RESEARCH PROJECT MANAGEMENT

Part 1: Research Fundamentals
Module Two: Research Types and Characteristics
Learning Outcomes

At the completion of this module, you will be able to:

- Examine the components of the Research/Development/Commercialization continuum (Innovation Value Chain)
- Define basic and applied research, development, commercialization
- Define and provide an example of “Innovation”
- Examine research and development as a component of the business innovation process
- Explore aspects of industry analysis, including needs assessment and work practice observational studies
- Explore basic prototyping categories (Proof-of-Principle; Form Study; Visual; and Functional Prototypes)
- Explore the value of usability testing and consumer testing
Recap: What is Research?

Scientific or scholarly investigation, especially study or experiment aimed at the discovery, interpretation, or application of facts, theories, or laws - from the French recherché – to “search thoroughly” (New Penguin dictionary)

Careful or diligent search; studious inquiry or examination; investigation or experimentation aimed at the discovery and interpretation of facts; or practical application of facts; collecting of information on a particular subject (Miriam Webster Dictionary)

Research involves:
- Investigation
- Experimentation
- Asking and answering research questions
- Disseminating research results
What is Basic Research?

Basic (aka fundamental or pure) research is driven by a scientist's curiosity or interest in a scientific question. Basic Research is investigation that will expand human knowledge, or discover something new.

There may be no obvious commercial value to the discoveries that result from basic research. Or the research results may be very long term.

For example, basic science investigations probe for answers to questions such as:

- How did the universe begin?
- What are protons, neutrons, and electrons composed of?
- How can we genetically engineer grapes for winter hardiness?
What is Applied Research?

**Applied Research** is investigation designed to apply new knowledge or science or solve practical problems in the modern world, rather than to acquire knowledge for knowledge's sake.

For example, applied researchers may investigate ways to:

- Improve viticulture production techniques
- Treat a specific disease
- Improve the energy efficiency of homes, offices, or modes of transportation

**Applied Research** at Colleges helps business, industry, or community organizations develop and test new products, processes, or services that will make them more competitive and successful.
Examples of Applied Research Projects

Review and discuss applied research projects at the College related to a sector of interest.
Key Definitions

**Basic Research** is investigation that will expand human knowledge, or discover something new.

**Applied Research** is investigation designed to apply new knowledge or science or solve practical problems in the modern world.

**Development** is the process of taking ideas or applications and producing products or processes.

**Commercialization** is creating economic value from something new.

**Innovation** is making valued changes by the incorporation of something new (to the organization, not necessarily to the world).
The Innovation Value Chain
Industry/Market Analysis:

In today's market small and medium businesses (SMEs) need to be able to be competitive. Before bringing a new or enhanced product to the commercial market, SMEs need to conduct a variety of activities in order to assess the commercial market place. (Cole, E., Fulton, J., Akridge, J., Erickson, K., & Linton, S., 2004. Industry Analysis: The five forces. http://www.ces.purdue.edu/extmedia/ec/ec-722.pdf)
Industry/Market analysis

An Industry Analysis is typically undertaken by small and medium businesses (SMEs) to answer the question: What are the key factors for competitive success? Answers to that question typically provide useful insights into the SME’s business strategy. One of the pioneers of industry analysis, Michael Porter, identified 5 forces that are widely used to assess the marketplace of an industry:

- Bargaining power of suppliers
- Bargaining power of buyers
- Threat of new entrants
- Threat of substitutes
- Rivalry among competitors
A **PEST Market Analysis** measures the market potential and ‘fit’ for a product or process. It is useful to understand market growth or decline (positioning); it helps set the potential and direction for a business; factors are essentially EXTERNAL; it is most helpful to conduct prior to completing a SWOT (strengths, weaknesses, opportunities, threats) analysis.

‘**PEST’ Stands for:**

- **Political** (e.g. environmental issues, legislations, trading policies, funding, international pressures)
- **Economic** (e.g. economic situation, taxation issues, trade cycles, industry factors, customer drivers)
- **Social** (e.g. lifestyle & consumer trends, demographics, media, ethnic/religious factors)
- **Technological** (e.g. technology development, research funding, information and communications, innovation potential, intellectual property issues)
A **SWOT analysis** (also called stakeholder analysis) is conducted as part of a needs assessment or an ‘environmental scan’. It provides a framework to assess a specific business unit or proposition.

‘**SWOT’ stands for:**

- Strength (resources and capabilities)
- Weaknesses (flipside of a strength)
- Opportunities (need, growth) – reflecting external conditions
- Threats (changes that present a potential threat)
Industry/Market analysis:

Needs Assessment

Needs assessment is a process for determining and addressing needs, or "gaps" between current conditions and desired conditions, often used for improvement strategies for products, processes, organizations, or communities.

In the context of product improvement, it is known as consumer needs analysis. It involves identifying material problems/deficits/weaknesses and advantages/opportunities/strengths, and evaluating possible solutions that take those qualities into consideration.
Workplace Observational Studies

Workplace observational studies (sometimes referred to as audit and measurement studies) are conducted across industries in order to observe the current context or performance of the workplace or what is naturally occurring without disturbing the normal operations within the setting. These types of studies contribute both to broadening our understanding of work and are useful for providing information for specific product design and/or development, implementation and evaluation.

Some examples include:

- Time-motion task analysis (e.g. to determine the number and types of interruptions in tasks)
- Time utilization study (e.g. measures how space is used over time, and compares the intensity of space utilization with type of activity and type of user)
- Ethnographically oriented study (e.g. culturally-focused studies to inform system design by providing rich material on which to propose general design recommendations)
Prototyping: Purpose, Categories, Advantages & Disadvantages

A prototype is an original type, form, or instance of something serving as a typical example, basis, or standard for other things of the same category.

In many fields, there is great uncertainty as to whether a new design will actually do what is desired. New designs often have unexpected problems. A prototype is often used as part of the product design process to allow engineers and designers the ability to explore design alternatives, test theories and confirm performance prior to starting production of a new product. For example, some prototypes are used to confirm and verify consumer interest in a proposed design whereas other prototypes will attempt to verify the performance or suitability of a specific design approach.

In general, an iterative series of prototypes will be designed, constructed and tested as the final design emerges and is prepared for production. With rare exceptions, multiple iterations of prototypes are used to progressively refine the design. A common strategy is to design, test, evaluate and then modify the design based on analysis of the prototype.
Prototyping

In general, “prototypes” fall into four basic categories:

1. Proof-of-Principle Prototype (Model) (also called a breadboard). This type of prototype is used to test some aspect of the intended design without attempting to exactly simulate the visual appearance, choice of materials or intended manufacturing process. Such prototypes can be used to “prove” a potential design approach such as range of motion, mechanics, sensors, architecture, etc. These types of models are often used to identify which design options will not work, or where further development and testing is necessary.
Prototyping

2. Form Study Prototype (Model). This type of prototype will allow designers to explore the basic size, look and feel of a product without simulating the actual function or exact visual appearance of the product. They can help assess ergonomic factors and provide insight into visual aspects of the product's final form. Form Study Prototypes are often hand-carved or machined models from easily sculpted, inexpensive materials (e.g., urethane foam), without representing the intended color, finish, or texture. Rapid prototyping equipment may be used for preparing highly accurate models. Due to the materials used, these models are intended for internal decision making and are generally not durable enough or suitable for use by representative users or consumers.
3. Visual Prototype (Model) will capture the intended design aesthetic and simulate the appearance, color and surface textures of the intended product but will not actually embody the function(s) of the final product. These models will be suitable for use in market research, executive reviews and approval, packaging mock-ups, and photo shoots for sales literature.
4. **Functional Prototype (Model) (also called a working prototype)** will, to the greatest extent practical, attempt to simulate the final design, aesthetics, materials and functionality of the intended design. The functional prototype may be reduced in size (scaled down) in order to reduce costs. The construction of a fully working full-scale prototype and the ultimate test of concept is the engineers' final check for design flaws and allows last-minute improvements to be made before larger production runs are ordered. Modern visualization technologies (virtual reality) may be used to reduce the cost of actually making the product and testing it in the real world.
Advantages of Prototyping

Advantages of prototyping:

- May provide the proof of concept necessary to attract funding
- Early visibility of the prototype gives users an idea of what the final system looks like
- Encourages active participation among users and producer
- Cost effective (Development costs reduced)
- Increases development speed
- Helps to identify any problems with the efficacy of earlier design
- Helps to refine the potential risks associated with the delivery of the system being developed
- Various aspects can be tested and quicker feedback can be obtained from the user
- User interaction may be available during development cycle of prototype
Disadvantages of Prototyping:

- Depending on type of prototype developed, there are limitations on the validity of the design, use, durability, etc.
- Producer might get too attached to it
- Not suitable for large application
Usability Testing

Usability testing is a technique used to evaluate a product by testing it on users. It focuses on measuring a human-made product's capacity to meet its intended purpose. Examples of products that commonly benefit from usability testing are websites or web applications, computer interfaces, documents, or devices.
Consumer Testing

**Consumer testing** is a technique used to evaluate a product or process by testing it on consumers. It focuses on measuring a product's capacity to accomplish its intended objective. The tests can examine consumer preferences or consumer response. Examples of products that commonly benefit from consumer testing are food and beverage products, business or tourism services, and marketing strategies and campaigns.

Reflect on the following questions:

- What are you looking for in a consumer test?
- When should you do consumer testing?
- What can you learn through consumer testing?
- What should you keep in mind when consumer testing? (e.g. use of human participants)
- Where do you conduct consumer testing?
- How many participants are needed for a reliable consumer test?