UNIVERSITY OF APPLIED SCIENCES UTRECHT

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Proceedings of the 14th European Conference on Management, Leadership and Governance

HU University of Applied Sciences Utrecht, Netherlands

18-19 October 2018

Edited by
Prof. dr. Pascal Ravesteijn and
Dr. Ing. Benny M.E. de Waal

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ECMLG 2018

Hosted By

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Prof. dr. Pascal Ravesteijn

Review Process
Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, abstracts were reviewed for relevance and accessibility and successful authors were invited to submit full papers. Many thanks to the reviewers who helped ensure the quality of all the submissions.

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Preface

These proceedings represent the work of contributors to the 14th European Conference on Management Leadership and Governance (ECMLG 2018), hosted this year by HU University of Applied Sciences, Utrecht, the Netherlands on 18-19 October 2018. The Conference Chair is Prof. Dr. Pascal Ravesteijn and the Programme Chair is Dr. Ing. Benny M.E. de Waal.

ECMLG is now a well-established event on the academic research calendar and in its 14th year the key aim remains the opportunity for participants to share ideas and meet the people who hold them. The scope of papers will ensure an interesting two days. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research.

The opening keynote presentation is given by Brian Johnson who is Chief Architect at ASL BISL Foundation and Brian will discuss “BiSL next as a Generic Conceptual model for Digital Transformation”. The second day of the conference will start with an address by Lineke Sneller from Nyenrode Business University, talking about “Agile in Control: A Square Circle or White Snow?”

With an initial submission of 120 abstracts, after the double blind, peer review process there are 98 Academic research papers, 6 PhD research papers, 2 Masters Research papers and 1 Non-academic papers published in these Conference Proceedings. These papers represent research from Australia, Bahrain, Belgium, China, the Czech Republic,_Estonia, Germany, Ghana, Greece, Hungary, Iran, Italy, Japan, Kazakhstan, Malaysia, the Netherlands, New Zealand, Nigeria, Pakistan, Poland, Portugal, Russia, South Africa, Sweden, the UAE the UK, Uzbekistan, and Venezuela.

We hope you enjoy the conference.

Dr. Ing. Benny M.E. de Waal and Prof. dr. Pascal Ravesteijn
ECMLG Conference and Programme Chairs
HU University of Applied Sciences
The Netherlands
October 2018

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Biographies

Conference and Programme Chairs

Dr. Ing. Benny M.E. de Waal is assistant professor at the HU University of Applied Science. He received his PhD in 2013 at Utrecht University with research into user participation in BPM implementation. Current research is focused on digital leadership, business process management, and performance management.

Prof. dr. Pascal Ravesteijn is professor of Process Innovation and Information Systems at the HU. He gained his PhD in 2011 at Utrecht University with research into the implementation of BPM systems. His current research is focused on IT driven business and process innovation and the subsequent issues around digital leadership and skills needed in organisations to succeed in the digital transformation.

Keynote Speakers

Brian Johnson is author of more than 30 books on best practice in IT and how business is failed by IT. His latest publication is BiSL® Next; A framework for Business Information Management. One of his current roles is Chief Architect at ASL BISL Foundation. The Utrecht based Foundation provides guidance on Business Information Management to a wide range of public and private sector businesses in the Benelux. They publish best practice guidance and together with certification bodies provide education and examinations. The ASL BISL's ambition is to grow as an International organisation, and Brian is chief architect for the redesign of all guidance."

Lineke Sneller is Professor of IT Value at Nyenrode Business University, and Director of the Centre for Information and Management Accounting Control Systems. She holds a master's degree in business econometrics, and is a post-master's chartered controller (RC). Lineke has written around fifty books and articles on Enterprise Resource Planning, Corporate Governance, IT Value and the role of the CIO. In 2010, she successfully defended her PhD dissertation with title Does ERP add company value? In the past fifteen years, Lineke has held CIO and board member positions at Vodafone NL, Tele2 NL and InterfaceFLOR Europe. She has been the president of the Dutch Computer Society (Ngi), and a member of the advisory board of the Association of Chartered Controllers (VRC). In 2010 Lineke became Dutch CIO of the Year.

Biographies of Contributing Authors

Toon Abcouwer works at the University of Amsterdam. His research interest is on how organizations deal with crisis situations. Especially the different roles that information and learning play in the various phases of crisis handling has his special interest. It is his believe that traditional governance approaches only offer a partial solution for that.

Isaac Nana Akuffo is a second year Ph.D. student in management at the School of Economics and Business Administration at the University of Tartu, Estonia. He comes from Ghana but currently living in Estonia for Ph.D. studies. He has over five years of university teaching experience both in Ghana and Estonia. His research interests are leadership, ethics, innovation and internationalization, strategic management and work attitudes. He loves football, boxing, and music.

Nikolaos Apostolopoulos is Lecturer in Entrepreneurship and researcher at the Responsible Entrepreneurship and Social Innovation research group of the Plymouth Business School, University of Plymouth. He holds his PhD in Entrepreneurship and Sustainable Development. He acts as an expert at the SAYWA project 'Legal boundaries of work between Peru and Bolivia' which is funded by EuropeAid. He was successfully co-applicant of the Enterprise Educators UK research 2017/2018. He acts as scientific adviser at the Labour Institute (INE-GSEE) and at the rehabilitation centre 'Amaltheia'. Finally, his publications focus on entrepreneurship and sustainability.

Dr. Iman K.I.M. Ashmawy is an Assistant Professor of Public Administration at Cairo University. She published and reviewed various researches on local government, organizational behaviour, ethics in the public sector, and HRM, as well as attended numerous conferences and workshops on the same topics.

Anna Bagirova is a professor of economics and sociology at Ural Federal University (Russia). She explores issues of human capital, labour economics and sociology of labour. She is interested in data analysis. Her research interests include also demographical processes and their determinants. She is a doctoral supervisor and a member of International Sociological Association.

Ing. Martina Bednarova Education-2015 – Doctoral studies University of Economics, Prague, Faculty of Management Jindrichuv Hradec, subject field management As a PhD student I specialize in management of healthcare. Particularly I focus on the managerial styles applied in healthcare and their influence on the selected indicators.

Ronald Beffers works as an information manager at the Radiocommunications Agency of the Ministry of Economic Affairs and Climate Policy in Amersfoort. He specializes in information management and how BiSL can be used for implementing information management in organizations.

Slim Ben-Hassine obtained a DBA from Liverpool John Moores University in 2014, prior to that he studied economics before starting his career in Finance department. He was then enrolled as Finance Director and Operations Manager. With over 22 years of experience, he is today Managing Director (Finance & Administration and Key Account Management) in his own IT-Company.

Stefan Cronholm is professor in the subject of informatics. He specializes in requirement specification, methods concerning design and evaluation of information systems, IT service management, and qualitative research approaches. Stefan has published more than 100 scientific papers and a vast range of pedagogical material. Stefan is the head of the Research Group InnovationLab.

Ian Jester M. de Vera is a university extension specialist in UP ISSI, where he currently heads its Information and Public Affairs Office. He finished a master's degree in Technology Management at the University of the Philippines and is now working towards his Doctor of Professional Studies degree at Central Queensland University in Sydney, Australia.

António Luís Dionísio is completing his PhD in Management at the University of Évora, he is currently the Manager of Team of Fidelidade Insurance Company, S.A.. Guest teacher in the areas of Human Resources

Management and Team Management, having as main research areas the flexibility of work, competence development, minimum team management and knowledge.

Dr Nina Evans is Associate Head of IT and Mathematical Science at UniSA in Australia. She teaches ICT Leadership, Business Information Systems and Knowledge Management. She holds tertiary qualifications in Chemical Engineering, Education, Computer Science, a Masters in IT, an MBA and a PhD. She does research in Knowledge Management, Innovation in SMEs and has published widely.

Marja Exalto-Sijbrands, PhD logistics, is lecturer at the institute for Business Administration of HU University of Applied sciences, and assistant professor at the research group Process Innovation and Information Systems. Her interests are Strategic Decision making and Supply Chain Management. Marja started her career in process innovation and logistics consultancy.

Valerie Priscilla Goby (PhD, JCU, Australia) is a professor in the College of Business, Zayed University, Dubai. Her research interests include leadership, communication, and workforce localization and she has published in a wide range of journals including Journal of Business Ethics, International Journal of Organizational Analysis, and Corporate Communications: An International Journal.

Vittorio Guida received his master degree in Government and Administration (summa con laude) from the University of Salerno in 2017. In the last year as he collaborated as a research assistant to studies on organizational topics directed by Professor Roberta Troisi in order to improve his research skills and to compete in PhD selections that he passed.

Richard Hubbard (UK-Based), currently a doctoral student with Loughborough University and working in collaboration with the Construction Industry Training Board (CITB) on projects aimed at advancing the understanding of leadership and management skills at strategic, sectoral and occupational levels.

Rabiu Iliya born in 1980. I am a holder of MBA, MSc in Entrepreneurship. I joined Jigawa State Polytechnic of Nigeria in 2011 as a lecturer teaching management courses to date. I am also teaching with the Nigerian institute of management charted (NIM) since 2013 to date.

Salim Khan is pursuing his PhD degree from school of management, Harbin Institute of Technology, China. Their study major is business administration and they are working under the supervision of professor Dapeng Liang. Salim got his master's degree in business administration from Quaid-i-Azam University Islamabad Pakistan. His research work is the impact of market competition on employees' morality which falls in the domain of organizational psychology.

Tomáš Kincl is Associate Professor at the Department of Manangement, Faculty of Management, University of Economics, Prague. He is interested in marketing strategy, online marketing and social media, marketing communications, customer satisfaction, sentiment analysis and cross-cultural differences.

Perry Lauf has thirty years of experience in Information Services within different organisations and in different roles as engineer, project manager, product manager, portfolio manager and Information manager. Especially active within the business IT alignment and business information management dealing with IT demand in big organisations. He has a BSc Electrical engineering, Ing. Economical Business Technics, and a MSc Informatics

Michael Le Duc, Ph.D., is assistant professor in business, marketing, at Mälardalen University in Sweden. He holds a Ph.D. degree from the School of Business, Stockholm University. His research areas include marketing of services, ethnography in the music industry and leadership. He is chairman of union Saco- and SULF at the university since November 2014.

Cindy Londt works in the field of Adult and Vocational Learning in South Africa. She is the Operations Executive for OMNI HR Consulting, and has studied in the fields of Occupationally Directed Education, Training and Development Practices. Her research interests include Operations in Education, Training and Development, Contact Centre Operations, Project Management and e-learning practices.

Dr Ann Lourens obtained undergraduate qualifications in Operations Management followed by MBA (Cum laude) and DBA. Prior to a career in academia, Ann worked in various manufacturing industries in operations related positions. As an academic, Ann has a keen research interest in students' (particularly women engineering students) development and retention and to this end has developed and managed several co-curricular interventions.

Maria Mach-Król is associate professor at the Katowice University of Economics, Poland. She received her PhD degree in information systems for management from the University of Lodz, Poland in 1998. She is author and co-author of more than 60 journal papers, six books, and several book chapters. Current research interests include artificial intelligence, big data and knowledge based systems.

Agata Markova is a PhD student at the University of Economics, Prague, Faculty of Management. She holds a Master in management. Her current fields of interest are Social Care Management, Leadership and Human Resource Management in Social Care. She teaches Data Analysis and Presentation. She also participates on a national research project.

Lize Moldenhauer works in the field of Adult and Vocational Learning in South Africa. She is the Managing Director of OMNI HR Consulting and the COO for the Shoprite Checkers Development Trust. She has studied in the fields of Occupationally Directed Education, Training and Development Practices and her research interests include Contact Centre Management, Human Resources, e-learning practices and occupational learning.

Christopher Moon is an award winning ecopreneur and founder of several eco businesses. He is Senior Lecturer at Middlesex University and the author of over 60 papers including co-author of the book Business Ethics for the Economist. Chris is Lead Judge of the international Innovation & Entrepreneurship Teaching Excellence Awards 2016-2018 and finalist in 2015. He is a fellow of the RSA, HEA, with a PhD from Imperial College.

Jürgen Moors is an operations manager at BASF Antwerp, Belgium. He has been active since 2003 for BASF. At the moment he is also embarked in an executive Phd program at Antwerp Management School. In this program he focuses on leadership, climate and big data analytics.

Dr. Jonathan A. Odukoya, is a Senior Lecturer in the Department of Psychology, Covenant University, and the National Coordinator of the Educational Research Network for West and Central Africa in Nigeria. He worked with the West African Examinations for eleven years. The exposure opportuned him to serve as Consultant to organizations to UNICEF, UNESCO and USAID.

Augustina Nkechi Oko was born on 12th April, 1978 to the family of Late Mr. & Mrs.Michael Oko of Amaelu village, Amaizu, Afikpo in Ebonyi State, Nigeria. She studied Educational Management (English option) from Enugu State University of Science and Technology. Married to Late Mr. Godwin Oko Agha in 1999 with 3 children.

Dr Ronald Orth is Head of Department Business Excellence Methods at Fraunhofer Institute for Production Systems and Design Technology, Berlin, Germany. Ronald holds a MBA degree from Free University Berlin and a Doctor of Engineering from Technical University Berlin. He has worked in several research and consultancy projects with partners from industry and the public sector.

Dr. John Politis is Senior Academic of Business at Charles Darwin University, Australia, and Adjunct Virtual Professor of Laureate International Universities- University of Roehampton, UK. Ph.D. in Management from the University of Technology, Sydney; Australia. He is currently a member of a number of editorial boards, including The Leadership and Organisational Development Journal, The Electronic Journal of Management, Leadership and Governance (EJMLG), and the Knowledge Management Research and Practice Journal.

Prof. Dr. Evgeny Popov is the Honored scientist of the Russian Federation (2006), member of the Russian Academy of Sciences (2011), head of the Economic Theory Department of the Institute of Economics of the Ural Branch of the Russian Academy of Sciences. Economic theory, institutional economics, firm behaviors are the spheres of his scientific interest.

Prof. Pavel Pudil, Sc.D. is Director of Joint Laboratory of Management at the Faculty of Management, University of Economics Prague, Czech Republic In 2000 he was elected Fellow of IAPR (International Association of Pattern Recognition) for his contribution to the field of statistical pattern recognition. His research interests include learning approaches to decision-making and managerial data analysis. He has 2400 WoS citations with H-index = 16.

Redouane Sarrakh is a PhD researcher at the Faculty of Science and Engineering, the University of Wolverhampton, researching the impact of sustainability strategies on the Qatar energy sector. He received a BEng (Hons) in Process Engineering from the EMI Engineering School in Morocco and MSc in Oil and Gas Management from the University of Wolverhampton.

Haziah Sa'ari is a Researcher and Lecturer at the Universiti Teknologi MARA (UiTM) Malaysia. Her current research looks at the transformation of entrepreneurship and related competencies by academic libraries in Asian countries such as Thailand, Indonesia and China. She wrote his PhD on entrepreneurial competencies and innovative behaviour in Malaysian Research Universities.

Amitrajit Sarkar is a senior member of faculty at Ara Institute of Canterbury and an affiliated research associate at University of Canterbury, Christchurch, New Zealand. He has published widely in Software engineering and Management Information Systems. His main research interests include IT Governance and IS resilience, which is an aspect of organisational resilience.

Xander Seerden is a Masters Student in the Dual Degree Programme Global IT Management which is jointly taught by Tilburg University and the University of Turku. His academic fields of interest include IT Management, IT Security and (Privacy) Governance. He has working experience in IT transformation projects.

Dr. Elena Serova is an academic Elena Serova is working now in National Research University Higher School of Economics St. Petersburg Branch. Her role combines teaching and research in equal measure. Her research interests are related to Business Analysis, Strategic Management, Marketing, and Information Management. She has co-authored the books and collections of essays, regular key presenter at national and international conferences.

Maria José Sousa (PhD in Management) is a University Professor and a research fellow of CIEO (Algarve University) and BRU-ISCTE/IUL. She has co-authored over 50 articles and book chapters and published in several scientific journals (e.g. Journal of Business Research, I. J. of Knowledge, Culture and Change Management, Information Systems Frontiers, European Planning Studies and others).

Katarzyna Szelągowska-Rudzka Ph.D. is an academic teacher and scientist at Gdynia Maritime University at Faculty of Entrepreneurship and Quality Science in Poland. Her scientific interests are as follows: Human Resource Management, employee direct participation, management style, Corporate Social Responsibility especially in relation to employees.

Emőke Takács has started her carrier as a researcher at the Hungarian Public Administration, where she was involved in training civil servants. She then has worked on the EU accession of Hungary and Romania, getting close to EU policies. Her interest is in efficient knowledge acquisition and management.

David Abasilim Ugochukwu is a lecturer and a Doctoral Candidate of Public Administration in the Department of Political Science and International Relations, Covenant University, Ota, Ogun State, Nigeria.

Dr. René van Dinten (1957) works for the University of Applied Sciences Utrecht since 1997. He is lecturer of performance management and author of the study-book 'Strategic and Operational Performance Management'. He obtained the degree of doctor (PhD) at Nyenrode Business University. His thesis was entitled 'Blockades in the process of achieving strategic alignment'.

Frank van Outvorst is associated to the research group Information Manangement and Process Innovation of the HU Utrecht University of Applied Sciences, The Lifecycle Company and the ASLBiSL Foundation. Frank works as a consultant in the field of (corporate) governance of IT and business information management. From curiosity deived from his professional practice Frank is also committed to doing research in the field of digital

leadership, business information management, (corporate) governance of IT and maturity of business information management. Frank is also involved in WorkingGroup 40 of ISO.

Andreas Walmsley is Associate Professor Entrepreneurship at University of Plymouth. Alongside teaching undergraduate and postgraduate students Andreas' research interests extend to entrepreneurship education, responsible entrepreneurship and entrepreneurship in the tourism and hospitality industries. He is currently writing a book 'Entrepreneurship in Tourism' to be published by Routledge (2018) and has published a number of papers relating to employment in tourism.

Philippa Wells works at Federation University Australia after having been on the staff at two different universities in New Zealand. A lawyer by qualification and background, she researches in the area of governance for sustainability and has a particular interest in the intersection of public policy and governance. Her experience in union governance has led to an interest in the role and future of employee unions in Higher Education, as is reflected in the paper.

Bing Wu Berberich is the Acting Associate Dean of Learning and Teaching at International Business School Suzhou (IBSS) at XJTLU, specialising in International HRM, Psychological Contract, and SME related research topics. Alexander Mackrell is a recent MSc Management graduate of IBSS, XJTLU Suzhou, specialising in Psychological Contract and Leadership research.

Health Care Information Technologies Innovation

Elena Serova[1] and Irina Guryeva[2]
[1]National Research University Higher School of Economics, St. Petersburg, Russian Federation
[2]Company SISTeMA srl. Rome, Italy
serovah@gmail.com
irisha.guryeva@gmail.com

Abstract: The concept of innovation in medicine is associated with something new that will have a positive effect in an area where it will be introduced. Innovation is also about something that will work better, than whatever. Healthcare is one of the important areas and it is open to new experts, for contemporary information technologies and innovative start-ups. In such a socially significant sphere as healthcare industry, innovation activity has become vital especially in such areas as automation of physician working place, creation of unified electronic medical record, distribution of intelligent decision support systems for medical solutions, application and wide dissemination of new medical technologies, telemedicine development. The intersection of medicine and ICT has led to the emergence of a new sector of economy - Health IT. The main goal of this research is to identify the most attractive directions for ICT innovations in healthcare industry. This paper deals with the issues of international researches in the field of Health IT innovation. The types of ICT innovations in health care system are quite different and comprise several categories. The authors will consider in detail the next from them: Electronic Health Records, Clinical Decision Support Systems, Telemedicine, and Internet of Things. It is empirical and theoretical research in equal measure. The research is based on literature review, analysis of large volumes of information, and findings of investigations in this field. The theoretical contribution and practical value of the work is based on consideration and analysis of the distinction between implementation of IT innovation in Italian, Russian, and American health care system according to Triple-Helix Model. Research methodology is methods and procedures of system and comparative analysis, deduction by analogy and modelling. The paper also contains the comprehensive review and comparison the types of ICT innovations in healthcare sector, and it focuses on the main characteristics of Clinical Decision Support Systems.

Keywords: Innovations in Healthcare, Health IT, Clinical Decision Support Systems, Triple-Helix Model

1. Introduction

The concept of innovation in medicine is associated with something new that will have a positive effect in an area where it will be introduced. Innovation is also about something that will work better, than whatever.

Healthcare is one of the important areas and it is open to new experts, for contemporary information technologies and innovative start-ups. In such a socially significant sphere as medicine, innovation activity has become vital, because its results are used to obtain a qualitatively new idea of treatment and process management in healthcare. Nowadays researches notice that priorities began to change in such directions as automation of physician working place, creation of unified electronic medical record, a distribution of intelligent decision support systems for medical solutions, an application and wide dissemination of new medical technologies, telemedicine development. These are all the examples of the innovative changes in the healthcare system. Information and communication technologies (ICT) remain a key driver of innovation in healthcare industry. The intersection of these two industries has led to the emergence of a new sector of the economy - Health IT. Health IT can be described as the use of a suite of products and services designed to improve and coordinate patient care, address growing health costs and confront the long-term burden of disease using technology.

The next statements are considered as the basic hypotheses: in Russia, as over the world, Information and communication technologies are the main driver of healthcare industry innovative development. The types of ICT innovations in health care system are quite different and comprise several categories. The authors will consider in detail the most significant from them: Electronic Health Records, Clinical Decision Support Systems, Telemedicine, and Internet of Things. Clinical Decision Support Systems become especially important among other types of innovations and leading representatives in Russian market. They can be considered as the highest level of electronic health records (EHR) and medical expert systems, facilitating the enhancement of Evidence-Based Medicine.

The main goal of this research is to identify the most attractive directions for ICT innovations in Russian healthcare industry. The study put forward the following research questions, answers to which are meant to aid in achieving the research purpose:

- How can IT innovation leading representatives in Russian market affect healthcare industry?
- What is the distinction between implementation of IT innovation in Russian, Italian and American health care system according to Triple-Helix Model?

This paper deals with the issues of Russian and international researches in the field of Health IT innovation. It is empirical and theoretical research in equal measure. The research is based on literature review, analysis of large volumes of information, and findings of investigations in this field. Research methodology is methods and procedures of system and comparative analysis, deduction by analogy and modelling.

The theoretical contribution and practical value of the work is based on consideration and analysis of the distinction between implementation of Health IT innovation in Russian, Italian and American health care system according to Triple-Helix Model. The paper also contains the comprehensive review and comparison the types of ICT innovations in the healthcare sector, and it focuses on the main characteristics of the Clinical Decision Support Systems (CDSSs) leading representatives in Russian market.

The paper is structured as follows: Introduction; Theoretical and methodological fundamentals of ICT innovations in healthcare industry and Literature review; Types of ICT innovations in the healthcare sector; Innovative medical information systems: essentials of Russian market; Measuring ICT innovations in healthcare system; Conclusion, and References.

2. Theoretical and Methodological Fundamentals of ICT Innovations in Healthcare Industry and Brief Literature Review

To identify the main characteristics of the innovation activity in healthcare industry, first of all, the term «innovation development process» should be defined. The most common definition was given by Rogers: «The innovation-development process consists of all of the decisions, activities, and their impacts that occur from recognition of a need or problem, through research, development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences» (Rogers, 1983). In this process, serendipity plays an important role. Nevertheless, in the field of medicine, serendipity is not enough; it should be underpinned by clinical trials. Such experiments are designed to determine the effects of an innovation in terms of its safety and efficacy. In addition, they help to make a positive or negative decision about further diffusion of the innovation. Cooper describes innovation process as «a formal blueprint, roadmap, template or thought process for driving a new product project from the idea stage through to marker launch and beyond» (Cooper, 1994). However, both definitions have one common point. Due to the fact that healthcare is a branch of social sphere, the economic effect, i.e. commercialization, becomes less obvious. Therefore, creating an innovative product or service, a researcher is primarily focused on medical and social efficiency.

There are three main approaches to introduction of innovations in organizations, providing services to the public in general and medical services in particular: passive (let it happen), supporting (help it happen) and active (make it happen) (Greenhalgh, Robert, MacFarlane, Bate&Kyriakidou, 2004.). Passive process of innovation diffusion is characterized by the fact that new technology appears in the organization by accident and then it adapts to its introduction. Innovation penetration is not particularly stimulated. Supporting process of new technologies implementation assumes that an organization realized the need for innovation. Therefore, new technologies are subject to discussion, their implementation is carried out by making the appropriate decision (formal or informal) and supported by holding the special events. Active process of innovation dissemination is based on a systematic and planned analysis of new technologies, the ordered management procedures, built into the overall management of the organization. Most health organizations follow passive or supporting process of innovation introduction and, therefore, the intensity of the spread of new technologies in health care facilities is lower than in other sectors of the economy. New technologies in medicine are the major reason of rising health care costs, that is why outcome analysis / cost-effectiveness studies for a new medical technology are often crucial to the development of the innovation (Medical Innovation in the Changing Healthcare Marketplace: Conference Summary, 2002). At the same time, it is a fairly common fact

that some organizations show reluctance to conduct cost-effectiveness studies of new technology being introduced before it will hold cost assessment.

According to Omachonu and Einspruch (2010, p.10) healthcare organizations perform such activities as treatment, diagnosis, prevention, education, research and outreach. In serving these purposes, they must effectively manage quality, costs, safety, efficiency and outcomes. The basis for healthcare innovation are the needs of patients and the healthcare practitioners and providers who deliver care. Quite often, healthcare organizations arrive at innovation by relying on new or existing information technology. Successful innovation process focuses on three areas the most: how the patient is seen, how the patient is heard, and how the patient's needs are met.

Innovation in health care presents two kinds of financial challenges: funding the innovation development process and figuring out who will pay how much for the product or service it provides. While venture capitalists supporting IT start-ups may be able to get their money back in two to three years, investors in a biotech firms have to wait ten years even to find out whether a product will be approved for use (Herzlinger, 2006.). Besides that, it is difficult for venture capitalists to assess the extent to which the public policy will change, which creates a major uncertainty for them. To foster innovation public policies must be consistent in order to have a salutary effect on prices, the investments required, and the timeframe from idea to marketplace.

Concerning Russian experience, the authors identify the main drivers and barriers to innovation development process in the healthcare industry. In a more strict manner, the following factors were highlighted:

- Development of new economic relations, aimed at creating a market in health care;
- Substantial and increasing private investment in medical R&D;
- Establishment of sound systems of mutually beneficial relationships between health care organizations, enterprises and citizens;
- Formation of a business climate conducive to investment appeal for private partners.

And what about the barriers, they are:

- Product distribution (unlike consumer products, healthcare products are distributed through a more complex supply chain that involves multiple parties, including medical device manufacturers and distributors, physicians and nurses who provide the product to the end user, and the patient, who generally has no input on product or pricing considerations);
- Healthcare culture (by nature and for good reason, the healthcare industry is incredibly risk averse);
- Complex value analysis model;
- Misconception about what constitutes innovation.

Information and communication technologies are contributing enormously to the improvements we can see in health industry (Wang Y, Kung, Wang W & Cegielski, 2018). Lyle Berkowitz, MD, associate chief medical officer of innovation for Northwestern Memorial Hospital in Chicago and Chris McCarthy noticed: «healthcare system is not sustainable, and we certainly have to become more innovative. IT is a tool, but it is a really important and powerful tool that will help us spread innovation more efficiently and effectively. We need to think about how we can do things differently and how information technology can enable these changes in the safest, quickest and most cost-effective manner» (Berkowitz&McCarthy, 2013). The development of ICT caused four important worldwide changes that have transformed the business environment. Organizations or societies that do not respond to these changes will not be able to survive and prosper in the new business environment. These changes are listed in Table 1. Various types of innovations involve changes in the application of ICT.

Therefore, the concept of «ICT innovations» originated. Swanson and Ramiller defined it «as the pursuit of IT applications new to an organization» (Swanson&Ramiller, 2004). Lyytinen and Rose claimed that ICT innovation is «the creation and new organizational application of digital computers and communication technologies» (Lyytinen&Rose, 2003). ICT innovations result from exponential improvements in computing speed and data storage functions that have led over time to radically enhanced functionality in processing, storage, transfer, and display of information. In their simplest form, ICT innovations involve only a

technological component changes in hardware and software that are new to an industry, but they are often complemented with organizational innovations including new forms of cognition, meaning, work process, business process, or organizational structure. Specific ICT innovations involve these elements in different proportions and consequently affect the content, scope, and organization of ICT innovation processes within an organization or the industry (Swanson, 1994).

Table 1: The changing business environment

New Environment	Changes to Business Environment
Globalisation	Global markets Global workgroups Global delivery systems, Borderless world
Knowledge economy	New product and services Time-based competition Shorter product life cycle
Transformation of Business Enterprises	Flat organisations, Decentralisation Employees' flexibility Location independence, Empowerment Collaborative work and teamwork
Emergence of the Digital Organisations	Extensive use of digital network Digital relationship with customers and suppliers Digital management Rapid sensing and responding to environmental changes

3. Research methodology

Scientific methodology of the research is methods and procedures of system and comparative analysis, deduction by analogy and modelling. The research is based on a system point of view by taking into account all aspects of the situation development and focuses on the interactions between different elements of complex systems. System analysis requests the methods of modeling as the main tool of research. The research is using the concept of Triple Helix Model applied to statistical data, drawn from OECD MSTI, Eurostat and Rosstat Databases.

This research investigates the differences between countries in ICT innovations implementation using the concept of Triple Helix Model. There was made qualitative analysis based on statistical data for national science and innovation systems. The concept of the Triple Helix is an analytical construct that systematizes the key features of University-Industry-Government interactions into an 'innovation system' format. It was designed in mid-1990s by Henry Etzkowitz (USA) and Loet Leydesdorff (the Netherlands) as a result of attempts to interpret the shift from a dominating industry-government dyad in the Industrial Society to a growing triadic relationship between university-industry-government in the Knowledge Society. At the same time, this model can be considered as a method for understanding the sources and development paths of innovation. Since the innovation process is becoming more open and nonlinear (Chesbrough, 2011), the emergence of the Triple Helix is the response, aimed simultaneously at promotion of innovative projects and creation of communities, networking among economic agents.

A substantive body of Triple Helix consists of two main complementary perspectives (Etzkowitz & Leydesdorff, 1998; Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2003; Etzkowitz and Ranga, 2013):

- (Neo)institutional perspective, encompasses case studies and comparative historical analyses that explore different configurations arising from the positioning of the university, industry and government institutional spheres relative to each other, with one as a gravitational center;
- (Neo)evolutionary perspective, inspired by the theory of social systems of communication and mathematical theory of communication, which sees the University, Industry and Government as co-evolving subsets of social systems.

To make a comparison between countries researches have use the (neo) institutional perspective, which distinguishes three main configurations (Etzkowitz and Ranga, 2013):

- Static configuration, where government plays the lead role, driving academia and industry, but also limiting their capacity to initiate and develop innovative transformations;
- Laissez-faire configuration, characterized by a limited state intervention in the economy, with industry as the driving force and the other two spheres acting as supporting structures and having limited roles in innovation: university acting mainly as a provider of skilled human capital, and government mainly as a regulator of social and economic mechanisms;
- Balanced configuration, specific to the transition to a Knowledge Society, where university and other knowledge institutions act in partnership with industry and government and even take the lead in joint initiatives.

4. Types of ICT innovations in healthcare sector

New digital information, nanotechnology, semiconductor products, and genetic engineering are revolutionizing health care, making old assumptions invalid and creating unanticipated prospects for innovation and improvement of existing processes. That means the types of ICT innovations in health care system are quite different and comprise several categories. The authors consider in detail the most significant from them.

4.1.1 Electronic Health Records

Implementing electronic health records (EHRs) in healthcare sector was an inevitable challenge, because they are a way to capture and utilize real-time data to provide high-quality patient care, ensuring efficiency and effective use of time and resources. In a more strict sense, although the terms EHR, EMR (electronic medical record) and PHR (personal health record) are often used as synonyms, they have some principal differences.

The EHR is a longitudinal electronic record of patient health information generated by one or more encounters in any health care delivery setting (Available from Internet: www.himss.org/ASP/topics_ehr.asp). The EMR is, defined as the legal patient record in hospitals and ambulatory environments, and which can serve as a data source for the EHR (Habib, 2010). The PHR is an electronic application used by patients to maintain and manage their health information in a private, secure, and confidential environment.

What are the advantages of implementing Electronic Health Records? EHRs help providers better to manage care for patients by (Available from the official Website of the Office of the National Coordination for Health Information Technology (ONC): https://www.healthit.gov/faq/what-are-advantages-electronic-health-records):

1. Providing accurate, up-to-date, and complete information about patients at the point of care;
2. Enabling quick access to patient records for more coordinated, efficient care;
3. Securely sharing electronic information with patients and other clinicians;
4. Helping providers more effectively diagnose patients, reduce medical errors, and provide safer care;
5. Improving patient and provider interaction and communication, as well as health care convenience.
6. Enabling safer, more reliable prescribing;
7. Helping promote legible, complete documentation and accurate, streamlined coding and billing;
8. Enhancing privacy and security of patient data.
9. Helping providers improve productivity and work-life balance.
10. Enabling providers to improve efficiency and meet their business goals.
11. Reducing costs through decreased paperwork, improved safety, reduced duplication of testing, and improved health.

Using EHRs can help an organization build a sustainable medical practice. While EHRs do require investments for technology and training, a fully functional EHR system can lead to long-term savings in a variety of areas and better business. Studies have shown EHRs to generate a positive return on investment (Grieger, Cohen, Krusch, 2007). Another significant ICT innovation in healthcare industry is clinical decision support systems (CDSSs).

4.1.2 Clinical Decision Support Systems

Clinical Decision Support Systems are «active knowledge systems which use two or more items of patient data to generate case-specific advice» (Van der Lei&Talmon, 1997). It should be noted that the role of CDSS becomes especially important in Russia nowadays. Incorporating EHR and CDSS together into the process of medicine has the potential to change the way medicine has been taught and practiced (Berner, 2007). It can be said that CDSS is the highest level of EHR. Since «clinical decision support systems are computer systems designed to impact clinician decision making about individual patients at the point in time that these decisions are made» (Berner, 2007), it is clear it would be beneficial to have a fully integrated CDSS and EHR.

There are two main types of CDSS: knowledge-based systems, that include compiled clinical knowledge and non-knowledge-based, that employ machine learning and other statistical pattern recognition approaches.

Most CDSSs consist of three parts: the knowledge base, the inference or reasoning engine, and a mechanism to communicate with the user. CDSSs, that do not use a knowledge base, use a form of artificial intelligence called machine learning, which allow computers to learn from experiences and/or recognize patterns in the clinical data. Two types of non-knowledge-based systems are artificial neural networks and genetic algorithms. By delivery modes, the CDSS market is divided into web-based, on-premises and cloud computing systems. Nowadays web-based segment occupies the largest share of the global CDSS market. However, the market for cloud-based solutions is expected to have the highest growth rate in the near future.

The key products of clinical decision support systems' market are IBM Watson Platform for Health (USA) and Philips Healthcare (Netherlands). The authors also would like to mention Socmedica CDSS as the most competitive sample of such systems from Russian and Biopharma Navigator - from Italian domestic markets. The pivot Table 2 to represents the main similarities and differences of these systems.

Table 2: Pivot table of Clinical Decision Support Systems

№	Characteristics	Socmedica CDSS	IBM Watson Health	Philips Healthcare	Biopharma Navigator
1	Targeted audience	pat, doc, clinic	pat, doc, clinic	pat, doc, clinic	Global pharmaceutical and bio-tech innovative companies
2	Personification of patients	yes	yes	yes	no
3	Forecasting	yes	yes	yes	no
4	Diagnostics	yes	yes	yes	no
5	Decision support	yes	yes	yes	yes
6	Clinical specialties	all	Oncology, Genomics, Drug discovery	Anesthesia, Cardiology, Critical care, Mother&Child care, Oncology, Radiology, Sleep Apnea care	Pharmaceutics, Biotechnology, Drug discovery and development
7	Input data	any	any	sympt, lab, x-ray, epid	Global clinical trial registries, MEDLINE db, adverse events reporting data, approved drug products
8	Self-learning	yes	yes	no	no

Analyzing the data of the Table 2, the first thing the researches can pay attention to is that the systems are developed for different clinical specialties. Accordingly, they have different formats of input data and targeted audience. The second thing - Italian system has the greatest number of characteristic features. The reason for this is quite clear. Biopharma Navigator is a particular case of company's patented Cogito technology. This technology was designed to serve not only Life Sciences industry, but also Banking & Insurance, Media & Publishing, Government and Oil & Gas sectors. In other words, Biopharma Navigator is an expert system, developed for companies to achieve their strategic goals rather than to apply in clinical practice. That is why the system does not have such characteristics, as forecasting, diagnostics and self-learning.

On the contrary, Russian system has the most generalized set of characteristics. This is due to the fact, that company-developer of the product pursued the goal to outperform its potential competitors - IBM Watson Health and Philips Healthcare. Along with question-answering communication method with the system, included into IBM Watson model, Socmedica uses a principal of background monitoring of patient clinical material. System developers are based on the assumption that most physicians do not realize that they commit errors therefore, they will not make any requests to the system. Other physicians are too busy to make requests in timely manner. So Socmedica approach minimizes human factor that leads to errors. It is worth noting that Russian and Italian systems based on the similar model for knowledge representation. Both systems use ontologies for constructing a semantic network.

Generally, existing expert systems represent a local solution to a narrow range of questions. Meanwhile both IBM Watson Health and Philips Healthcare are intended to solve a wide range of issues. The principal difference with Watson Platform for Health is that Philips Healthcare presents a system of interrelated elements that collects data from multiple sources. In contrast with IBM solution, which focuses on radically new approach for processing patient medical data, Philips directed its activity on developing medical diagnostic imaging and patient monitoring systems - the embedded support tools for clinical decision making. This is what determines the differences in input data and self-learning characteristics of two systems.

4.1.3 Telemedicine

Telemedicine is the use of information and communication technologies to provide and support healthcare services at distant locations. Telemedicine can give a new model for interaction with the patients or other important entities such as hospitals, pharmacies, physicians and governmental agencies (Burney, 2010). It can be divided into three main categories: store-and-forward, remote monitoring and interactive services (Ramos, 2010). According to the «Global Telemedicine Market - Industry Analysis, Size, Share, Growth, Trends, and Forecast to 2021» report, announced by «Research and Markets» company, the global telemedicine market is dominated by North America and Europe. North America accounted for lion's share of the total telemedicine market because of high demand for technologically advanced products. Europe is the second leading market for telemedicine and is likely to maintain its position throughout the forecasting period. In the coming years, the telemedicine market is expected to witness the highest growth in the Asia-Pacific region, with emphasis on India, China, and Japan.

4.1.4 Internet of Things

Global Standards Initiative defined the Internet of Things (IoT) as global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. In simpler words, this concept entails the use of electronic devices that capture or monitor data and are connected to a private or public cloud, enabling them automatically to trigger certain events. Internet-connected devices can be introduced to patients in various forms. Whether data comes from fetal monitors, electrocardiograms, temperature monitors or blood glucose levels, tracking health information is vital for some patients. Many of these measures require follow-up interaction with a healthcare professional. This creates a potential for smarter devices to deliver data that are more valuable and reduce the need for direct patient-physician interaction.

5. Medical information systems: essential of Russian market

In Russia there are about 670 solutions in the field of medical information systems (MIS), provided by 240 Russian companies. Estimation of the quantity of MIS, installed annually is about 3 650 installations. Therefore, the volume of the Russian market of MIS is about 11.5 bln rubles per year, taking into account the price of one installation of about 3,0 mln rubles and annual technical support cost of about 5% of the price. At the same time, only 25% of installed MIS contain modules of decision-making support.

Only 40% of Russian developers offer modules of decision-making support for MIS. The majority of solutions focus only on information support regarding treatment standards, interpretation and visualization of laboratory data. Examples of the key players working in this direction are the following companies:

1. LLC «Complex medical information systems» (K-MIS), LLC «Post Modern Technology» (Medialog): automatic interpretation and visualization of laboratory parameters, enquiry support of treatment standards.
2. «SP.ARM» company: information and enquiry system.

3. PO «Vidar»: specialization on storing images of instrumental diagnostics and their analysis.
4. LLC «Torins» (Hospital): automatic analysis and visualization of deviations of laboratory parameters from normal.
5. LLC «Siams»: automated analysis of images for laboratory diagnostics.

According to the estimations the number of clinics and hospitals, in which medical information systems were installed, at the end of 2013 amounted 8 760. Growth rates reached 8-9% per year.

Trying to find a solution, most comparable with the best foreign practices in the field of clinical decision support, the authors also considered residents of the «Skolkovo Innovation Foundation». The main goal of Skolkovo Foundation is to create a sustainable ecosystem of entrepreneurship and innovation, generating a startup culture and encouraging venture capitalism (Available from Internet: http://sk.ru/foundation/about/).

The Foundation is split into five research clusters: IT, Energy, Nuclear, Biomedicine, and Space. One of the IT cluster residents is «*Socmedica» company*, which purpose is creation of an expert system for the diagnosis and decision making support in clinical practice. In addition, its decision seems to be the most comprehensive representative of Russian CDSSs. However, nowadays the project is still on the first stage of development. At the current moment just working prototype of *decision support system for drug therapy* is ready. Investments are needed for creation the first version of the key product of the company - *decision support system for clinical practice*.

The amount of investment required – $3.5 mln, of which $1.5 mln the company plans to get by attracting investors. In the process of key products development other separate products will be created and introduced to the market:

- System of risk prediction for clinical complications;
- Expert system for diagnostics «Electronic physician»;
- Expert system of personal medical support «Personal doctor».

At the current stage, the company is active negotiating with prospective purchasers. Several contracts have been signed; the first sell is expected within 4 months. It is expected that in 14 months after the required investments the company will become self-financed. Two years after the beginning of financing, net profit should be about $0.2 mln. The company predicts possibility of withdrawal of an investor in the beginning of the 3rd year by selling its share to a strategic investor. As such strategic investors, the company regards large companies, leaders of EHR market.

6. Implication of Triple Helix Model in Russian Health IT industry

In the concept of Triple Helix, the authors notice the enhanced role of the university, which becomes a basis for innovation and practical R&D, as well as actual entrepreneurial projects. The researches see the transition from a teaching university or a research university to an entrepreneurial university. The university creates institutions that govern the process of commercialization of innovation (technology transfer offices), stimulate the creation of new businesses (business incubators) and cooperation with existing companies (science parks). For example, the academic spin-off is one of the forms of such technology transfer.

In this research, the authors focus attention on Health Information Technology sector of economy. Health IT infrastructure varies widely in different countries, as indeed do the organization and funding of health services.

To be sure, no country has all the answers for a perfect health care system. However, all nations can learn from the leaders. Russian economy is high-tech research oriented, in particular, in the sphere of ICT innovations development. However, the chances for successful implementation of an innovative project directly depend on the ability of researchers to establish strategic relations with industry and end-users. One of the key reasons for the high importance of the network of contacts with other companies is the lack of state support for spin-offs in Russia. The amount of capital required to implement high-tech projects is many times higher than state subsidies. In addition, program to support medium high-tech enterprises is missing.

The crisis of 2009 provoked a change of policy about the academic spin-off, the Federal Law №217 was adopted to support the creation of spin-off Russian universities and research organizations. However, according to the norms of Russian fiscal legislation, higher education organization had to transfer entire revenue from licensing to the federal budget. Thus, the incentives for registration and maintenance of patents, the creation of innovative infrastructure, establishment and maintenance of contacts with companies do not exist at the proper level.

Nevertheless, there is also a positive trend: the Association of Russian Entrepreneurial Universities has been established. This is definitely a step forward to put Triple Helix model into action. Now the Association includes five universities, among which Moscow State University (Economics Department), Saint-Petersburg State University of IT, Mechanics and Optics (SSUIMO). Their mission is to promote cooperation between university and industry, and to enhance Russian competitive advantage in high-tech activities.

To summarize all of the above, for successful implementation the Triple Helix model, firstly, innovation initiative should come from university, industry and government in relatively equal measure, and secondly, the traditional role of university as an educational institution should be reconsidered to an entrepreneurial university that encompasses all the previous elements but takes them to a new level and has slightly different goals.

Most effectively, these ideas were realized in the USA. In both countries, Italy and Russia, researches see drawbacks in the cooperation between academia and business. Meanwhile Russia's potential for the development of Health IT sector of the economy is estimated higher than that of Italy. Firstly, due to the fact that Italy's economy is not IT-oriented, that is why Italian government collaborates with foreign companies. Secondly, in Italy the domestic business enterprises' contribution to the public R&D expenditures is the lowest in comparison with Russia and USA.

At the same time, Russia is having trouble in financing R&D by government and higher education, and for this reason in order to realize innovative projects Russian entrepreneurs attract foreign investments. Data, supporting these findings, are given in the Table 3.

Table 3: Science base, Knowledge flows and commercialisation Indicators for Italy, Russia and United States

	Public R&D expenditures (per GDP), 2013	Industry-financed public R&D expenditures (per GDP), 2013
Italy	67.993	19.673
Russia	52.607	126.221
USA	102.183	45.206

Source: (http://www.oecd-ilibrary.org/)

7. In conclusion

The key findings of the research is that CDSSs become especially important among other types of innovations. They can be considered as the highest level of electronic health records (EHR) and medical expert systems, facilitating the enhancement of Evidence-Based Medicine. The introduction of CDSS in a medical facility will involve the changes in its business processes management, which will help clinicians to concentrate on things they ought to do, spending less time on the mechanics, the bureaucracy, the paperwork, etc. The paper describes and evaluates three key CDSSs - IBM Watson Health (USA), Philips Healthcare (Netherlands), and determines the best representatives of such systems in Russian markets. The paper considers the main characteristics of described systems to make the comparative analysis between them.

The objectives of this research also were to reveal factors, which cause differences in ICT innovations implementation in Russian, Italian and American Health IT. Russian domestic innovative IT-product in healthcare system - «Socmedica» decision support system for clinical practice was chosen as perspective, because Clinical Decision Support Systems were identified as one of the most attractive directions for ICT innovations in Russian healthcare industry.

This research investigates the differences between countries in ICT innovations implementation using the concept of Triple Helix Model. There was made qualitative analysis based on statistical data for national science and innovation systems.
According to the concept of the Triple Helix, the best environments for innovation are created at the intersections of university, industry and government institutional spheres. Additionally, the traditional role of university as an educational institution should be reconsidered to an entrepreneurial university, creating favorable conditions for the joint development of science and business.

Most effectively, these ideas were realized in the USA. In both countries, Italy and Russia, the authors see drawbacks in the cooperation between academia and business. Meanwhile Russia's potential for the development of Health IT sector of the economy is estimated higher than that of Italy. Firstly, due to the fact that Italy's economy is not IT-oriented, that is why Italian government collaborates with foreign companies. Secondly, in Italy the domestic business enterprises' contribution to the public R&D expenditures is the lowest in comparison with Russia and USA.

At the same time, Russia is experiencing difficulties in financing R&D by government and higher education, and for this reason in order to realize innovative projects in Healthcare Russian entrepreneurs attract foreign investments.

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