evolve into "entrepreneurship" because innovation is the large end of the funnel that appeals to and actually requires participation by a much broader audience.
- Non-business, non-engineering, and non-STEM people are every bit as important to include in that innovation process because the process is not as rich and has inferior outcomes without that diversity [29].

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Difference in Entrepreneurship and Innovation

- The terms *entrepreneurship* and *innovation* are over and over again used interchangeably, nevertheless this is deceptive. Innovation is frequently the starting point on which an entrepreneurial business is built for the reason of the competitive advantage it offers.
- On the contrary, the act of entrepreneurship is simply one means of bringing an innovation to the marketplace.

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Conclusion

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