

## **THE PECULIARITIES AND CHALLENGES OF KNOWLEDGE AND EXPERIENCE EXCHANGE**

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**Abstract.** This paper is devoted to the analysis of main peculiarities and challenges of knowledge and experience (K&E) exchange processes between seniors and young people. Author consider and analyze: (a) the general characteristics of the seniors and young as actors of K&E exchange processes, (b) main approaches for exchanging and transferring knowledge and experience, (c) some successful cases of knowledge and experience exchange in Canada, Sweden, US, Japan, China, Taiwan, Ukraine and other countries, (d) models, means and methods for K&E transfer and data processing, (e) peculiarities of K&E exchange at Intelligent Information Systems Department of PMBSNU. Special focus made on the “both directions” feature of the K&E exchange processes for “senior-young” chain in the traditional (education, safety, industry) and quickly-developing (information communication technology) areas of human activity.

*Keywords: knowledge, experience, exchange, senior, young, peculiarities, challenges.*

### **Introduction**

Your Excellency, RACEF President Dr. Jaime Gil Aluja, Academicians and Corresponding Academicians of the Royal Academy of Economic and Financial Sciences of Spain, Honor Members of Barcelona Economic Network, Distinguished Guests, Ladies and Gentlemen!

It is a great pleasure for me to participate in this XVI-th International Act under the title “Been senior: knowledge and experience”, which is organized in on-line virtual mode instead traditional face-to-face scientific meeting in Barcelona, in particular, in the headquarter of RACEF.

It is hard time now for all scientists around the world due to pandemic situation with COVID-19, or more exactly, due to global restrictions related to the COVID-19 pandemic. But nevertheless, we need to adapt our activities to the circumstances and it is very nice that we have such good possibility for conversation and exchange of our opinions in the framework of virtual conference.

Indeed, it is a great honor for me to be involved in the BEN’s and RACEF’s multi-disciplinary discussion on the actual and highly-important problem, current issues, and challenges of contemporary exchange of knowledge and experience (between senior and young people) in the different areas of industry, science and technology, as well as in information and economic fields.

Thanks a lot again to organizers, to President, Vice-Presidents and Secretary of RACEF for: (a) great work which they done for organization of this important international meeting in uncertain pandemic conditions with invitation of the distinguished participants from Austria, Azerbaijan, Algeria, Belarus, Israel, Italy, Mexico, Poland, Romania, Serbia, Spain, Switzerland, Tunisie and Ukraine; (b) given us a chance to present our research point of view on the abovementioned topic, to ask interesting questions and to make joint conclusions (c) talking about the perspectives of international cooperation in development general and specific approaches, universal models and efficient methods for exchange of knowledge and experience exchange.

Let me also cordially deliver a warm feeling and friendly wishes from Rector Dr. Leonid Klymenko, professors, teachers and students of our Petro Mohyla Black Sea National University – PMBSNU (Mykolaiv, Ukraine), from Association of Ukrainian universities and from kind citizens of Mykolaiv-city. As you know Mykolaiv has a great scientific and cooperation relations with RACEF and two academicians (members of RACEF) are the Honour Cause Doctors, in particular, Dr. Jaime Gil Aluja at Ukrainian Maritime Technical University since 2000 (now – Admiral Makarov National University of Shipbuilding) and Dr. Janusz Kacprzyk at Petro Mohyla Black Sea National University since 2020. These are the great examples of knowledge and experience exchange by scientific cooperation on the international level.

According to the topic under discussion I would like to say that interrelations between knowledge of seniors and enthusiasm of youth, between experience of oldest and career desires and best physical conditions of youngest people as well as a problem of successful transformation knowledge and experience (K&E) from seniors to youth for fruitful and quick development of an economy have some challenges and peculiarities which are actual and common for different countries in the world.

### **General characteristics of the actors of K&E exchange processes**

The topic of my presentation at this XVI-th International Act “The Peculiarities and Challenges of Knowledge and Experience Exchange: Senior and Young” is based on the discussion of different aspects of such K&E exchange and transformation in both directions of the chain “senior-young” with some focuses on the world’s and Ukraine’s tendencies.

It is really “both directions” exchange processes because knowledge and experience can be transformed from seniors to young in most traditional fields of knowledge and from young to seniors in some modern cases.

Let’s discuss the main characteristics of the actors (senior and young) of the K&E exchange processes.

**The seniors**, as usual, have a lot of knowledge and experience in their field of expertise, but (due to age) in most cases have not strong health and longtime activity during working day.

In traditional working mode they have quickly fatigues, low endurance, persistence, staying power, durability and hardiness.

The seniors have very good background, for example, may be graduated from several universities or from different faculties and specialties of the one university, and may have scientific degrees (PhD, Dr.Sc. or Dr. habil.) or academic statuses such as Academician, Corresponding Academicians, Professor, Associate Professor and different honor titles which are the basis for their distinguished K&E.

The seniors can be divided in several groups or categories, in particular:

a) working seniors as representatives of senior staff of companies who may share their knowledge and experience with young staff;

b) retired non-working seniors with great experience who want to share their knowledge with young specialists in their fields with great goal – all valued knowledge should be transferred to next generations and any pieces of knowledge and experience may not be lost;

c) retired non-working seniors who want to find new job and who want to change their professional qualifications to another field of human activity comparing with their previous knowledge and experience (army veterans, army officers, people who are retired in non-old age due to working in harmful environment, polar or special conditions and others);

d) the seniors with disabilities who want to have new knowledge and experience based on modern information communication technologies (ICT).

Efficient and perspective young people have a lot of intentions to get high-caliber knowledge and best experience as soon as possible.

The main characteristics of **young people** are enthusiasm, ambition, aspiration to have success in carrier and others and it is very important that young people have, usually, good health, can work hardly without fatigues, and may alternate between work and exercise.

By the way, in some quickly-developing fields of knowledge young scientists and specialists may have the same qualification levels as seniors and, in some cases; they may have even higher qualification levels.

A lot of young scientists are invited or keynote speakers at the international congresses, conferences and symposiums in the field of computer sciences, artificial intelligence, information technologies and systems, intelligent robotics, data science, e-learning and others [1-11].

Young people may be also divided in several groups or categories, such as:

a) young people who want to get new and more deeper knowledge in their area of qualification and expertise;

b) young people who want to extend the frameworks of their knowledge and to get multidisciplinary knowledge in the areas which are close to their qualification and expertise;

c) young people who want to get knowledge in new or alternative areas of knowledge comparing with their background;

d) young people with disabilities who want to have new knowledge and experience based on modern ICT technologies;

e) young people who have specific knowledge in high-developed fields of human activity (for example, computer science and IT industry, including Internet of Things (IoT) [12-22], Data Science and Intelligent Analysis of Information [22-31], etc.) and who want to share their knowledge and experience with seniors and young, which are interesting in such K&E.

### **The analysis of main approaches for exchanging and transferring knowledge and experience**

Let us analyze the different ways of knowledge and experience transferring in the both directions of “senior-young” chain.

Among the most efficient methods and approaches of K&E exchanges are:

a) publication of important aspects of knowledge in the area of expertise and successful cases from practical experience (monographs [2-5, 32-38], articles [12, 25, 28, 39-43], surveys [13-15], reports [44], etc.) including joint publications of senior and young scientists [16-18] and special monographs devoted to distinguished professors, like Prof. Jaume Gil Aluja [34], Prof. Vsevolod M. Kuntsevich [32];

- b) scientific, methodological and practical presentations at the different research and practical forums such as conferences, symposiums, seminars, workshops, etc.;
- c) organizing summer or winter schools or special education camps [45] on the contemporary fields of knowledge;
- d) proposing e-training [1] and distance learning [11] education with preliminary prepared lectures and trainings by experienced seniors or distinguished young specialists;
- e) creating mixed expert groups of specialists (seniors and young people) at the governmental or municipal levels for development of strategies in solving special actual problems of city infrastructure, transportation, logistics, education, industry, etc.;
- f) creating mixed “senior-young” groups of scientists for participation in special research grants’ competitions for development and implementation of the research projects in different fields of human activity;
- g) invitation of the experienced seniors with highest knowledge and expertise for expert evaluation of young scientists research proposals and for assessment of novelty, originality and perspectives of practical implementation of the research projects executed by young scientists;
- h) creating special consulting centers where seniors can consult young specialists [46] according to their demands in the multidisciplinary knowledge;
- i) reviewing articles, books and conference papers with critical and useful comments for their improving and with recommendation for publication (accept, reject, major revision, minor revision, etc.);
- j) creating computerized expert systems with knowledge data which are synthesized based on the seniors’ knowledge and experience;
- k) involving high experienced seniors to expert interviewing processes on the global and regional problems and challenges with alternative solutions (climate changing [47], pandemic, energy saving [48], safety [49] and so on).

### **Successful cases of knowledge and experience exchange**

Let us discuss some published approaches, ideas and successful practical cases in knowledge transfer and experience exchange.

*K&E exchange regarding construction projects based on MMKM.* The authors [56] note that K&E regarding to maintenance management of government department in Taiwan are hard to be

shared taking into account some law misunderstandings and the frequent changing in engineering staff. The authors propose a Mind Map Knowledge Management (MMKM) approach for reusing and sharing knowledge and experience of experienced engineers in the field of construction. Senior and junior engineers can effectively and easily exchange knowledge [56] and experience regarding to their current construction project.

*K&E exchange based on micro-tasking.* Micro-tasking can help senior workers preserve their knowledge and experience for significant contribution to the development of their communities [55]. But sometimes the experienced senior workers have problems with their low skills in modern technologies including ICT. Authors [55] have developed a question-answer card interface to allow the elderly to participate in micro-tasks with minimal ICT skills and learning efforts. They also consider several alternatives for applying the question-answer card in creating new and perspective work opportunities for seniors.

*Creating globally competent engineers based on learning from senior-level professionals.* Education for global competency (including the professional and ICT skills) is an important peculiarity of the training of 21st century engineers. In [50] author underlines that improving curricular and co-curricular experiences designed to foster globally competent engineers is a very important things for modern science and technology development and requires a lot of activities and efforts based on efficient knowledge and experience exchange processes. The publication [50] discusses the main peculiarities of on- and off-campus activities and important lessons learned from senior-level professionals for creating globally competent engineers.

*Virtual community of practice to share knowledge and experience.* The paper [39] explores the involving entrepreneurs in a virtual community of practice with the goal to share their knowledge and experiences. Involving intensity was chosen for measuring the level of knowledge sharing with introduced website indices based on the message length, message frequency and reciprocity in the K&E exchanging process. The set of measurement indices indicate the utility of the website from the viewpoint of its members' participation. The authors concluded that entrepreneurs normally use message size in short (less 100 words) or medium (less 250 words) styles during participation in the discussions. The authors underline that senior members and discussion moderators play important roles in discussion activation and in stimulating the community interest to the discussion topic.

*Experience of Institute of Electrical Engineers of Japan for utilizing senior researchers and engineers.* The imbalance between birthrate and aging population in Japan can led in not far future to

the decrease of productive-age population. At the same time, the quantity of senior people who want to be useful for the society is increasing. It is proposed in [58], to utilize senior researchers and engineers with specialized knowledge and experiences for the development of different industrial areas. The paper considers the professional system of Institute of Electrical Engineers of Japan which is utilizing senior researchers and engineers. This system is a service system that provides (a) the knowledge of seniors to clients as value and (b) the opportunities to work for seniors [58].

*Consulting as professional satisfaction for seniors.* T.R.Beattie in [46], based on his own consulting experiences, (a) notes that consulting can provide professional satisfaction and some personal income for seniors and (b) analyzes many factors leading to a successful consulting business based on accumulated personal knowledge and experience. Seniors can do full-time or part-time consulting depends on their comfortable feeling, desires and feedback from young people.

*Seniors' K&E for power planning in ICT companies.* The tacit knowledge and experience of senior staff is a base for ICT companies [40], especially in particular for effective power planning with the goal of supporting the growing number of their providing services. The loss of such knowledge and experience resulting from the retirement of staff is an important challenge for the large ICT companies. The study [40] considers a systematic power planning model based on the multi-criteria evaluation of operational performance. The proposed model can give competitive advantages to ICT companies by to more effectively managing their power resources.

*Interrelation between cognitive reserve and cognitive competences.* The study [51] investigates the interrelation between a level of cognitive reserve (CR), defined as previously acquired knowledge and experience, and a level of cognitive competences in adults. It is supposed that high CR plays a protective role concerning to cognitive capacities in senior citizens. The applied CR index can be calculated based on (a) formal education level, (b) involvement in social, occupational and physical activity, and (c) level of social support. Authors provide testing experiment for checking the hypothesis that a lower CR would predict lower cognitive capacities. 120 healthy adults were tested and all participants were divided into two groups with lower and higher cognitive levels. Older age corresponds to poorer cognitive function. Authors concluded that higher CR's level reduces the risk of cognitive difficulties in healthy adults and the risk of cognitive decline increases with age.

*Work environment and efficiency of K&E exchange.* Authors in [52] noted that employees are the human capital that contributes to the success of high-performance and sustainable organizations, which are investing in retaining skilled workers, in particular senior workers whose knowledge and

experience are a valuable asset that should be passed to younger co-workers. One way for solving this problem is in creating conditions for a feeling of employee's wellness in their work environment. In paper [52], the physical and social perception of well-being at the workplace is combined with different techniques for acquiring the expertise and increasing qualification of the employees in the required domains of professional knowledge. This is particularly relevant for seniors to whom the feeling of fulfilment and recognition is much appreciated. "Intelligent behavior" (IB) is the proposed solution based on (a) informing employees about their well-being status and (b) sending special notifications for minimization of the risk of fatigue or stress at work. IB supports workers in their participation in new and rewarding projects with application of their knowledge and experience, as well as, provides employee recognition and social well-being at the workplace. Authors underline that team management and tutoring of younger co-workers by seniors are the perspective innovative peculiarities [52].

*Project management boot camps.* Stantec's Quality Management System includes 10-Point Project Management (PM) Framework, which guides the development of projects from start to finish [45]. A key component of the PM Framework is the PM Boot Camp, a full-day in-class session delivered year-round in Stantec's offices around the world. The Boot Camps incorporate safety moments, group exercises, and specific examples dealing with real experiences in project management. The Boot Camps train over 700 of project support people annually. Since the launch of the Boot Camps, over 3,800 Stantec project managers, developers and support staff have taken the training in the framework of over 48,000 person hours of face-to-face learning. The knowledge and experiences exchange and the connection of the PM Framework to different practical examples and situations confirm the value of the training for both young project managers and senior leadership [45].

*Strategy for resolving the talent gap.* The talent gap in the E&P industry is a real challenge and the attrition in the current workforce and the increasing percentage of junior employees are the main reasons. In this situation there are not enough possibilities for the two generations for K&E exchange and as a result some knowledge and experience may be lost.

The strategy for resolving the talent gap is based on the following proposals [53]: (a) accelerating junior employees' development, (b) leveraging the experience of senior staff, (c) a structured knowledge sharing system, and (d) new methods for filling current talent vacancies. The successful realization of the proposed strategy will significantly improve K&E exchange processes and ensure knowledge preservation within large E&P companies [53].

*Reproducing knowledge and experience of human experts by intelligent expert systems.* Nowadays the corporations have some challenges which deal with the senior staff retirement and losing valued knowledge. Expert systems (ES) which are the research area of artificial intelligence (AI) can help this problem solving because the ES are applications that could reproduce the knowledge and experience of a human expert. The paper [54] is devoted to designing and implementing ES for corporate bankruptcy analysis. Author proposes to use the production rules in ES which are synthesized based on indebtedness and solvency ratios.

*Safety review activity.* Discussion from diversified viewpoints is very important for process safety review. Mitsubishi Chemical Corporation [49] has been working to improve process safety by performing safety review (SR) activities. The aim of the SR activity is to improve safety of processes and operations by sharing information from a broad range of perspectives. The member of SR instructor team is composed of retired and senior engineers who have abundant knowledge and experience about structure of different technological processes and safety measures. The SR is a real K&E exchange activity in which knowledge, experiences and perspectives are sharing by participants.

*Clinical experience of veteran doctors of Chinese medicine.* The article [57] deals with preservation of knowledge and clinical experience of veteran doctors of Chinese medicine (CM) by developing a database using experience of famous CM acupuncture master in southern China. The main goal is to discover the acupuncture point selection patterns which require profession knowledge and experience from senior CM doctors. It is supposed [57] that these patterns are the underlying knowledge that can be analyzed and discovered by a series of corresponding algorithms.

*The role of Internet of Things.* ICT has improved in recent years, including the Internet of Things technology, that is helpful on the one hand for traffic and shopping, and on the second hand is applying to build the environment of health care and increase the quality of home care service based on existing clinical knowledge and experience. The paper [12] propose a life supporting approach in the home environment of senior citizens based on the architecture of Internet of Things.

*Utilizing knowledge and experiences in the field of power system protection.* Correct interpretation of fault and disturbance data is critical for the reliability and continuous operation of the power system. Having an understanding of the fundamental guidelines for the event analysis process is imperative for new power engineers to properly evaluate faults. As senior power engineers retire, detailed knowledge about faults may be lost. The paper [59] devoted to experienced fundamentals of

power system fault analysis and provides the new power engineers with basic steps, requirements and decision-making approaches for correct analyzing and interpreting fault disturbances [59].

*Knowledge and experience exchange and demographic change.* Demographic change poses new challenges to both companies and society as a whole. Among the main of them is a challenge that valued knowledge and experience are often lost with senior experts' retirement. In [60] authors discuss the opportunities to meet these challenges based on innovation contests that provides integrating those affected by demographic change into the development of innovative products and services.

*K&E exchange for supporting current electric power systems.* Electric utilities depend on the knowledge and expertise of the power industry workforce to support the national electric power system (NEPS). The losing knowledge and experience of seniors can lead to catastrophic effects on the industry and society. Today, the NEPS need to find qualified personnel who understand the design, operation, and maintenance of electric power systems. Last investigations in education systems illustrate, that number of students interested in electrical engineering is declining. Electrical engineering programs aimed at providing graduates to the power industry have declined over the past two decades, and many of the faculty have retired and have not been replaced. The paper [61] analyze some successful approaches based on the experience from utilities and manufacturers: (a) programs presently being conducted by companies to interest students in electrical engineering and provide real-life, hands-on experiences once in college; (b) company internship and education programs that ensure employees are getting the training necessary to prepare for long-term workforce needs; (c) recommendations on how to act now to understand and prepare for long-term workforce needs [61].

*K&E exchange by involvement of senior citizens in cultural and social events.* Zagreb City Libraries have been conducting programs intended for the social inclusion of senior citizens and their active involvement in cultural and social events. In the project 65 plus [62] senior citizens are simultaneously users (students who acquire new knowledge) and creators (teachers who share their knowledge and experience with others) of abovementioned programs.

*e-Training programs developed by senior employees.* Most e-Training programs of enterprises are developed by senior employees who have plenty of knowledge and experience. At the same time, it becomes a challenging issue to effectively translate the K&E of seniors to computerized subject materials, especially for unexperienced teachers. A multi-expert e-Training course design model and a computer-assisted e-Training course development system are proposed in [1]. A practical application

has shown that the innovative approach can (a) improve the quality of the e-Training courses and (b) help experienced employees to well organize their domain knowledge.

*Advanced experience maps for construction projects.* In order to enhance experience management for engineers participating in construction projects, it is helpful to provide them the platform for exchanging the previous knowledge and experience effectively. The paper [63] presents a practical method to capture and represent construction project-based experience by using project-based experience maps (PBPM). The valued experience source of executed projects may be acquired effectively from the experienced and senior engineers. The multimedia-supported experience management system presents a friendly web-based platform that enables engineers to learn previous available experience during the construction phase of a construction project [63].

*Knowledge retention and age management.* The paper [64] which based on age management research in Swedish multinational company is devoted to the knowledge retention process the main components of which are knowledge capture, knowledge codification and the internalizing of knowledge in organizations. The knowledge retention is a complex phenomenon, because (a) valued knowledge is tacit, (b) knowing is highly subjective and (c) knowing is transferred through learning in collaboration with others in work situations. Knowledge retention should be an on-going way for organizations in which tacit knowledge and knowing are important. The paper [64] underlines the importance of K&E exchange and knowing retention in continual interaction between such actors as seniors and young.

*Exploring sport-related practical knowledge.* The paper [65] explores sport-related practical knowledge based on experience of a senior adult competitive tennis performer. Data were collected through formal interviews and participant observation and analyzed through narrative inquiry and conventional coding techniques. In particular, the participant's practical knowledge centered on performance capabilities and strategic planning that revealed opponent limitations. This knowledge can be used within the relationships among individual capabilities, the task, and the situated context of game play.

*Senior experience exchange in education venture.* In [66] authors described the Canadian educational venture in which elderly people were involved in interdisciplinary course "Social perspectives in aging" as senior consultants. This senior group was a part of students' body. As result, all three categories (students, professors and senior consultants) had benefitted from this experience: (a)

knowledge have been broadened, (b) stereotypes modified and (c) intergenerational contacts strengthened.

*Generation change and higher education management in Ukraine.* In [41], authors discuss the influence of generation change to the reforms of Ukrainian education system based on (a) analysis of current age management of the Ukrainian universities, (b) analysis and synthesis of the strategies, programs, curricula and ratings using experience of educational and scientific activity in Taras Shevchenko National University of Kyiv. Special attention is paid to systematic and comparative methods for determination of the essence and peculiarities of universities leadership in Ukraine.

### **Research methods for K&E transfer and data processing**

A lot of the efficient approaches and methods are used for description and mathematical formalization of knowledge and experiences exchange processes, including well-approbated methods of modelling and simulation, fuzzy information processing, statistics, multi-criteria decision making theory, artificial intelligence, sociology, pedagogy and others [25, 36, 37, 42, 43, 67, 68].

Let us consider several examples of research approaches and methods with real applications for knowledge transfer and data processing.

*Archive data and fuzzy information processing.* The authors in [39] investigate sharing processes in virtual community based on the analysis of the archival data during over a three-year period. Content analysis was employed to test a sample of “highly engaged”, “moderately engaged”, “low engaged” and “not engaged” discussion topics as part of the online discourse.

*Interviewing senior-level professionals.* In [50] author uses interview method for sharing knowledge and experience and develop the approach for training globally competent engineers based on 16 hour-long interviews of senior-level professionals at a large Multinational Defense Company who were currently working in or had previously completed assignments that included extensive international components. Interview transcripts were analyzed via a modified grounded theory approach [69, 70]. Interviewees were asked (a) to describe their experiences, including how they prepared, their motivations for participating, and what challenges they faced before, during, and afterward; (b) to identify any cultural differences they observed or experienced, including those related to communication, decision-making, project management, problem solving, and style of engineering; and (c) to make recommendations for individuals beginning international assignments and for educational and corporate institutions.

*Multi-criteria operational performance evaluation.* In [40] authors use a multi-criteria operational performance evaluation for power planning in ICT infrastructure. A group version of the fuzzy repertory grid and fuzzy TOPSIS [40, 68] approaches is applied to forming a set of evaluation criteria that senior staff agree on, and then the priorities of the telecom rooms are evaluated against this.

*Mixed group testing and mathematical methods of data processing.* In [51] it was hypothesised that a lower CR would predict lower cognitive capacities. The testing study involved 75 women and 45 men ranging in age from 40 to 85 years. The subjects' current cognitive competences were assessed using Montreal Cognitive Assessment test (MoCA), Wechsler Adult Intelligence Scale (WAIS) subtests, verbal fluency tests and Dysexecutive Questionnaire, self-report version (DEX-S). In order to determine whether lower level of CR is related to lower level of cognitive abilities in the adults, logistic regression analysis was carried out, also taking into account age, cardiovascular status and depression level.

Among other abovementioned approaches, methods and means for successful providing K&E exchange are: computerized expert systems [54], the question-answer card interface to allow the elderly to participate in micro-tasks with minimal ICT skills [55], Mind Map Knowledge Management (MMKM) approach [56], the SR-approach], HAZchart analysis and PHA-Organizer for risk evaluation [49], deep learning [57], Project-based Experience Maps (PBPM) [63].

### **Peculiarities of K&E exchange at Intelligent Information Systems Department (IISD) of PMBSNU**

The K&E exchange is very important direction for activity of the professors, teachers, PhD-students and MSc/BSc students at Intelligent Information Systems Department of PMBSNU [75].

Among the main successful ways and peculiarities of the K&E exchange at IISD are:

1) Conducting joint research in the framework of research projects on the international, national and regional levels, in particular:

- (a) Tempus project “Cabriolet” on development of university-industry cooperation models [76];
- (b) DAAD-project on mobile robotics in cooperation with Saarland University (Germany) as part of OstPartnerShaftProgram;
- (c) RACEF-project on exploration of Spain-Ukraine opportunities for close cooperation;
- (d) international projects with Chinese enterprises on development of modern means of intelligent robotics and automation;

(e) ALIOT project «Internet of Things for Industry and Human Application» (573818-EPP-1-2016-1-UK-EPPKA2-CBHE-JP) funded under the Erasmus+ program [77,78] and others.

On the national level, the Ukrainian Government pay a lot of attention to K&E exchange between experienced researchers and young scientists by control the quantity of students who are involved in executing research projects which are financially supported by Ministry of Education and Science of Ukraine. National Research Foundation of Ukraine established in 2018 also support such kind of K&E exchange by announcing the All-Ukrainian research grants' competition in 2020 with nomination "Support for research by leading and young scientists» for research groups which consist of senior and young scientists and 50% of project executes should be from each category of researchers - senior and young [79].

2) Organizing annual scientific, practical and methodical conferences and workshops for senior and young researchers, for example: 2nd International Workshop "Information Communication Technologies and Embedded Systems" – ICT-2020 (November, 2020), All-Ukrainian conferences "Olbia Forum - 2020: strategies of the countries of the Black Sea region in the geopolitical space" (June, 2020) and "Mohyla Readings - 2020: experience and trends of society development in Ukraine: global, national and regional aspects" (November, 2020), Scientific and practical conference of young scientists, graduate students and students "Intelligent Information Systems" (January, 2020) as well as Start-up battles, Spring, Summer, Autumn and Winter Schools with lectures from outstanding scientists and presentations by students. Besides, a lot of scientific presentations are made by our professors together with students as co-authors at different international conferences (IDAACS-2019, DESSERT-2020, DSMP-2020, ICTERI-2020 and others) in other countries (Azerbaijan, France, Poland, Turkey) and in different Ukrainian cities (Kyiv, Kharkiv, Lviv, Odesa, etc.); Joint "senior-young" publication of the conference papers and research articles at the different Conference Proceedings and international journals, for example, IEEE Proceedings, CEUR Proceedings and such international journals as Problems of Regional Energetics, Data, Shipbuilding and Marine Infrastructure, Sensors and Transducers, International Journal of Computing and others.

3) Students have nice practice and good examples from experiences professors (how to prepare abstract, article, conference paper and patent for corresponding submissions) during study the course "Basics of the scientific research".

4) Flexible approach to students schedule formation gives the possibility for students to combine studying at the University and working in IT-companies. K&E exchange, in this case, is successful not

only between professors and students but also between students with work experience in IT-industry from one side and professors and unexperienced students from another side.

5) Internship (abroad and in leading Ukrainian organizations) is a good possibility for students to get new practice knowledge and experience by conducting research and working in the framework of experienced team for executing and implementing real-life R&D projects. In particular, student's internship at Saarland University (Germany) and in such companies as Global Logic and AMICO are the successful examples of K&E exchange.

6) Invitation of the experienced lecturers from leading IT-companies as well as from abroad (for example, from Saarland University, Germany and Barcelona University, Spain) to give the lectures on modern and emerging technologies for our students and professors is also the perspective way for K&E exchange.

7) Individual grants for teaching and conducting research in US, Germany and other countries in the framework of Fulbright Program, IREX Program, DAAD program and others give very positive pulses in K&E exchange for both representatives of send and host institutions.

### **Conclusion**

It is impossible to consider and deeply analyze in one paper all valued cases of K&E exchange from world's practice but this paper is an attempt to analyze the peculiarities and challenges of knowledge and experience exchange between senior and young in "both directions" for different areas of human activity (education, construction, electrical power systems, entrepreneurship, medicine, climate, sport, ICT, power planning and others).

It is evidently, that experienced scientists around the world should consolidate the efforts in K&E exchange for mutual benefit and sustainable development of our societies by creating new efficient methods, means, software, mathematical models and algorithms which allow to increase efficiency of K&E transformation and exchange between such actors as seniors and young people.

Special attention should be paid to the internationalization of K&E exchange processes based on the successful international [38, 67, 71-74] cooperation in science and education.

Thank you very much for your attention.

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