

# Chapter II

## Innovation Studies

### INTRODUCTION

This chapter will explore literature in the field of innovation in order to establish a conceptual framework for the auto-ID trajectory research. The primary aim of this review is to provide a critical response to the literature on technological innovation. The review will also serve to: (i) identify and understand widely accepted definitions, concepts and terms, born from past innovation research as a guide for further research; (ii) review theories, theoretical frameworks and methods adopted by other researchers doing similar innovation studies (especially in the area of information technology) in order to choose an appropriate approach for this study; (iii) understand what aspects of complex high technologies (high-tech) have already been explored by researchers and what aspects have been neglected and to discover any similarities or differences in existing findings.

Previous research will be examined in this chapter using a two-tiered approach; topical at the surface layer and chronologically organized therein. This type of analytical strategy is advantageous because similar patterns, trends, or findings can be uncovered and organized into clusters over time. Each study will be categorized according to the theory and research method used by the author(s). Additionally, findings of each study will be briefly highlighted for comparison. Seminal works will be treated at a greater length than smaller studies. The same emphasis will be attached to reporting accurate summaries, and responding critically to previous research. Overall, greater consideration will be given to reviewing contemporary innovation literature, as opposed to outdated research that was never conducted with the knowledge of information technologies.

### FUNDAMENTAL DEFINITIONS IN THE INNOVATION PROCESS

#### **Invention, Innovation and Diffusion**

This section will be dedicated to defining the fundamental links between invention, innovation and diffusion as it applies to this research. The three terms are different, however, as Lindley (1997, p. 19) observes at the same time, the terms are also closely allied. Sahal (1981, p. 41) makes the distinction that an invention is the creation of a “new device” and an innovation is the “commercial application” of

that device. Similarly Braun (1984, p. 39) argues that “...an invention is merely an idea for a prototype of a new product or process and does not become an innovation until it reaches the market [diffusion].” Most inventions never become innovations; they fall by the wayside on the long road from idea to marketable product (Westrum, 1991, p. 150). For a thorough introduction into the diffusion of innovations see Rogers (1995).

### Invention: Mutation, Recombination, Hybrid

As suggested by Jacob Schmookler, a patentable invention is a new product or process that shows a significant degree of originality and has some future use (1966, p. 6). A question often asked is, do all inventions fall into the same category? The answer according to Farrell (1993) and Mokyr (1996) is no: inventions may differ depending on how their formation came about. Table 1 shows that invention can be classified into three types, mutation, recombination, and hybrid (Mokyr, 1996, p. 69). Without reference to Farrell or Mokyr, Edquist (1997, p. 1) states, “[i]nnovations are new creations of economic significance... [that] may be brand new but are more often new combinations of existing elements.”

### Innovation: Radical vs. Incremental

Generally, an innovation can be described as “...a process or a product, a technical or an organizational change, an incremental improvement or a radical breakthrough” (Deideren, 1990, p. 123 quoted in Lindley 1997, p. 20). Since the 1900s the term innovation has undergone many revisions with the emergence of new theories in the field of economics. Schumpeter’s (1939, p. 87f) well-known definition of innovation is directly linked to neoclassical economic theory by means of the production function: “...we will simply define innovation as the setting up of a new production function. This covers the case of a new commodity as well as those of a new form of organization... this function describes the way in which quantity of product varies if quantities of factors vary. If, instead of quantities of factors, we vary the form of the function, we have an innovation... we may express the same thing by saying that innovation combines factors in a new way, or that it consists in carrying out New Combinations.” The production function indicates the “maximum amount of product that can be obtained from any specific combination

Table 1. Types of inventions

Type of Invention	Description
Mutation	“Of course, mutations are variations on existing material. Most of the genetic material in every mutant is not new...”
Recombination	“Because technological recombination is multiparental, the opportunities for innovation through novel combinations of existing knowledge are a function of the complexity and diversity of the economy.”
Hybrid	“The difference between a hybrid and a recombinant invention is that a hybrid is a combination of two (or more) <i>artefacts</i> , rather than the information embedded in them... In most cases, hybrid inventions require complementary types of invention that are necessary if the pieces are to work together and the new device is to be made operational.”

The definitions for the different types of inventions have been taken from Mokyr (1996, pp. 70-73).

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