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STRASBOURG APRIL 26TH TO 28TH ICOLIM 2017 INTERNATIONAL CONFERENCE ON LIVE MAINTENANCE

STUDY ON THE QUALITY MANAGEMENT AND HEALTH AND SAFETY ASPECTS ON PERCEIVED LIVE WORKING IMPLEMENTATION DIMENSIONS

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The purpose of this paper is to examine whether compliance with the requirements for:

- the safety and health,
- the quality and
- the effectiveness and efficiency of

maintenance processes with the implementation of LW at low voltage can be achieved.

The study draws upon study carried out among the Slovenian electrical utilities and international.

STUDY WAS CARRIED OUT AMONG SLOVENIAN AND FOREIGN LW EXPERTS.

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SLOVENIA & LW

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The start of LW implementation on low voltage (LV) in 2011 progressed with a successful LW implementation on medium voltage (MV) – S/S cleaning in 2013, i.e. exactly 100 years after an electrician in Ohio, USA, used the LW method on MV for the first time.

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SLOVENIA & LW

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Our articles, which were published at ICOLIM 2011 and ICOLIM 2014, described in detail the development of implementing and carrying out LW in Slovenia in the nuclear power plant and in industrial (private) and distribution companies (public) on LV and MV level with the emphasis on the training and the "Zero Accidents" philosophy.

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STUDY OF LW EFFECTS IN SLOVENIA

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In agreement with the Slovenian electrical distribution companies
Elektro Gorenjska (EG), Elektro Ljubljana (EL) and Elektro Maribor (EM),
an outsourcing survey was carried out on "the introduction and implementation of LW on LV in distribution companies"

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STUDY OF LW EFFECTS IN SLOVENIA

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The survey was conducted among technician and coordinators (EG, EL and EM), who completed the basic training for LW at LV in October 2011 and refresher courses in October 2013 and October 2015 (every two years).

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THE QUESTIONNAIRE

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The questionnaire of the introduction and implementation of LW on LV in Slovenian distribution companies contained 99 questions divided into six groups:

Part I. “Introductory basic information about respondents" (12 questions)”,
Part II. “Competencies for implementation LW at LV (personal, distribution)” (25 questions),
Part III. “Safety and health (OSH) of LW at LV” (12 questions),
Part IV. “Quality management in the implementation of LW at LV” (11 questions),
Part V. “Efficiency and effectiveness in the implementation of LW at LV” (14 questions),
Part VI. “Appendix” (25 questions).

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RESPONDENTS FROM UTILITIES

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Respondents	EG	EL	EM	TOTAL
Technician	3	7	16	26
Coordinators	12	5	12	29
TOTAL	15	12	28	55

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SUMMARY
OF THE RESULTS REGARDING THE COMPARISON BETWEEN COORDINATORS AND WORKERS

Dimension	Mc	Mw	t	p
Competencies for LW	4,14	3,83	2,631	0,011
OSH at LW	4,75	4,66	0,851	0,408
Quality management at LW	4,58	4,20	2,006	0,066
Efficiency and effectiveness at LW	4,30	4,02	2,396	0,026

Note. M_c *– Mean value for coordinators,* M_w *– mean value for workers*

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INTERNATIONAL STUDY OF THE LIVE WORKING EFFECTS

STRASBOURG APRIL 26TH TO 28TH ICOLIM 2017 INTERNATIONAL CONFERENCE ON LIVE MAINTENANCE

This survey was carried out in 2014 amongst the LWA committee members from Croatia, Czech, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Romania, Spain and Slovenia and participants of ICOLIM 2014.
The survey later also included LW specialists who are active in CIGRE.

INTERNATIONAL STUDY OF THE LIVE WORKING EFFECTS

The University of Maribor, Faculty of Organizational Sciences and the Institute for research and development (I.R.R.) of C&G d.o.o. Ljubljana, Slovenia have carried out a research project in 2014 on the "Contribution of Live Working (LW) to the quality, safety, efficiency and effectiveness of maintenance procedures".

Contribución a Trabajos con Tensión (TCT) para la calidad, seguridad, eficiencia y efectividad en los procedimientos de mantenimiento. (Spanish)

Istraživanje o doprinosu rada pod naponom na kvalitetu, sigurnost, učinkovitost i uspješnost procesa održavanja. (Croatian)

Raziskava o prispevku dela pod napetostjo h kakovosti, varnosti ter učinkovitosti in uspešnosti procesov vzdrževanja. (Slovenian)

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THE QUESTIONNAIRE

STRASBOURG APRIL 26TH TO 28TH ICOLIM 2017 INTERNATIONAL CONFERENCE ON LIVE MAINTENANCE

The international questionnaire contained 83 questions divided into five groups:

Part I. "BASIC INFORMATION ON THE RESPONDENTS" (10 questions),

Part II. "QUALITY MANAGEMENT DURING LW IMPLEMENTATION" (20 questions),

Part III. "HEALTH AND SAFETY AT WORK DURING LW IMPLEMENTATION" (19 questions),

Part IV. "EFFICIENCY AND EFFECTIVENESS OF LW IMPLEMENTATION" (15 questions),

Part VI. "ADDITIONAL SECTION" (19 questions).

INTERNATIONAL SURVEY

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Univerza v Mariboru
Fakulteta za organizacijske vede

C & G D.O.O. LJUBLJANA

Subject: **Contribution of Live Working (LW) to the quality, safety, efficiency and effectiveness of maintenance procedures**

Dear Sirs,

The University of Maribor, Faculty of Organizational Sciences and the Institute for research and development (I.R.R.) of C&G d.o.o. Ljubljana, Slovenia have carried out a research project on the "Contribution of Live Working (LW) to the quality, safety, efficiency and effectiveness of maintenance procedures".

QUESTIONNAIRE

I. BASIC INFORMATION ON THE RESPONDENTS

1. I work in (country): _____

2. As a LW professional, I am employed in (mark with an X):
   __ Transmission
   __ Distribution
   __ Power generation
   __ Industry
   __ Assembly/Engineering/Services
   __ Training grounds/centre
   __ Institute/University
   __ PPE manufacturing
   __ Tool/equipment manufacturing
   __ Other _____

II. QUALITY MANAGEMENT DURING LW IMPLEMENTATION

Could you estimate, how the quality management system influences the satisfaction of consumers and the quality of electrical energy during LW implementation *Grades: 1 – Don't agree at all; 5 – Completely agree (encircle the appropriate answer)*					
SECTION: Quality management system during LW implementation					
1. Companies that carry out LW in our country **have implemented the quality management system** ISO 9001:2008	1	2	3	4	5
2. Companies that carry out LW in our country **have implemented different management systems** (ISO 9001, ISO14001, OHSAS 18001 and/or others)	1	2	3	4	5

III. HEALTH AND SAFETY AT WORK DURING LW IMPLEMENTATION

Could you estimate the attitude towards measures for health and safety at work during LW *Grades: 1 – Don't agree at all; 5 – Completely agree (encircle the appropriate answer)*					
SECTION: Health and safety at work during LW implementation					
1. Maintenance workers (linemen) on electrical installations (networks) **should be trained electricians**	1	2	3	4	5
2. Basic theoretical and practical training **should be mandatory** for all LW workers	1	2	3	4	5

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INTERNATIONAL SURVEY

STRASBOURG APRIL 26TH TO 28TH ICOLIM 2017 INTERNATIONAL CONFERENCE ON LIVE MAINTENANCE

IV. EFFICIENCY AND EFFECTIVENESS OF LW IMPLEMENTATION

Could you estimate the efficiency and effectiveness of LW implementation *Grades: 1 – Don't agree at all; 5 – Completely agree (encircle the appropriate answer)*					
SECTION: Efficiency and effectiveness of LW implementation					
1. Consumers **are satisfied,** if uninterrupted energy supply is ensured	1	2	3	4	5
2. Preventive maintenance with LW **enables reliable power supply of systems** that ensure personal and general safety of people (hospitals, nuclear power plants, tunnels, traffic, etc.)	1	2	3	4	5
3. Preventive maintenance with LW **increases the availability of machinery** in process manufacturing 24/7 (medicine, paper, etc.)	1	2	3	4	5
4. Preventive maintenance with LW **enables flexibility** of work on networks or machinery, because it is carried out independently from other staff	1	2	3	4	5
5. Preventive maintenance with LW **enables time flexibility** of maintenance work (no work during weekends, no overtime, etc.)	1	2	3	4	5

V. ADDITIONAL SECTION

Could you estimate how you see dead working and evaluate the status of linemen who carry out LW *Grades: 1 – Don't agree at all; 5 – Completely agree (encircle the appropriate answer)*					
SECTION: Dead working					
1. Linemen **carry out** dead work **routinely**	1	2	3	4	5
2. Linemen **need** additional training for dead work	1	2	3	4	5

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RESPONDENTS FROM COUNTRIES

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A total of 171 respondents from 36 countries participated in the survey.

Most of the respondents were from Slovenia (44 or 25.7%) and Croatia (27 or 15.8%).

The respondents from abroad were in average represented with a sample size of 1 to 5.

The above-average response of LW experts was seen in Hungary (10), Canada (9), Germany (8) and Poland (6).

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COMPARISON

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Observing the four dimensions ("Quality management at LW", "Health and safety at LW", "Reliability and Availability of LW" and "Performance of LW providers").

We can see that the highest mean value of Slovenian dataset corresponds to the "Reliability and Availability of LW" (M = 4,52), while the lowest value corresponds to the "Performance of LW providers" (M = 4,05).

Given the international dataset our results showed that the highest mean value corresponds to the "Health and safety at LW" (M = 4,61), while the lowest value corresponds to the "Performance of LW providers" (M = 4,17).

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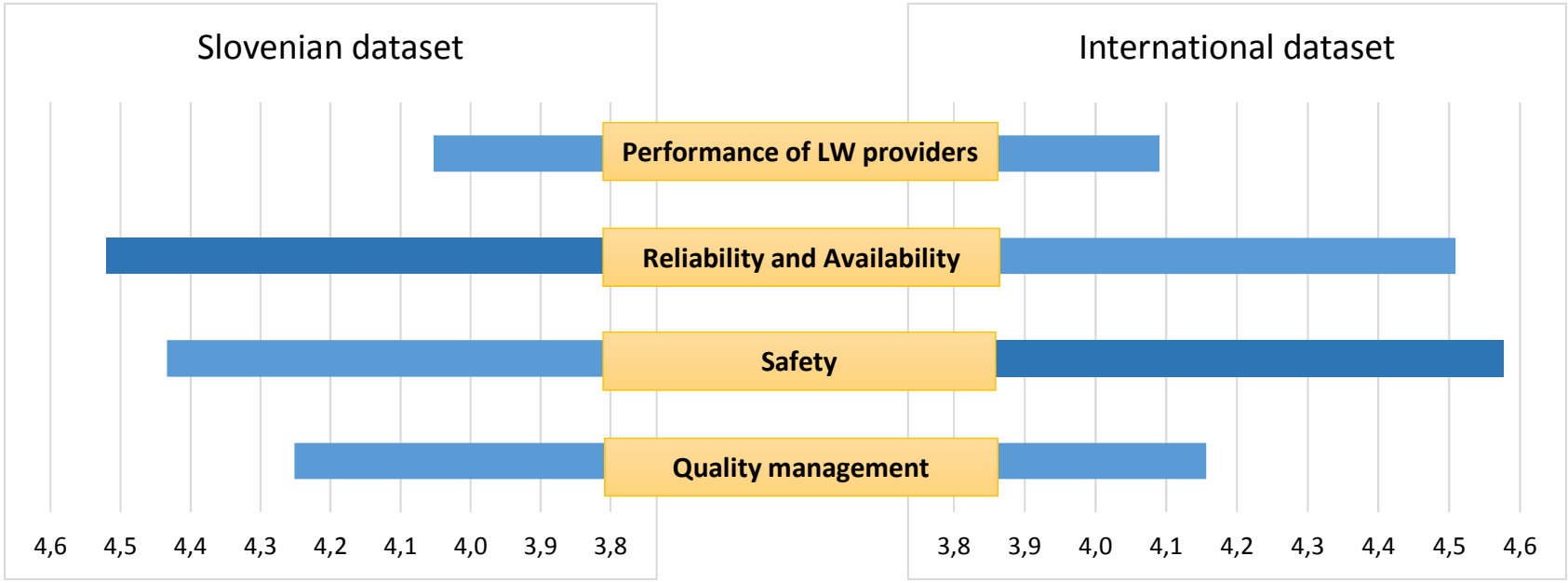
COMPARISON

STRASBOURG APRIL 26TH TO 28TH ICOLIM 2017 INTERNATIONAL CONFERENCE ON LIVE MAINTENANCE



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CONCLUSIONS

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It is evident from the survey results that safety and health was highlighted as the most important factors/dimensions from the perspective of technician and instructors.

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CONCLUSIONS

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The results of the Slovenian study suggested that health and safety aspects of LW are vital for achieving efficiency and effectiveness of LW.

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CONCLUSIONS

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Similarly, the results of the international survey showed that health and safety aspects of LW are considered as very important in achieving expected outcomes of LW.

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CONCLUSIONS

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However, the results indicated that Slovenian experts perceived the elements of LW in a similar way as foreign experts.

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CONCLUSIONS

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The results of the regression analysis have confirmed the premise that quality management as well as health and safety at work can be beneficial in terms of reliability, flexibility and availability of electric installations and performance of LW workers.

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CONCLUSIONS

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Results from both empirical studies emphasise the importance for LW providers to recognize safety aspects, the importance of providing periodical training in the field of LW as well as the need to be aligned with the requirements concerning the safety equipment.

Furthermore, it should be noted that standardized management systems, such as ISO 9001 and OHSAS 18001, can provide systematic approach towards integrating the quality management and safety aspects into the LW procedures and processes.

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FUTURE RESEARCH

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It is of great importance that research is continued as it should give answers to the following questions - does carrying out of maintenance of electrical installations by the live working method:

- have an impact on meeting the requirements of customers for electricity and higher level of quality of electricity?
- reduce the number of accidents at work with electricity?
- contribute to better effectiveness and efficiency when carrying out preventive maintenance of electrical installations?

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We would like to thank to the LW colleagues who supported our international survey from LWA committee members from Croatia, Czech, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Romania, Spain and Slovenia and participants of ICOLIM 2014 in Budapest and LW specialists who are active in CIGRE.

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THANK YOU FOR YOUR ATTENTION

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