Chapter 5.2
Human Factors in Knowledge Management:
Building Better Systems by Employing Human Systems Integration Methods

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ABSTRACT

This chapter presents an overview of key Human Systems Integration (HSI), Human Factors (HF), and Knowledge Management (KM) methods that support building user-centered systems. The chapter stresses that KM can benefit the systems design process by reducing rework and duplication of effort. In addition, tools aiding KM implementation within the HSI and Human Factors (HF) domains are discussed. HSI practices created and employed within the discipline of Systems Engineering (SE) have brought positive changes to the systems development lifecycle (SDLC) process, affording increasingly complex and smarter systems to be built. These increases in systems complexity have created a need for systems designers and program managers to apply KM principles to systematically create, share, retain, and transfer workforce skills, facts, processes, capabilities, and experiences in a systematic fashion. The authors describe the importance and benefits of integrating HSI and KM practices to build better and smarter systems.

DOI: 10.4018/978-1-60960-783-8.ch5.2

INTRODUCTION

Knowledge Management

Knowledge Management (KM) is a multidisciplinary practice spanning fields such as information systems and business administration. It has many applications in industry. Knowledge Management focuses on identifying, employing, storing, and distributing available resources on a project to generate expertise, insight, and information during the development of a product, service, or model. The process of KM incorporates elements of knowledge acquisition, its creation, and its transition into the information stores of society (Phoha, 2001). Studies indicate that the effects of a changing, diverse, and mobile workforce result in companies having an increasingly difficult time retaining knowledgeable employees (Ryan, 2000). The integration of Human Factors in Knowledge Management entails capturing and retrieving information relevant to human capabilities and limitations to build new knowledge or extend current knowledge. This process is inextricably bound and inseparable from human cognition, introducing all sorts of bias. It is a classic problem of psychology, where the cognitive agent must study its own workings, complete with biases, limitations, and perceptual qualities.

Therefore, the management of knowledge occurs within a biased behavioral, cultural, and personal context. This context may vary greatly between individuals. Past research in KM has revealed the importance of considering human cognitive and physical factors when designing knowledge management systems. Human factors practitioners study and apply knowledge relative to human physical, cognitive, and sensory capabilities and limitations to design better products, processes and interfaces (Karwowski, 2006a). KM is especially important in situations where tacit (as opposed to implicit) knowledge exists. Tacit knowledge is not consciously known or recallable by a subject performing a task (he or she "just knows how to do it"), while implicit knowledge is knowledge which is easily transferred by the subject to others, and thus, can be easily documented (Alavi & Leidner, 2001). The advantages of adopting KM practices include:

- Rapid formation of subjective, objective, and empirical knowledge
- Knowledge integration
- Accessibility and conductivity to collaborative problem solving

Human Systems Integration (HSI) is pertinent to systems engineering, specifically, the human component of every system. HSI aims to prevent system designs that do not adequately consider human capabilities and limitations. Thus, HSI is the choice interdisciplinary process for integrating human capabilities and limitations within and across all system elements, i.e. an essential enabler to systems engineering practice. The goal of HSI is to optimize total system performance while accommodating both select and general characteristics of the end user population that will operate, maintain, and support the system in an effort to minimize overall system lifecycle costs and enhance human-system compatibility (Folds et al., 2008). Throughout system design, development, fielding, sustainment, and retirement processes, HSI experts work to ensure the consideration and accommodation of human capabilities and limitations. Within systems engineering, the human is recognized as an integral element of each system through the HSI component, which ensures that human factors have a prominent place throughout the total system lifecycle. Good design practices include the human element within requirements, reliability, and maintainability processes.

The attention to HSI in system development programs have resulted in hundreds of human-centered design improvements and enhanced human-system compatibility. Efforts were concentrated on maximizing total system performance through improvements in workload management, safety, maintenance, and reliability. These efforts resulted in billions of dollars saved and the prevention of hundreds of possible system related safety issues (Booher and Minninger, 2003).

Karwowski (2000) stated that system-human compatibility should be considered at all levels, including physical, perceptual, cognitive, emotional, social, organizational, and environmental considerations. This requires quantification of