CENTER FOR
COMPLEX SYSTEMS
& ENTERPRISES

Human-Centered Innovation

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May 17, 2016

Overview

- Human-Centered Design
  - Existing Approaches
  - Overcoming Limitations
- Immersion Lab
- Case Studies
- Observations on Innovation
- Summary

Human-Centered Design

- A process of considering and balancing the concerns, values, and perceptions of **all the stakeholders** in a design
- Overarching Issues
  - Valid methods and tools help solve the problems for which they are intended
  - Acceptable methods and tools solve problems in ways that stakeholders prefer
  - Viable methods and tools provide benefits that are worth the costs of use
  - Costs here include the efforts needed to learn and use methods and tools, not just the purchase price

Existing Approaches

- Viability: Sponsors of modeling efforts complain that they take too long and are too expensive
- Acceptability: Many key stakeholders in the types of problems of interest are not educated in modeling and simulation
- Validity: Assumptions may be inconsistent across component models; coupled states across component models can lead to incomputable or unstable computations

Overcoming Limitations

- **Avoid over-modeling** by delaying equations and deep computation, with initial emphasis on interactive pruning of the problem space prior to any in-depth explorations
- **Immerse key stakeholders** in interactive visualizations of the phenomena, and relationships among phenomena associated with their domain and the questions of interest
- **Explicitly address model composition issues**, including agreeing on a consistent set of assumptions across models

Immersion Lab

Case Studies

- Business Planning
- New Product Planning
- Technology Investments
- Enterprise Transformation

Business Planning

- Products vs. Services
- Defense Conversion
- R&D as a Service
- Academic Strategies

New Product Planning

- Automobile Engine
- Microprocessors
- Digital Signal Processor
- Medical Imaging System

Technology Investments

- Magnetoresistive RAM
- Optical Computing
- Unmanned Air Vehicles
- Licensing Technology

Enterprise Transformation

- Value Opportunities
- Value Deficiencies
- Population Health
- Affordable Care Act

Observations on Innovation

- Starting Assumptions
- Framing Problems
- Implementing Solutions

Starting Assumptions

- **Who are the stakeholders in the problem of interest and its solution?** Identify key stakeholders and their interests. All critical stakeholders need to be aligned in the sense that impacts on their interests are understood. The automobile engine case study illustrates the consequences of not understanding these impacts.
- **Look at problems and solutions from the perspectives of stakeholders.** How are they likely to be thinking? In the licensing technologies case study, it was crucial to understand buyers' exercise costs. This led to the idea that the licensor could provide the licensee consulting services to exercise the option less expensively.
- **Articulate and validate assumptions.** Significant risks can result when here are unrecognized assumptions. The digital signal processor case study illustrated the importance of validating assumptions before deciding to invest in development. This can sometimes be difficult when key stakeholders "know" what is best.
- **Understand how other stakeholders may act.** The effectiveness of a strategy is strongly affected by competitors. This is well illustrated by the case studies of the medical imaging system and the Affordable Care Act. Having one or more team members play competitors' roles can often facilitate this.

Framing Problems

- **Define value carefully**. Translating invention to innovation requires clear value propositions, as illustrated by the R&D services and microprocessor case studies. In both cases, value needed to be framed from the perspective of the marketplace, not the inventors. Markets do not see their main role as providing money to keep inventors happy.
- **Think is terms of both current business and possible future businesses.** Current success provides options for future success, but perhaps with different configurations for different markets. The optical computing case study illustrated how current products and customers provide options for new products and customers.
- **Consider possibilities for customizing solutions for different customers and constituencies.** The population health case study required stratification and tailoring of processes to varying health needs. This was critical to the viability of these population health offerings. Henry Ford, almost 100 years ago, was the last person to believe that everyone wanted exactly the same automobile.
- **Access and integrate available data sets** on customers, competitors, technologies, etc. The MRAM case study showed how data integration increases confidence. Great insights can be gained by mining available data sets, including internal sets, publicly available sets, and purchasable sets.
- **Plans should include strategies for dealing with legacies.** The status quo can be an enormous constraint because it is known, paid for, and in place. The unmanned air vehicles case study illustrated the need to get legacies "off the books." Discarding or liquidating assets for which one paid dearly can be painful.

Implementing Solutions

- **It can be great fun to pursue market and/or technology opportunities.** Innovators can earn high payoffs, albeit with high risks, as depicted in the value opportunities case study. The key is to have the human and financial resources to support and sustain the commitment to innovate.
- **In stark comparison, crises are not fun**. The value deficiencies case study illustrated the high costs and substantial consequences of delaying change. Often, the status quo has devoured most available human and financial resources. When change is under-resourced, failure is quite common.
- **The existing enterprise can hold change back**. The products vs. services and defense conversion case studies portrayed the difficulty of changing business models. New business opportunities may be very attractive, but if success requires substantially new business models, one should assess the enterprise's abilities to make the required changes.
- **Change should involve stopping as well as starting things**. Stopping things will likely disappoint one or more stakeholders. The academic strategies case study illustrated the difficulty of keeping everybody supportive. The consequence is that the status quo dominates, especially when senior management team members were recruited to be stewards of the status quo.

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