Chapter 7
Paradigms, Science, and Technology:
The Case of E-Customs

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ABSTRACT

This chapter explores the concept of paradigms, science, and technology in the context of information technology (IT). Therefore, the linear model of Francis Bacon and Thomas Kuhn's notion of scientific paradigms are reviewed. This review reveals that the linear model has to be advanced, and supports the adoption of Kuhnian ideas from science to technology. As IT paradigms transform business processes, a five-level concept is introduced for deriving managerial implications and guidelines. Within the case of e-customs, a European-funded project tries to ease border security and control by adopting a common standardized e-customs solution across the public sector in Europe. The rise of the IT paradigm within customs and its effect on business operations will be explained. This chapter contributes to the research in diffusion and adoption of innovation using science progress and the interplay of science and technology as dominant concepts.

"Give a little boy a hammer and everything looks like a nail." Abraham Harold Maslow (1908-1970), American psychologist

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INTRODUCTION

"Give a little boy a hammer and everything looks like a nail." The quote of Abraham Harold Maslow (1908-1970), an American psychologist, guides the

reader through each section. In analogy to the case of electronic-customs (e-customs), which will be presented later, the quote could be interpreted as giving Internet technology to a customs office, while that office's export processes remain paper-based.

The boy instinctively relates what he already knows about the hammer to new problems and challenges. Only if major problems cannot be solved by this method and more problems accumulate, we begin to ask ourselves if there are other ways of looking at the situation. In Thomas Kuhn's words, this is the heart of the scientific progress.

Thomas Kuhn's notion of scientific paradigms (Kuhn, 1962) that have been early adopted as technological paradigms (Dosi, 1982), can be described as the punctuated nature of technological change combined with path dependency of innovation processes in times of incremental progress (Peine, 2008). When analyzing the quote, the path dependency of the innovation process shows that the boy will use the hammer very efficiently for nails, whereas in times of radical technological change, he will scrutinize the one-sided use of the hammer. A paradigm sets out an array of expected solutions to accepted problems (Lakatos & Musgrave, 1970).

The description of an advanced model of Francis Bacon (Bacon, 1605) supports the transferability from science to technological paradigms, which are exemplified with IT paradigms. Examples are software and programming developments, as well as the technical progress from mainframe to personal computers, are currently finalized in a technological paradigm of virtual resources accessible through the Internet.

Internet technology is the underlying technology of e-customs. Theories are applied to an e-customs project called Information Technology for Adoption and Intelligent Design for e-Government (ITAIDE), which has been launched for the adoption of standardized e-customs systems on an international level. A value assessment and a five level business transformation plan accompany the description of technical progress in IT.

SCIENCE AND TECHNOLOGY

While science is considered a knowledge base, technology is defined as the physical manifestation of that knowledge (Khalil, 1999). Some definitions of science and technology are:

- Science analyzes and looks for explanations in general terms. The benchmark is still the natural law and the periodic system for classification. Explanation is a natural law applied to specific boundary conditions. Technology is very much problem solving oriented, where problems come from practical considerations.
- Science lives on open questions – surprises. Every surprise is a potential candidate for a new research field and new results. Within a technology, side effects are objectionable; everything has to be controlled to avoid accidents and non-performance.
- Technology must have a goal to fix or build something, a reliable and sturdy bridge for example. The goal in science usually comes from within science. The goals of technology are defined by the needs of customers– short term solutions are better than solutions for the long term.

Indeed, science and technology are much closer today than in earlier times. A good example is computer technology. It developed in a logical path from Leibniz to Microsoft, yet only in hindsight. Another example is the X-ray technology invented by Konrad Röntgen in 1895.

Within one year after the detection of X-rays, more than 49 scientific books were on the market, including more than 1,000 scientific papers. X-ray technology spread with a speed that is amazing even for 21st century standards. Just two months