A Step Towards the Adoption of Standards Within the UK Ministry of Defence

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ABSTRACT

This article seeks to identify the factors that have impacted the adoption of ISO 10303, the Standard for the Exchange of Product Data (STEP), within the UK Ministry of Defence. The analysis presented in this article is based on Diffusion of Innovation (DOI) Theory and the theory surrounding the Economics of Standards. Using a case study approach, the results indicate that several DOI and economic factors have impacted the adoption of STEP. These findings offer insights into some of the technological, organizational, and environmental influences on standards adoption. It is envisioned that these results will make a contribution towards the body of knowledge surrounding the factors and barriers critical to the adoption of standards like STEP, and enable more effective development and adoption of these standards.

Keywords: diffusion of innovations; ISO 10303; network effects; standards

Any comments attributable to UK MoD employees (as part of the interview process) reflect the thoughts of the individuals and not necessarily those of the UK MoD.

INTRODUCTION

Despite a well-documented history relating to the development of ISO 10303, the Standard for the Exchange of Product Data (STEP), a review of the literature shows that there is very limited empirical research into the factors that impact the adoption of STEP. This means that academics and practitioners devoted to the ongoing development and use of STEP still lack a significant body of evidence regarding the factors and barriers critical to the adoption of STEP. In particular, no study has looked specifically at the adoption of STEP in the defence environment. In this article we present findings from a qualitative case study into the adoption of STEP within the UK Ministry of Defence (MoD). We draw upon Diffusion of Innovation (DOI) theory (Rogers, 2003) and the theory relating to the Economics of Standards.
(Fichman & Kemerer, 1993b) to identify these factors. These two theories were chosen because they are well established and extensively used in information technology and standards adoption research. The first two sections of this article give a brief introduction to the development, current activities, and research surrounding STEP. Following is a review of the adoption-related theories that act as the theoretical foundation of this research. The concluding sections of the article detail the methodology, case background, and findings that have emerged with regards to the factors that influence the adoption of STEP within the UK MoD.

INTRODUCTION TO STEP

Standards have been in existence since the beginning of recorded history (Krechmer, 1996). Some standards were developed as a consequence of man’s desire to harmonise his activities, and other standards emerged in response to the needs of an evolving and increasing complex society, and the waves of human progress and technology. This is demonstrated in the development of standards to enable the exchange of product data. As Kemmerer (1999) points out, “the evolution of exchanging product data in an electronic form arose in parallel to the creation and use of computers. As advances in computational and communications technology occurred, emphasis shifted from algorithm/programming to data exchange.” The use of these standards to facilitate product data exchange offered a solution to the high backend costs associated with the use of converters for point-to-point customised data exchange, and allowed product data to be shared and utilized without recreating applications or data sets (Albrecht, Dean, & Hansen, 2003).

Over the years, there have been a number of de jure and de facto data exchange standards in use. However, many of the early standards, for example, the Initial Graphics Exchange Specification (IGES) and Electronic Design Interchange Format (EDIF), were bounded by their restriction to graphical and geometrical information (ProSTEP, 2004). Therefore, in order to override this problem and curb the development of a multitude of standards, work began in the mid 80s on developing a new overarching standard known as ISO 10303—Standard for the Exchange of Product Data (STEP). STEP built upon the lessons learned from the previous standards and had the advantage of not just focusing on basic descriptions of what data are, but on the meanings of data and how data relate to each other (Kemmerer, 1999).

STEP was approved as a full international standard for product data exchange in 1994 under the banner of ISO (International Organization for Standardization), Technical Committee 184 (Industrial-Automation Systems and Integration), and Sub-Committee 4 (Industrial Data) also known as ISO/TC184/SC4. What emerged from the standardisation efforts was a comprehensive series of documents which provided industry with the ability to exchange and share the information used to describe a product throughout the supply chain to the end customer, and throughout the entire life cycle of the product (Mason, 2002). Therefore, the architecture of STEP was built as a series of parts to support the development of standards for product data exchange, sharing, and archiving. Parts 201 to 240 detail the implementable data specifications of STEP known as Application Protocols (AP). Examples of APs are:

- AP224: Mechanical parts definition for process planning using machining features
- AP210: Electronic assembly, interconnection, and packaging design
- AP239: Product Life Cycle Support

An Application Protocol (ISO 10303-2xx) is in principle first written independently of STEP using the terminology of the application or industry area, resulting in an Application Reference Model (ARM). This model is then mapped to STEP concepts using the EXPRESS data modelling language. The result is an Application Interpreted Model (AIM), which is the actual data model of the application protocol in STEP (Männistö, et al., 1998).
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