7th International Scientific Conference
Technics and Informatics in Education
Faculty of Technical Sciences, Čačak, Serbia, 25-27th May 2018

Session 2: IT Education and Practice UDC: 378:004

Knowledge Sources in ICS Fields With Daily Intensity of Innovation – „TIE"-2017

Živadin Micić [1*], Vesna Ružičić[1]
[1] University of Kragujevac, Faculty of Technical Sciences Čačak, Serbia
[*] micic@kg.ac.rs

Abstract: *The paper presents the multicriteria research and statistical analysis of knowledge trends in the standardized Engineering fields (**technics**) and Information Technology (**informatics**). The focus is on the innovation of the sources of knowledge (in **education**), at the beginning of the second decade of the XXI century until 2017 – "TIE"-2017. The goal is to provide the resources and improve the quality of knowledge, on the platform of the international I (ISO) and local (national SRPS) standardization. The paper presents the significant details (results and analysis) by comparing the trends of knowledge sources, according to the analyzed fields / subfields classified according to the International Classification for Standards (ICS) ICS1 = 35 (Information Technology - IT), where ICS1 = 01 to 99. Moreover, the paper presents the plans for further development of an access to knowledge sources in the form of standards (as obligations), as well as comparisons of the index of innovation in IT with other standardized fields, especially the fields of engineering (e.g. ICS1 = 01, 23, 25, 35, 49, 83, 91 - daily intensity of innovation or weekly intensity - ICS1 = 29, 33, 59, 75, 77, etc.).*

Keywords: *standardization; knowledge sources; trends of knowledge; innovation index*

1. INTRODUCTION

The paper deals with a comparative analysis of local (SRPS – label for standards in Serbia, [1]) and international (ISO/IEC, [2]) knowledge sources in the fields classified according to ICS (international classification for standards). A comparative analysis of the field which has the highest (daily) intensity of innovation was presented for ICS1:

35 - Information technology comparable with

01 - Generalities; Terminology; Standardization; Documentation;

13 - Environment; Health protection; Safety and other Engineering fields:

23 - Fluid systems and components for general use

49 - Aircraft and space vehicle engineering,

83 - Rubber and plastic industries,

91 - Construction materials and building; or the daily intensity of innovation in engineering and technology (2016), and the weekly (flow 2017):

29 - Electrical engineering,

33 – Telecommunication; Audio and video engineering,

59 - Textile and leather technology,

75 - Petroleum and related technologies,

77 – Metallurgy, *etc*.

One of the objectives of the research in those fields is to compare innovativeness and determine the importance of local in relation to global knowledge sources. The focus is on the fields which belong to the area of ***technics and informatics*** (***TI***) with the aim of ***education*** – ***TIE*** (knowledge-based innovation).

The goal of this research is: 1) to determine the innovativeness in the fields of Information technology and Engineering fields, 2) to compare the mentioned fields and determine if there are differences between local and global knowledge sources (KS), 3) to determine the trend lines of innovation of KS, 4) clustering by the fields of innovation in time (until 1.2017), through PDCA – "TIE"-2017.

The content of the paper represents the upgrade of the previous works of the authors. The methodology is indicated in the previous works, so the largest part of this paper is dedicated to the results and discussion.

1.1. Related Work

There are many papers dealing with the standardization of Information technology and mentioned engineering fields. Some of them use the methodology similar to the one used in [3-7]. The proposed research has similarities with related research [3-7] regarding the fields of research, but the methodology used here is completely original and gives an insight in a comparative analysis of local and global levels.

Also, there are papers by other authors which deal with standardization, but with a different approach [8].

Compared to previous studies, according to [9], the annual sample of KS (on the ICS platform) is increased every year.

2. METHODOLOGY AND HYPOTHESES

The criteria of clustering vary depending on the separated and real innovation of KS, which is in accordance with the set goals and hypotheses.

2.1. Initial hypotheses

The initial hypotheses and research objectives are realized in the ICS fields with *daily intensity of innovation* through the PDCA (Plan, Do, Check, Act) method:

Hypothesis_1 - P (Plan) Planning and prediction of necessary future resources and financial requirements for KS – for each mentioned field at local (SRPS) and global (ISO) levels;

Hypothesis_2 - D (Do) Research and evaluation of knowledge sources enable obtaining explicit mathematical relations, and also trend lines of knowledge, as well as the possibility of comparing all the fields;

Hypothesis_3 - C (Check) There is a possibility of defining the correlations between knowledge with the intensity of innovation (Ii), with checks of clustered ICS fields according to the annual intensity of innovation at local (SRPS) and global (ISO) levels;

Hypothesis_4 - A (Act) Defining the relations between continuous (according to the PDCA) and discontinuous knowledge innovation, with the goal of improving knowledge base system on the platform of SRPS and ISO standardization.

2.2. Methodology

The statistical methodology and deductive - inductive methods have been used for predicting the future development and innovation. Methodologically, statistical indices have been formed for the comparison of ISO – SRPS relations in the fields of Information technology (ICS1 = 35) and other Engineering fields (ICS1 = 01, 23, 25, 29, 33, 49, 59, 75, 77, 83 and 91), i.e.: Quantity indices (Iq), value index (Iv) and index of quantitative variation for ranking (Iqi). The PDCA methodology and statistical research have been applied.

Quantity indices (Iq), defined and determined for both ISO and SRPS, refer to: Samples (Iqs), Published standards (Iqp), Standards Under development (Iqu), Standards Withdrawn from use (Iqw), Deleted projects (Iqd), Innovations in various stages of development (Iqi =Iqu/Year) - for the full previous calendar year. In general, for the knowledge sources (KS) - population Iqs, the equation (1) has been derived:

$$Iqs\ (KS) = Iqp + Iqw + Iqd + Iqu \qquad (1)$$

Two original JAVA applications [3] have been used for the analysis of the results. The methodology simplifies the proofs of the initial hypotheses (see Section 2.1, Hypothesis 3), using the relation (2), [10] to continually or periodically update the knowledge base - depending on the increase of KS (ΔKSt).

$$Ii_{/ICS} = \Delta KS_{/t/ICS} \approx (Iqu_{global/t} + (Iqp + Iqw + Iqd)_{/global+local/t-1/})_{ICS} \qquad (2)$$

The relation $Ii = \Delta KS_{/year/ICS} = Ii_{/year} \approx (Iqu_{/ISO/year} + (Iqp)_{/ISO+SRPS/year-1})_{ICS}$ has been applied to the examples of research $\Delta KS_{/year/ICS}$ in this paper.

3. RESULTS AND DISCUSSION

This section gives the results of the research related to local and global knowledge sources in Information technology and *Engineering fields* with the greatest (daily) intensity of innovation (ICS1 = 01, 23, 25, 29, 33, 49, 59, 75, 77, 83 and 91).

According to the applied methodology, 2017.01:

- on a sample of Iqs > 100000 KS,

- some of these fields (Table 2) are not the fields with the daily intensity of innovation (ICS1 = 29, 33, 59, 75 and 77),

- some fields do not belong to the engineering sciences (ICS1 = 11 - medicine, ICS1 = 13 – naturally- mathematical sciences).

The results are given for the period of three years (analysis of standards) in this field (ICS1 = 29, 33, 35) with two references [4, 5]. These results present systematized knowledge about engineering fields and Information technology field (ICS=35) where the authors also have significant results [3, 6, 7]. Another reason for choosing this period (2016-2017) for the analysis is that there is a declining line of trends in engineering fields in the last two years.

Innovation indices (Ii) of each field are determined by the cluster (year) of innovation (daily, weekly, monthly, etc.). The frequency of innovation is determined by the cluster:

- based on the annual time series of innovation, Table 1 (KS),

- based on the defined parameters of innovation (model), as well as

- according to the index indicators, Table 2 (increase of KS in code Ii or $\Delta KS_{/year/ICS}$).

The fields in which the values of this index (Ii) are greater than 250 (Ii > 250) belong to the cluster of daily innovation.

After the quantitative analysis we presented the examples of necessary resources and knowledge of all SRPS and ISO standards for all analyzed fields. Also, the examples of trend lines for SRPS and ISO are presented. An in-depth analysis of KS innovation in the subfields of one of the four areas being compared, was presented in other papers, on the example of ICS1 = 29 [4-5]).

Table 1. *Knowledge sources (KS), Innovation indices (Iqu, Iqp/i, Iqd…), indices of value (Iv), parallel ISO - SRPS, for the example: ICS1 = 29, 33, 35 (1.2015 - '15; 1.2016 - '16 and 1.2017 - '17)*

	Field/ Year		Samples (Iqs) (KS)		Published (Iqp)		Withdrawn (Iqw)		Delete (Iqd)	Developed (Iqu)		Iqp/(Year-1)		Iv - "trend" Iv/(Year-1)		ΣIvalues (CHF) ΣIv/Year.01	
I	ICS1	Year	ISO	Srps	ISO	srps	ISO	srps	ISO	ISO	srps	ISO	**srps**	ISO	srps	ISO	srps
1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)	17)	18)
		'15	66	2844	27	2391	27	405	0	**12**	48	1	**136**	138	3736	3006	70975
1	29	'16	71	3077	27	2604	27	448	0	**17**	25	0	**259**	0	7028	2556	71574
		'17	91	3228	32	2626	31	557	0	**12**	45	9	**127**	1422	3004	4044	76519
		'15	200	2282	118	2143	73	101	1	**8**	38	1	**227**	88	7436	14922	62800
2	33	'16	201	2493	116	2374	80	115	0	**5**	4	1	**252**	88	7454	15062	69551
		'17	209	2726	115	2548	82	171	0	**4**	7	1	**224**	118	7057	15224	75300
		'15	6693	1721	3407	1527	2425	177	49	**812**	17	**238**	**239**	33376	9927	377156	53392
3	35	'16	7023	1919	3618	1660	2638	256	53	**714**	3	**411**	**217**	46402	8379	399768	57437
		'17	7315	2110	3728	1785	2823	287	93	**631**	38	**302**	**157**	38384	5564	434588	61919

Table 2. *Analysis results for innovation indices (Iqu and Iqp for Ii > 250, 2016), according to data 2017.1*

ICS1	**01**	**11**	**13**	**23**	**25**	**29**	**33**	**35**	**49**	**59**	**75**	**77**	**83**	**91**
1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)
$Iqp_{/SRPS/2016}$	51	**100**	**161**	82	111	127	224	157	207	69	77	93	35	154
$Iqu_{/ISO/2017}$	354	**290**	**407**	221	259	12	4	631	211	84	128	144	261	214
$Ii_{/2017.1}$	**405**	**390**	**568**	**303**	**370**	**139**	**228**	**788**	**418**	**133**	**205**	**237**	**296**	**368**

Note: $Iqu_{/ISO/2017}$ = Standards under development, including: Amd, Cor and Std (amendments, corrections and standards)

3.1. Fields with daily intensity of innovation

As a starting point, we have done a quantitative analysis for all <u>*Engineering fields*</u> with daily intensity of innovation (ICS1 = 01, 23, 25, 35, 49, 83, 91). This is shown in Table 1, which provides a possibility of comparing local and global level of knowledge sources: $Iqs_{/35/ISO/2017.1}$ = 7315, $Iqs_{/35/SRPS/2017.1}$ = 2110 etc.

The table presents all fields, their indices and values in CHF. The presented results are given for the local (SRPS) and global (ISO) levels.

The analysis results for ICS1 = 35, are presented graphically in Fig. 1 and Fig. 2.2: with the trend of planned future needs, according to the relations (3.1) and (3.2).

$Y_{35/ISO/2006\text{-}2016}$ = Logarithmic/Power/Linear (3.1)

$Y_{35/SRPS/2006\text{-}2016}$=– Polynomial ($2012_{max}$) (3.2)

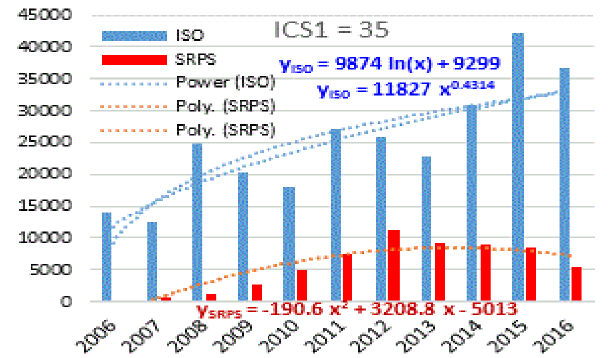

Figure 1. *Analysis results for ICS1 = 35 (2017)*

An additional analysis of the results is graphically shown in Fig. 2.1: a) with all available KS from the period from 1973 to 2015 (Iqu); Fig. 2.2: b) with the trend of planned future needs, according to the relations (3.1) and (3.2)

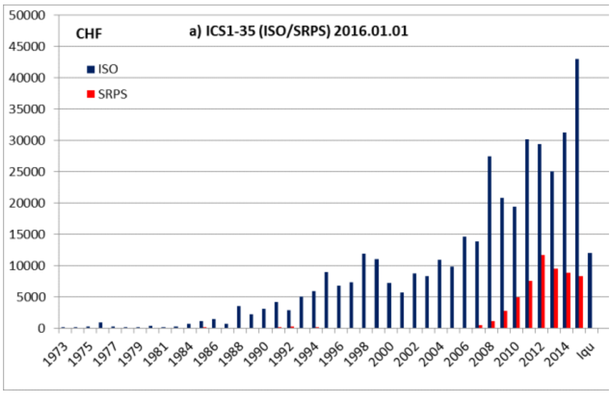

Figure 2.1. *Analysis of KS for ICS1 = 35 (2016.1)*

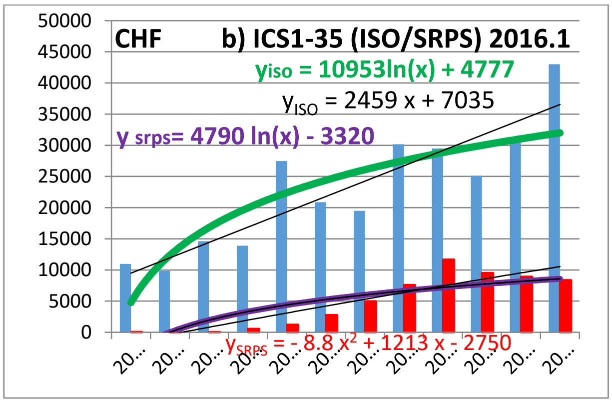

Figure 2.2. *Results for ICS1 = 35 (2016)*

The analysis results for ICS = 01 are presented graphically in Fig. 3, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 4.1) and (SRPS - 4.2).

$Y_{01/ISO/2001\text{-}2016}$ = – Polynomial/ Linear (4.1)

$Y_{01/SRPS/2007\text{-}2016}$ =− Polynomial (2013max) (4.2)

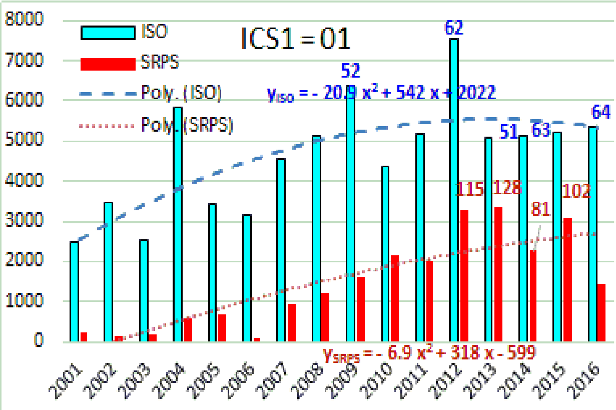

Figure 3. *Results for ICS1 = 01 (2017)*

The analysis results for ICS = 23, are presented graphically in Fig. 4, with all available samples from the period from 2000 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 5.1) and (SRPS - 5.2).

$Y_{23/ISO/2001\text{-}2016}$ =− Polynomial (2009max) (5.1)

$Y_{23/SRPS/2007\text{-}2016}$ =− Polynomial (2013max) (5.2)

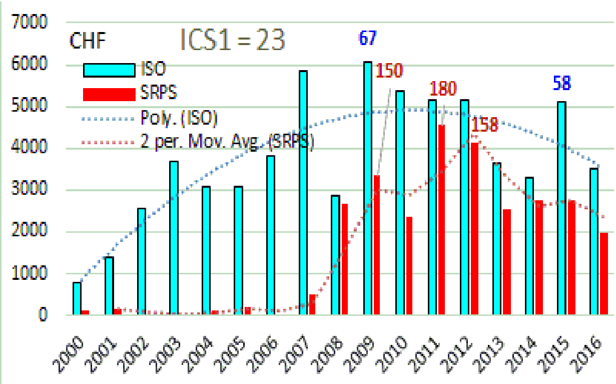

Figure 4. *Results for ICS1 = 23 (2017)*

The analysis results for ICS = 25, are presented graphically in Fig. 5, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 6.1) and (SRPS - 6.2).

$Y_{25/ISO/2001\text{-}2016}$ =− Polynomial/ Linear (6.1)

$Y_{25/SRPS/2007\text{-}2016}$ =− Polynomial (2012max) (6.2)

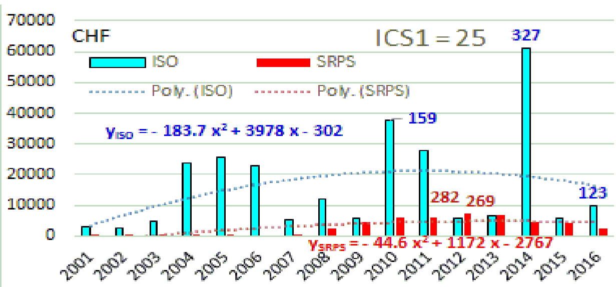

Figure 5. *Results for ICS1 = 25 (2017)*

The analysis results for ICS=49 are presented graphically in Fig. 6, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 7.1) and (SRPS - 7.2).

$Y_{49/ISO/2001\text{-}2016}$ = Linear (7.1)

$y_{49/SRPS/2007\text{-}2016}$ =− Polynomial (2012max) (7.2)

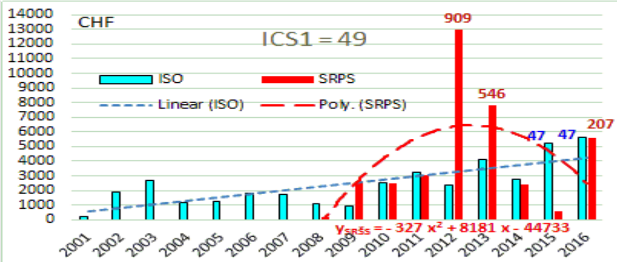

Figure 6. *Results for ICS1 = 49 (2017)*

The analysis results for ICS = 83 are presented graphically in Fig. 7, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 8.1) and (SRPS - 8.2).

$Y_{83/ISO/2001\text{-}2016}$ = Power/ ≈ Linear (8.1)

$Y_{83/SRPS/2007\text{-}2016}$ =− Polynomial (2012max) (8.2)

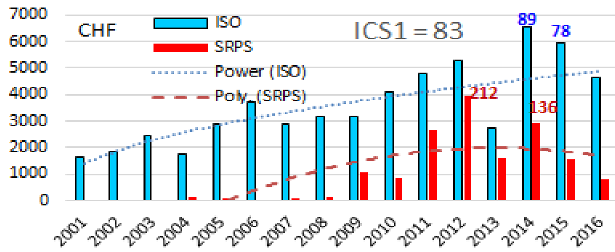

Figure 7. *Results for ICS1 = 83 (2017)*

The analysis results for ICS = 91 are presented graphically in Fig. 8, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 9.1) and (SRPS - 9.2).

$Y_{91/ISO/2001\text{-}2016}$ =− Polynomial (2014max) (9.1)

$Y_{91/SRPS/2007\text{-}2016}$ =− Polynomial (2012max) (9.2)

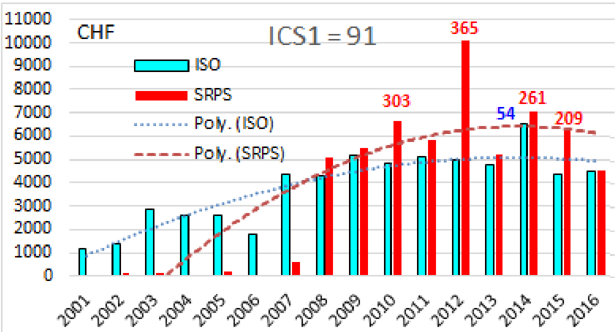

Figure 8. *Results for ICS1 = 91 (2017)*

3.2. Changes in the annual innovation index

In this section, five fields are presented (ICS1 = 29, 33, 59, 75 and 77):

- Innovation index (Ii) values in previous years were greater than 250 (Ii > 250),

- belonged to the cluster of daily innovation,

- and in 2017 this index was significantly reduced (Ii < 250).

The analysis results for ICS = 29 are presented graphically in Fig. 9.1 and Fig. 9.2: with all available samples from the period from 2003 to 2016, with the trend of planned future needs, according to the relations (10.1) and (10.2).

$y_{29/ISO/2008\text{-}2015}$ = Linear (10.1)

$y_{29/SRPS/2008\text{-}2016}$=− Polynomial ($2010_{max}$) (10.2)

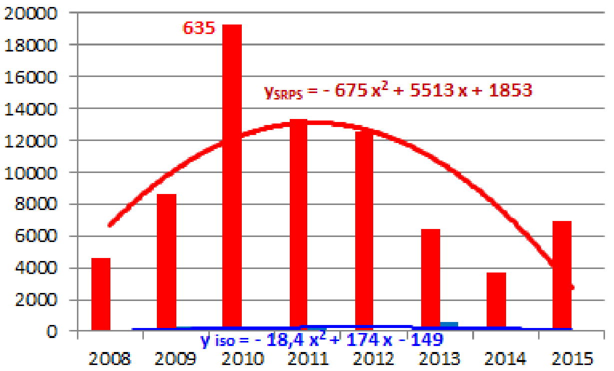

Figure 9.1. *Results for ICS1 = 29 (2016)*

The annual KS innovations (SRPS) reached a maximum in 2012 (in Fig. 9.1, $Iqp_{/29/SRPS/2015\_for\_2010}$ = 635; in Fig. 9.2, $Iqp_{/29/SRPS/2016\_for\_2010}$ = 602 KS)

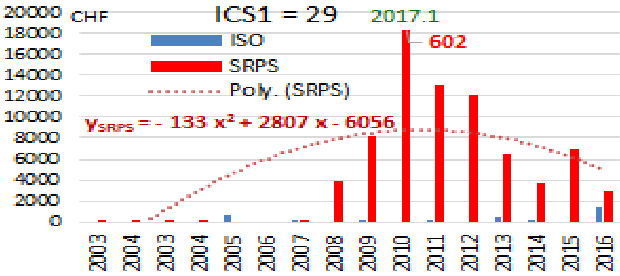

Figure 9.2. *Results for ICS1 = 29 (2017)*

The analysis results for ICS = 33 are presented graphically in Fig. 10.1 and 10.2: with all available samples from the period from 2001 to 2016; with the trend of planned future needs, according to the relations (11.1) and (11.2).

$y_{33/ISO/2001\text{-}2016}$ ≈ Linear (11.1)

$y_{33/SRPS/2007\text{-}2016}$=− Polynomial ($2012_{max}$) (11.2)

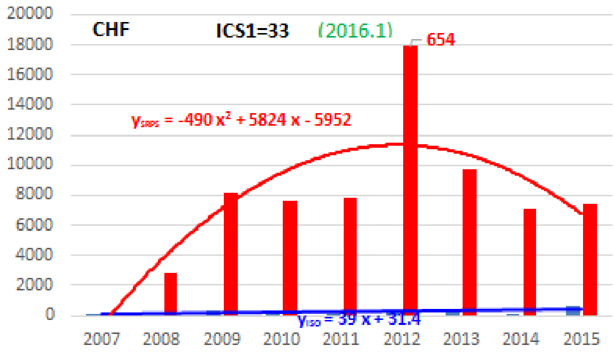

Figure 10.1. *Results for ICS1 = 33 (2016)*

The analysis results are presented graphically in *Results for ICS1 = 33*: with all available samples from the period from 1980 to 2015; Fig. 10.1: with the trend of planned future needs, according to the relations (11.3) and (11.4).

$y_{33/ISO/2007\text{-}2015} = -490x^2+5824x-5952.4$ (11.3)

$y_{33/SRPS/2007\text{-}2015} = 39x+31.4$ (11.4)

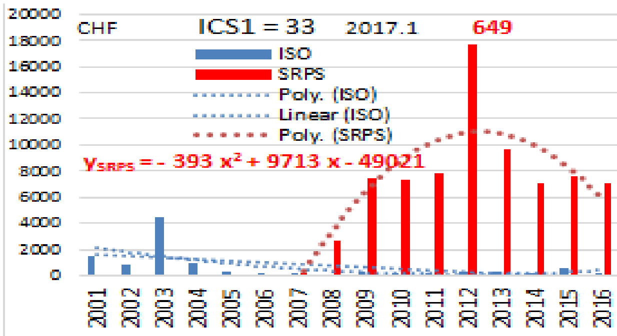

Figure 10.2. *Results for ICS1 = 33 (2017)*

The innovation trend in this field (for ICS = 33) is very similar to the trend in the field of Electrical engineering (for ICS = 29, see Fig. 9.1. and 9.2).

The annual KS innovations (SRPS) reached a maximum in 2012 ($Iqp_{/33/SRPS/2015\_for\_2012}$ = 654 KS; $Iqp_{/33/SRPS/2016\_for\_2012}$ = 649 KS).

The analysis results for ICS = 59 are presented graphically in Fig. 11, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 12.1) and (SRPS - 12.2).

$Y_{59/ISO/2001\text{-}2016}$ = Linear (12.1)

$Y_{59/SRPS/2007\text{-}2016}$=− Polynomial ($2012_{max}$) (12.2)

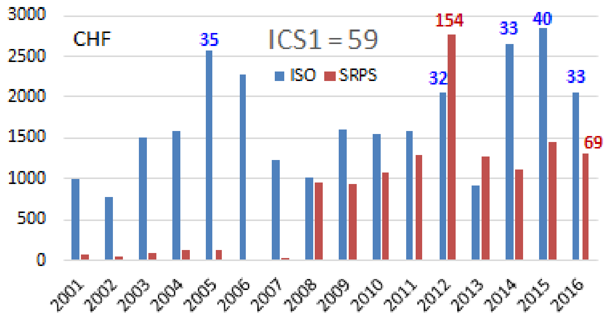

Figure 11. *Results for ICS1 = 59 (2017)*

The analysis results for ICS = 75 are presented graphically in Fig. 12, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 13.1) and (SRPS - 13.2).

$Y_{59/ISO/2001\text{-}2016}$ = Linear (13.1)

$Y_{59/SRPS/2007\text{-}2016}$=− Polynomial ($2011_{max}$) (13.2)

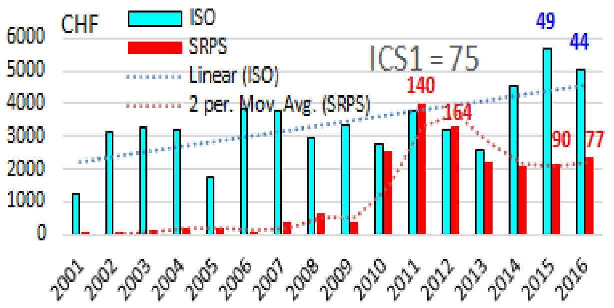

Figure 12. *Results for ICS1 = 75 (2017)*

The analysis results for ICS=77 are presented graphically in Fig. 13, with all available samples from the period from 2001 to 2016, with the trend of planned future needs for KS, according to the relations (ISO - 14.1) and (SRPS - 14.2).

$$Y_{77/ISO/2001\text{-}2016} = \text{Linear} \qquad (14.1)$$

$$Y_{77/SRPS/2007\text{-}2016} = -\text{ Polynomial } (2012_{max}) \qquad (14.2)$$

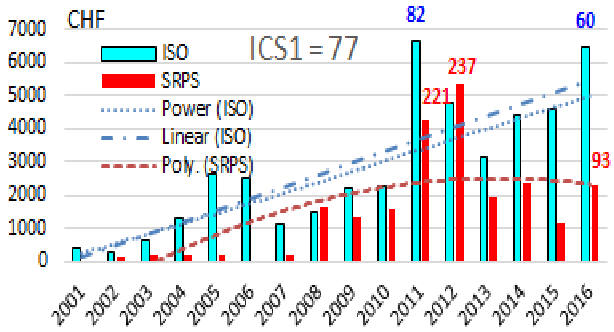

Figure 13. *Analysis results for ICS1 = 77 (2017)*

3.3. Discussion in the PDCA form

Based on these results, the discussion can be opened according to the presented initial hypotheses in PDCA: Plan – Do – Check – Act.

Plan: Resources

Future resources and financial requirements for each mentioned field at local (SRPS) and global (ISO) levels could be planned and predicted according to the presented results. The equations for trend lines have been established and the number of knowledge sources which are under development have been defined in this research. Table 1 (for analyzed fields) presents obvious facts and questions:

- The highest value of knowledge sources is in IT field

$\Sigma Iv_{/35/ISO/2016.01}$ = 399768 CHF (column 17),

- Question: Who could plan those resources (or knowledge sources in ISO standard form)?

- The value of local knowledge sources (in SRPS standard form) has a normal statistical distribution (Gaussian curve).

Do: Research and development

The original equations for trend lines of knowledge sources according to ICS have been established and presented in this research.

Knowledge sources are defined on the ICS platform with innovation intensity indices, value indices and other indices for comparison.

Information technologies were compared (ICS1 = 35) with all areas of ICS1, especially with engineering fields (ICS1 = 01, 23, 25, up to 91), with the highest intensity of innovation.

In the analysis of local KS (SRPS), the most common trend lines are *Polynomial*:

- in eight out of 12 analyzed fields (67%) the maximum is reached in 2012,

- intensive innovations began in 2008, as for the most of the images given in the paper,

- the illustrations obviously show a greater number of local (SRPS) innovations, but with significantly lower value indices, etc.

Check: Innovations and clustered fields

At this stage, the correlations between the level of innovation of knowledge sources by ICS, local and global levels, are analyzed. They are specifically intended for analyzing the clusters with the daily intensity of innovation (2017), which is comparable with the analyses in [9] - 2016-2015-2014). By comparing the local and global levels, it is concluded that the four engineering fields, due to the reduction of innovations and sources of knowledge at the local level (SRPS level), have moved from the cluster of daily innovation to the cluster of weekly innovation. A comparative analysis of the annual number of innovations (Ii) of ISO–SRPS KS on the examples of global innovations ($Iqu_{/ISO/year}$) and local publications ($Iqp_{/SRPS/(year-1)}$), is shown in Fig. 14.

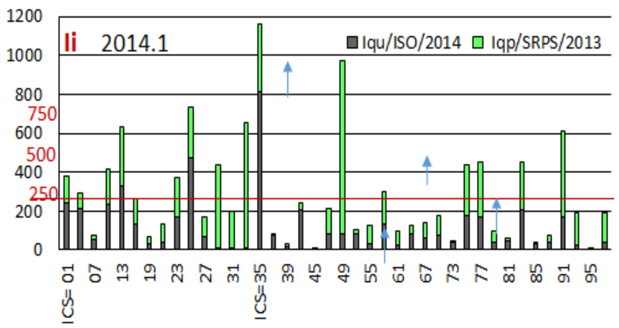

Figure 14. *Comparative analysis (Ii) of innovations of KS ISO–SRPS (2014)*

Tables 1 and 2, as well as Figures 1 to 13 (for analyzed fields) give obvious facts:

- from all international (ISO) projects under construction, most of them are in IT field ($Iqu_{/35/ISO/2017}$ = 621, column 9, Table 2),

- the number of SRPS innovations is higher than on ISO level, $Iqp_{/(29,33)/SRPS}$ (column 13 and 14),

- the most SRPS innovations are in Telecommunication; Audio and video engineering, (ICS1 = 33), $Iqp_{/33/SRPS/2017}$ = 224 (column 14).

Act: Improvement

Phase Act defines this methodology as applicable to any other field and gives possibilities for future research.

As an addition to the comparison of the results, in this research we have done an analysis for previous years (1.2015 and 1.2016). These results are presented in Fig. 15 and Fig.16. We chose more equations for trend lines to prove the similarities (Polynomial/ Linear/ Logarithmic/ Power…) for planning the necessary resources.

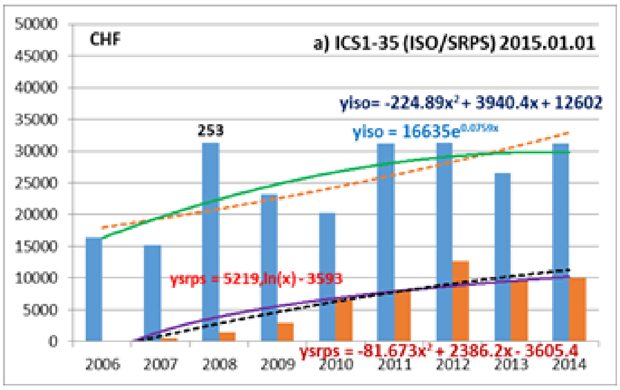

Figure 15. *Result for IT (ICS1 = 35): 2015.01*

Fig.15 and Fig. 16 show the number of KS for 2008, and according to the given data we can discuss the withdrawn standards through the years.

E.g, value for KS, $Iqs_{/35/ISO/2008}$ = 217 (2016.01, Fig. 16), reduced, relative to $Iqs_{/35/ISO/2008}$ = 253 (2015.01, Fig. 15).

Fig. 15 and Fig. 16 show the trend of planned future needs for two periods of the analysis (January 2015 and January 2016), according to the relations (3.3), (3.4), (3.5), (3.6), (3.7), (3.8), (3.9) and (3.10).

$$y_{35/ISO/2006\text{-}2014} = -224.89x^2 + 3940.4\,x + 12602 \quad (3.3)$$

$$y_{35/ISO/2006\text{-}2014} = 16635\, e^{0.0759x} \quad (3.4)$$

$$y_{35/SRPS/2006\text{-}2014} = -\,81.67\,x^2 + 2386\,x - 3605.4 \quad (3.5)$$

$$y_{35/SRPS/2006\text{-}2014} = 5219\,\ln(x) - 3593 \quad (3.6)$$

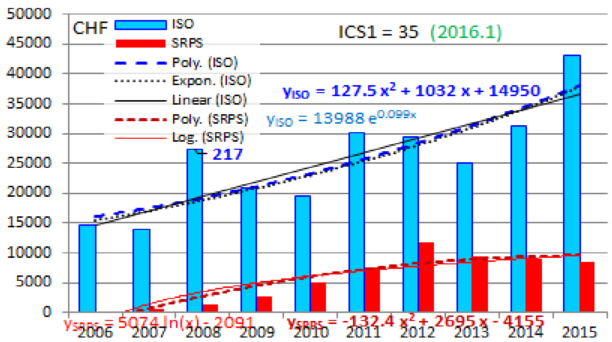

Figure 16. *Analysis results for IT (ICS1 = 35) 2016*

$$y_{35/ISO/2006\text{-}2015} = 127.5\,x^2 + 1032\,x + 14950 \quad (3.7)$$

$$y_{35/ISO/2006\text{-}2015} = 13988\, e^{0.099x} \quad (3.8)$$

$$y_{35/SRPS/2006\text{-}2015} = -132.4\,x^2 + 2695\,x - 4155 \quad (3.9)$$

$$y_{35/SRPS/2006\text{-}2015} = 5074\,\ln(x) - 2091 \quad (3.10)$$

Although the trend lines (mathematically observed) give similar results in resource planning, this can be discussed from several aspects:

- The choice of the most favorable trend line (exponential / linear / logarithmic / polynomial / power),

- The comparison and deviations of the planned resources based on the mathematical trend line in relation to the actual realization (which is particularly relevant for the planning and realization of ISO projects),

- The comparison of innovations on local (SRPS) and global (ISO) platforms,

- The approximations included in the methodology,

- Project for the development and implementation of an information-expert system (IES),

- The necessary experience of planners (managers), etc.

Fig. 15, Fig. 16 and Fig.1 show significant quantitative quantities / quantities of innovation (numerical and value) in 2015, 2016 and 2017. At the same time, the number and value of liabilities in previous years are also reduced.

This means that a professional should know about new sources, but also about those standards that are out of use.

By comparing this research to the related research, this paper gives a proposal to analyze knowledge sources on local and global levels with PDCA approach.

4. CONCLUSION

Based on the presented hypotheses and results, what follows are the conclusions reached through the PDCA methodology:

Plan: Planning resources for KS

According to the presented results a plan for future research (and innovation of the knowledge base) is defined. Apart from a statistical analysis, future research will include data mining techniques for predicting the number of KS at local and global levels.

Do: Products development

D (Do); "Do"- phase: Research and evaluation of KS enable obtaining explicit mathematical relations (3-14), as well as trend lines of knowledge sources in ICS1

The given results and indices analyses enable better organization of future tasks in the standardization of applications and products in the mentioned fields (ICS1 = 23, 25, 33, 35, 49, 83, 91).

Check: The intensity of innovation (Ii) - daily

Check phase proposes the activities for checking the initial hypotheses (according to the relation (2)) and gives an original methodology for future work which could be applied to all fields.

The following possibilities have been proven:

–The possibility of defining correlations between KS with daily (or weekly) intensity of innovation (Ii),

- With checking the clustered ICS1 fields, according to the annual intensity of innovation at local (SRPS) and global (ISO) levels.

Act: Applications and system improvements

Act-phase includes the creation of a Web based application and system (IES) for obtaining the correlations between the statistical results and knowledge improvements in order to improve the *knowledge base system* in PDCA.

ACKNOWLEDGMENT

The work presented here was supported by the Serbian Ministry of Education and Science – project III 44006, http://www.mi.sanu.ac.rs/projects/projects.htm#Interdisciplinary

The author thanks Ms. Lena Tica for English language editing.

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