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Creating a strategic national knowledge architecture: A comparative analysis of knowledge source innovation in the ICS subfields of multimedia and IT security

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ABSTRACT

This paper introduces a part of the research and emphasizes the segment of comparative and multicriteria statistical trend analyses within the second of 12 standardized IT fields. The paper focuses on the subfields with the highest intensity of knowledge innovation: multimedia coding, audio, images (sub-committee ISO/IEC JTC 1/SC 29), and IT security techniques (/SC 27). According to the International Classification of Standards (ICS), multimedia and security are classified into the second IT field (ICS2 = 35.040). The paper aims to provide and improve resources for product quality on the basis of the growth of knowledge source innovation. Simultaneously with the analysis of local resources, the trend of global source innovation is analyzed from the population of statistical samples of the standardized knowledge source units within the observed IT subfield. The research results provide confirmation of the hypotheses in PDCA phases and decision-making towards security and improvement of resources and products.

1. Introduction

The research presented in this paper relates to the trend analyses of the innovation intensity of *Knowledge Sources* (KS) (ISO, 1995) and the required individual knowledge for the target level of product quality improvement (ISS, 1996) in the subfields of IT security and multimedia. The paper defines the original trend lines for knowledge source monitoring and responsibility for creating the *Knowledge Base* (KB) (ISO, 1995) and *Knowledge Base System* (KBS) (ISO, 1995). According to the *International Classification of Standards* (ICS), IT is classified into *Domain Knowledge* (DK) (ISO, 1995) as ICS1 = 35, through 12 subfields. These are the two subfields, multimedia (ISO/IEC, 2015) and protection (ISO/IEC, 2012), that contain the highest level of knowledge innovation within the standardized IT fields (ICS2 = 35.040 – *Set of signs and information coding*) (Micić and Stanković, 2013). The subject of the research carried out in this paper is innovations in multimedia and IT security. The analysis results suggest standardization of a part of the collective knowledge based on global (ISO/IEC [ISO, 2015]) and local (SRPS [ISS, 2015]) standardization. Local standardization is a basis for creating Strategic National Knowledge Architecture (SNKA). Collective knowledge covers all standardized knowledge sources in one field: *domain knowledge* (DK). In some standardized fields, especially in IT fields, the difference between individual and collective knowledge (global and local) tends to increase (Micić and Stanković, 2013; Micić et al., 2013). The paper presents the

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trend of knowledge innovation which has been created and classified into subfields of development. Furthermore, the paper defines the knowledge source growth and accompanying knowledge basis and analyzes the subfields with the highest level of innovation intensity. Special objectives have been identified and reduced to the time dimension of the PDCA (Plan–Do–Check–Act) *quality loop* (ISS, 1996), or PDCA concept, as in (Micić and Stanković, 2013; Micić et al., 2013).

1.1. *Research objectives and initial hypotheses*

Research objectives of the paper are:

(a) to analyze trends of innovation intensity of KS;
(b) to define original trend lines for:
 (i) KS monitoring, and
(ii) responsibility for creating the KB and KBS;
(c) to provide and improve resources for product quality on the basis of the growth of KS information;
(d) to present models for the development of expert systems.

The stated objectives were incorporated in the initial hypotheses, and they were implicitly or explicitly related to SNKA. The initial hypotheses emphasize the results of the presented methodology, aiming to predict future resources according to the analysis of the knowledge source in multimedia and IT security. The initial hypotheses have been identified on the standardization platform for the examples of multimedia and IT security through the four phases of the PDCA concept:

Hypothesis 1. (*Plan* phase): It is possible to determine knowledge innovation, starting from the knowledge source (KS), for the purpose of resource planning for daily knowledge innovation;

Hypothesis 2. (*Do* phase): It is possible to define comparative indicators and indices (of quality and values) which realize trend monitoring and knowledge source growth (ΔKS);

Hypothesis 3. (*Check* phase): The possibility exists that innovation intensity can be defined, which is a prerequisite for the appropriate future checks (of knowledge and trends) and knowledge base innovation (KB);

Hypothesis 4. (*Act* phase): Determining the original trend lines provides the possibility of solving problems and providing resources for updating of the knowledge base. Due to great financial needs, an individual approach to KB is limited (almost restricted).

The initial hypotheses and objectives of the presented paper lead towards knowledge modeling and project solutions for the development and application of information-expert systems. In view of the above-mentioned, the following chapters present relevant papers (Section 2) in comparison with the presented methodology (Section 3) and actual results and an analysis through examples of the fields of multimedia and IT security (Section 4). Discussion of the results and the contribution of the research is presented in the order of the given hypotheses. The initial hypotheses were confirmed in PDCA phases (see Section 5). Furthermore, final reflections given at the end of the paper (Section 6) contain all the conclusions in the order of the set hypotheses regarding the PDCA concept.

2. Relevant papers

In the process of acquiring knowledge, time and costs present a significant aspect of innovations and monitoring of innovations in technological and dynamic environments (Cruz-González et al., 2015). Knowledge and appropriate strategic applications have become the most significant source of competitive advantages for *organizations* (ISS, 1996; Micić et al., 2014a). Similar studies published so far deal with the problems of knowledge innovation in IT fields, according to Lu et al. (2014). In other papers, it is knowledge modeling (Katić et al., 2015), knowledge management (Bencsik et al., 2014), and knowledge base innovation (Liu and Lin, 2012) that are the most conspicuous. In researches, the authors use the knowledge base as a basis and they also present models for the development of expert systems (Pozna and Precup, 2014), which is the objective of this paper as well.

It is expected that the relevant recommendations and conditions for adjustment in the standardization process will be briefly stated here, e. g. as suggested by Shin et al. (2015) and Kulik and Trinh (2013). In this paper, standards are the basis of the knowledge source (KS), whereas in other papers the standards are considered significant for knowledge control within an organization and their application presents an economical means of data transfer (Lee and Baek, 2014) . Furthermore, the application of the standard and model based on standardization supports the product development (Al-Ashaab et al., 2012).

Due to the sudden growth of multimedia data and knowledge sources, this research and the previously published researches in the field of multimedia have become more significant (Micić and Stanković, 2013). The published researches in multimedia fields correlate with this paper from the aspect of knowledge acquisition (KS) and knowledge base updating (KB) for the purpose of teaching and learning (Kassim et al., 2014; Polášek et al., 2013; Sallai, 2012). The modern process of education is greatly influenced by video-computer multimedia technologies, telecommunication systems, and interactive media (Polášek et al., 2013). Efficient data collection for creative data processing within an organization is highly significant for the development and application of tools for multimedia education (Sallai, 2012) and for better learning results (Kassim et al., 2014). Regular updating of the knowledge base in this field and monitoring of alterations are necessary, and they have been analyzed and shown in this paper. The growth in learning efficiency is significantly affected by multimedia data searches (Wu et al., 2012).

Fields of IT security can be observed from a number of aspects as well as numerous papers published (Ahmad et al., 2014; Bahtiyar and Çağlayan, 2013; Flores et al., 2014; Mesquida and Mas, 2015; Michelberger and Lábodi, 2012; Moral-García et al., 2014):