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FOREWORD

Digital transformation is shaping our lives continuously. The current economic trends confirm the shift to the digital economy and society. Significant changes occurred at micro and macro levels, new financial and commercial models emerged due to the digital platforms and ecosystems.

Digital platforms and ecosystems are created, managed and governed to support the private entrepreneurial initiatives. For the private sector, digital platforms come with the promise of exponential economic growth, scale through the network effects and no assets needed. Recent research shows that emerging digital ecosystems will score $60 trillion in revenue by 2025, which represents more than 30% of the global corporate revenue, and for the moment, only 3% of companies have adopted an active platform strategy.

The public sector starts to benefit from digital platforms and ecosystems, being designed as strategic elements for smart cities or even smart nations. Future policies should focus on the impact of quickly growing platforms and stimulate the creation of economic and social value. Strong private-public collaboration is needed to take advantage of the positive impact of digital platforms for both industry and society.

Scientists looking at these transformations have concluded that the Fourth Industrial Revolution is tightly linked to the new digital and physical technologies. New business models are being developed not only in emerging organizations but also have been adopted by traditional economic entities. In a few short years, the ranking of most valuable companies by market capitalization has shifted to being dominated by one business model – digital platforms and ecosystems.

The reality is that digital platforms are expanding across economies, reshaping how companies are doing business in a wide range of industries, such as finance, education, health care, media, retail, etc. while creating new public and private responsibilities. The companies embedding digital platforms in their current business operations are diverse: start-ups, traditional well-stablished, giants of the digital world all of them are being driven by the need of business model innovation to keep up with their competition.

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The "network effect" is shifting the production from inside the company to outside, the companies that are using platform act as facilitators to value creation, users being those who contribute to value creation themselves. In this inverted business model, digital platforms are more important than the product itself. It is about an openness that managers raised on traditional competitive dynamics find difficult to cope with. But, once the scale is achieved, digital ecosystems become extraordinarily powerful. The issue is how to turn this power into positive impact not only at the economic level but also at the social level.

Is just a matter of time, the digital economy will become attractive for more and more economic entities. The future doesn't wait for traditional restructuration of the company to be planned and implemented. Only those that will realize the importance of this imperative change will survive to current digital "storm."

Editor-in-chief,

Prof. Manuela Epure, PhD

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Digitalization of Bulgarian Cultural Heritage

Georgi Georgiev
New Bulgarian University, Department of Architecture
e-mail: gngeorgiev@nbu.bg, www.nbu.bg

Abstract. *The research of historical heritage is related to creation, storage and distribution of visual information about them. With the development of digital technologies, the three-dimensional scanning and visual regeneration of buildings of cultural heritage combined with 3D virtual reconstruction is becoming increasingly important tool for understanding and reconstructing the past. Instead of expensive laser scanning, cheaper photogrammetric methods for creating and processing of spatial (3D) images of historical and architectural monuments are finding a growing application. The article analyses the opportunities for use of different ICT tools, including inexpensive digital imaging options for preservation and exhibiting of large and diverse Bulgarian cultural heritage.*

Keywords: Historical Heritage, 3D Image, Digital Scan, Photogrammetry, ICT Tools, Virtual Reconstruction

JEL Codes: R1, R2

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1. Introduction

The research and promotion of the monuments of historical heritage is related to the creation, storage and distribution of visual information about them. In the past, from the antiquity to the last century, the possibilities of creating visual information were limited to two-dimensional images created on different materials and (more recently) video and images films.

With the development of digital technologies, the three-dimensional scanning and visual regeneration of buildings of the cultural heritage combined with 3D virtual reconstruction is becoming increasingly popular method - a major tool for understanding and reconstructing the past. A 3D scan is a digital representation of the object. During the 3D scanning process, the shape of an object is captured using a 3D scanning application. The sensors of the individual device (laser scanner, digital camera, tablet or a mobile phone) collect data related to the shape, the depth and the colour of the item that is 3D scanned and as a result, the final 3D file is formed. After the 3D scan is converted into a 3D file, the result can be edited with a 3D modelling application and eventually can be 3D printed.

The worldwide 3D scanning technology market is expected to increase more than twice over a five-year period, with key applications of these technologies being involved in preservation of cultural heritage. These data are reported in the latest report by the online company “Research and Markets”. The global 3D scanning market was valued at USD8427 million in 2017, and is projected to reach USD53345 million by 2025 (researchandmarkets.com).

As a part of South East Europe Bulgaria has an ancient history and culture. Being a crossroad of civilizations and religions throughout the centuries, the region has been acting as a natural link between the East and the West. This accounts for the wealth and diversity of its cultural heritage. The region boasts

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remarkable cultural treasures with unique identity, many of them listed as world heritage monuments. Its cultural integrity is unique, pointing back to common historical roots, intrinsic links and mutual influences. The cultural and historical heritage that has survived highlights distinct cultural corridors, dating back hundreds and thousands of years. These are the axes of age-old cultural and economic links in the region that have been preserved until this day. They include both the tangible and intangible cultural and historical heritage of the countries and peoples living in this part of Europe. Today, they are among the strongest bonds between nations as well as being the living memory of the local civilizations. The current status of the cultural heritage in Bulgaria and in the region is worrying because of its fragmentation within the closed national and local systems, rather than being seen in the existing trans-national cultural corridors. In most cases, this unique cultural heritage linked together in clearly visible cultural corridors is ambiguously known in Europe, in the world and even in the region itself. There has been a deficit of effective regional cooperation for a coordinated protection and use of the existing cultural resource.

Therefore, in the second half of last century concerted actions have been started in the region under the auspice of International Council on Monuments and Sites (ICOMOS) and with the support of various stakeholders. Bulgarian national committee of ICOMOS (icomos-bg.org) was founded in 1964 right after the establishment of ICOMOS. The aim of the Bulgarian National Committee of ICOMOS, in accordance with the Charter of the ICOMOS, was to assist in the investigation, preservation and enhancement of the values of the cultural heritage: monuments of culture, historical areas, towns, ensembles and sites, as well as in the use and promotion of the heritage. ICOMOS Bulgarian National Committee (BNC) should carry out a wide range of activities:

- Implements international programs and projects aimed at providing financial resources for cultural heritage conservation, management, and promotion; manages the funds allocated for the implementation of specific projects;
- Cooperates with central and local authorities, NGOs and the private business, exchanges experience and coordinates joint actions for heritage conservation and management.

Applying of ICT can be seen also as a key driver for starting of large-scale activities in preservation of Bulgarian immovable cultural heritage.

2. Use of ICT for 3D Imaging of Bulgarian Historical Heritage

The development of modern multimedia digital technologies and the global Internet network creates new opportunities for constructing visual images of objects also for Bulgarian cultural heritage. According to Kandulkova (2009), these technologies enable conditions for a new type of restoration activities - "Virtual Restoration" ("Information Technologies in the Study and Preservation of Architectural and Archaeological Monuments of Culture", Heritage: ESPRIT, under the general editing of Prof. Dr. Todor Krustev, Varna: LiterNet, 2009). Unlike conventional restoration, the virtual one allows for the construction and depiction of several versions for a single artefact, creation of hypothetical images of the objects surveyed, without jeopardizing their authenticity. Through the construction of three-dimensional models, the spatial characteristics of the monument are examined in different moments of its existence.

The creation of graphic reconstructions is an old approach that is used for studying of the monuments. It was applied well before the emergence of digital electronic technologies. The introduction of digital technology makes this approach significantly more effective. Digital three-dimensional models allow free choice for many different views, sections or projections of the object, which greatly expands the possibilities for variable and in-depth analysis (Figure 7). In addition to the study, documentation and analysis of architectural and archaeological valuables, digital technologies create new opportunities for their presentation and promotion.

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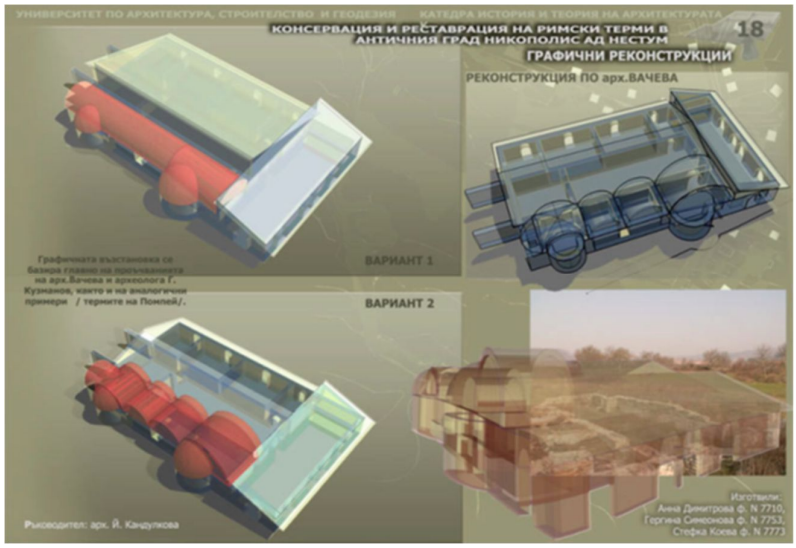

Fig. 1 Antique thermae in the late antique city of Nicopolis ad Nestum - optional graphic reconstructions; Course project on Restoration of architectural monuments of A. Dimitrova, G. Simeonova and St. Koeva, Under supervision of Assoc. Prof. J. Kandulkova, UACEG, 2007

The advantages digital technologies occur in several directions:

a. Improvement of image quality
b. Enhancement of the perception of objects by creating a three-dimensional digital image
c. Interactivity - possibility to create own "routes" of 3D image survey - the observer is an active participant and selects the ways of viewing
d. Opportunities for effective 'virtual restoration'.

3. Using photogrammetry for digital documentation of historical objects

One of the basic requirements for the restoration and reconstruction of buildings - architectural and historical monuments - is the restoration of the building with all its elements in their original shape (before the reconstruction). This requires a precise fixing of the dimensions and the spatial position of the building as well as all the facade elements - cornices, reliefs, friezes, pilasters, ornaments and others. Solving this problem by applying classical geodesic methods is too complicated and labour intensive, and in cases where the architectural layout of the building is richer - even impossible. For this reason, photogrammetric methods for creating spatial (3D) models for archiving historical and architectural monuments are finding a growing application.

Photogrammetry (from Greek: photo - light, gram - drawing, metreo - measurement) is a technology based on standard photography and projective geometry and was originally used to digitize large objects such as buildings, oil platforms and warehouses and is traditionally considered part of the geodesy belonging to the distance research direction. The principle on which photogrammetry is based is to capture a series of photo images of objects, and for subsequent processing, manual or automatic reference points for each photo are applied. Points can be added automatically or manually to create 3D measurements of the desired items from the given object. Photogrammetry is often used along with other 3D scanning technologies to provide complete surface measurements of parts of an object and to register small tolerances on large areas. Typical results are map, drawing or 3D model of a physical object or locality ("Applications of 3D Digitization", Practical Guide, Sofia, 2014).

3D scanning by photogrammetric methods is a modern, fast and accurate method for transforming the physical parameters of an object into an electronic format - a 3D digital model. Once the scanned data

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is already in the computer, all dimensions of the physical object, such as length, width, height, volume, object size, site location, surface area, etc., can be used. The development of modern digital imaging tools and, in particular, the modern possibilities for their processing and correction, create prerequisites for the application of digital photogrammetric technologies based on images obtained by ordinary digital cameras. Therefore, the financial benefits of using simple digital cameras for architectural scanning of buildings and cultural monuments are obvious. The greater is the advantage of photogrammetric methods for three-dimensional capture of architectural objects compared to laser scanning technology. This is mainly due to the huge difference in costs needed to implement the two alternative technologies. "... laser scanning takes too long and is still a very expensive technology compared to photogrammetric methods ..." ("Applications of 3D Digitization", Practical Guide, Sofia, 2014).

Many of the tasks in architectural photogrammetry are related to large amounts of information that need to be processed for a short time using modern and efficient technologies. Generally speaking, their essence is as follows: By inputting the information from the scanned images, stereoscopic observation is carried out by vectoring (three-dimensional digitization), the position of each point being determined on the display screen by the matching of similar points for each of the two images on which it is depicted. Graphics objects that are a product of such systems are typically designed for a pre-selected CAD system or for a suitable system for automated creation of plans and maps. The photogrammetric information is characterized by:

- greater completeness;
- diversity;
- structural definition.

The archiving of the monuments of architecture is usually done by photogrammetric surveying and using a precisely defined geodesic network. The digital photogrammetric cameras used provide high quality and credibility to the images. The variety of developed correlation imaging techniques and techniques allows for high quality outputs, and modern digital photogrammetry methods enable the input data to be instantiated relatively quickly and with high precision. With the use of modern digital cameras, the captured images are straightforward in digital form and avoid the technological process of scanning needed in analogue cameras. The accuracy of the geodesic support network can be achieved by precise measurements and using modern geodesic instruments. The digital three-dimensional model of the architectural object creates a significant increase in its efficiency. Besides the reliable transmission of the data on the site, an interconnection and an opportunity for their assessment are achieved, taking into account their specific features. The digital model allows not only the reliable storage of the data for an architectural object, but also the possibility to use it for the selection and assessment of new solutions related to its future development and preservation. (Pl. Maldjanski, "Development of Methods for Photographing and Processing of Data in Architectural Photogrammetry", Sofia, 2012)

By generating a three-dimensional model, a virtual description of the geometry and material construction of the surfaces of different objects is practically created. From it, it is possible subsequently generate different visual and spatial visualizations of 3D space. In this respect, two generic options for generating models can be distinguished:

3.1. Creation of "fast" 3D models

There are software products in which the model is generated based on several images from the object from different viewpoints. With their help, the program manually generates a generalized 3D pattern of the building or space. In the next phase, the specialized software takes the necessary snapshots of the photos and "dresses" the model. In this way, three-dimensional models of buildings with relatively

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simple shape, but with many details and decorations on the facade panels - mouldings, pilasters, complicated door and window openings, etc. are relatively quickly created.

3.2. Creation of detailed 3D models

This is the "classical" technology to build a complete three-dimensional model of the building or space. Besides being very labour-intensive, the process of building the model requires a considerable amount of data on the site - large and dimensioned plans, sections, views. The model can be created in various architectural design software such as ArchiCAD, ALLPLAN, Architectural Desktop, and REVIT Architecture etc. In order to obtain quality photorealistic end result, the model is further transferred and edited in one of the visualization programs - Cinema 4D, Artlantis, 3D Studio Max and others. (Fig. 2)

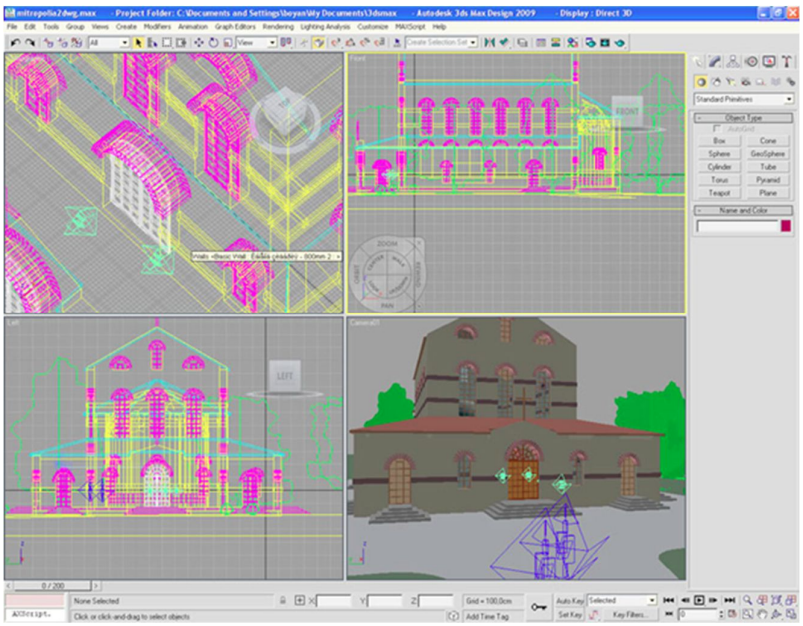

Fig. 2 Model Processing in 3D Studio Max, Source: Assoc. Prof. Dr. B. Georgiev

3.3. Photo cameras used in architectural photogrammetry

In modern architectural photogrammetry, digital images are most often used. They can be obtained directly via a digital sensor such as a CCD (Charge-Coupled Device) camera. They can also be captured with a traditional camera and subsequently scanned. For architectural purposes, the choice of cameras has long been limited to expensive and specialized metric cameras. Due to the limitations of the photogrammetric process, only metric cameras with elements of inner orientation were used in the past. Now varieties of digital capture systems are being developed and their price is constantly decreasing. The main advantage of these cameras is the ability to create digital images to be processed directly in the digital environment.

3.4. Image processing software

In order to process the images of the scanned object taken by digital cameras different image processing software is used.

Photomodeler (www.photomodeler.com) ia a widespread and relatively inexpensive tool for architectural and archaeological imagery. It works under Windows and allows measuring and transforming

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photos into 3D models, being one of image processing software that allows multiple snapshots of an object that reflect different aspects of it (different camera position etc.) to assemble a spatial model. This is an example of Professor Peter Waldhhausl of the Technical University in Vienna (Fig. 3). The basics of the capture, some of the source pictures and the model view, are seen. Photo Modeler software allows you to perform various operations on a created model (zoom-in, zoom-out, change design centre etc.). The use of CAD software to obtain directly a vector 3D model to which individual textures can be attached is the most common way to create digital models of architectural objects. Almost all 3D CAD modelling software allow this, but the most effective ones are 3D Studio-Max, Microstation and AutoCADMap. Fig.4 shows an example in AutoCADMap, while Fig. 5 shows the same object in Microstation.

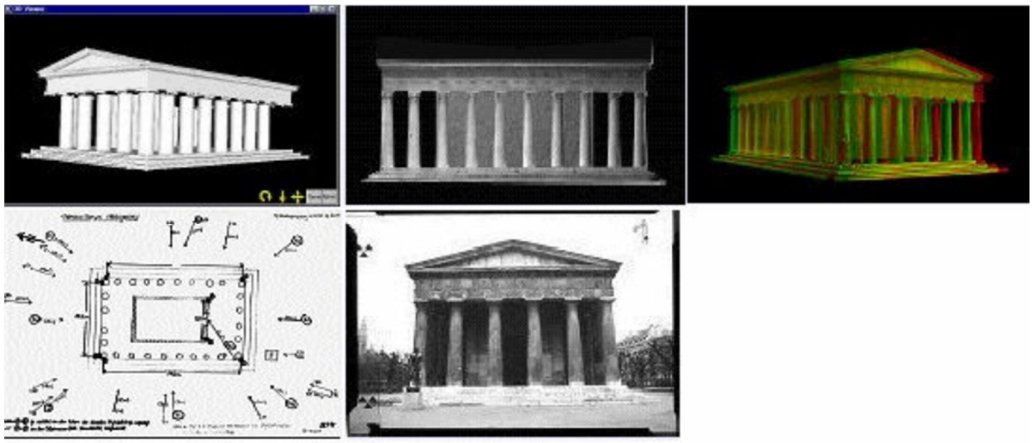

Fig. 3 Example provided by Professor Peter Waldhhausl of the Technical University of Vienna

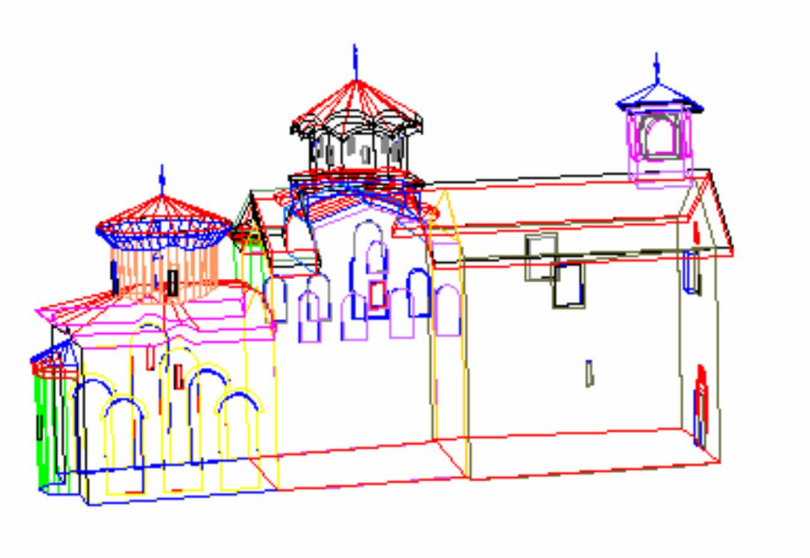

Fig. 4: 3D model of an architectural object created in AutoCADMap. Source: Assoc. prof. B. Georgiev

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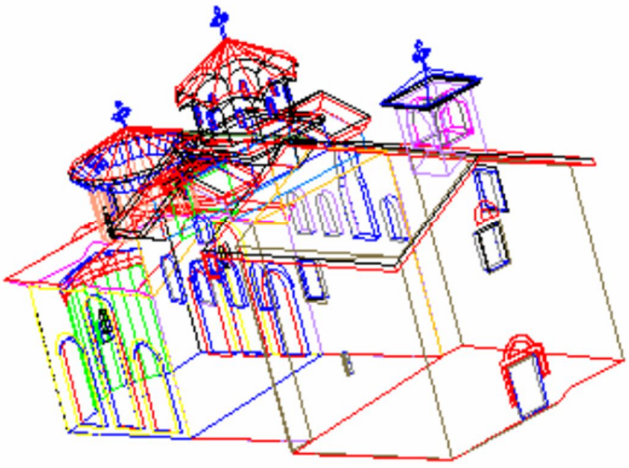

Fig. 5: 3D model of an architectural object created in Microstation.
Source: Assoc. prof B. Georgiev

The 3D Max software allows simultaneous creation of the digital model together with multimedia applications (*.avi files) that complement the multifunctional application of the digital image of the architectural object. It is possible to create video clips for different architectural features of an object, which besides for cognitive purpose can also be used as useful information for revealing the interrelations between objects.

4. Use of mobile phones to receive 3D digital object images

A modern smart phone can be used as 3D scanner. Some smart phones come integrated with a 3D scanning application. For other scanning apps can be downloaded from the internet store. Online stores increasingly supply 3D scanning apps. It is becoming quite easy to 3D scan an object or a person using a smart phone. More or less, the procedure of the 3D scanning for all phone-scanning applications is similar. First, the object that is to be scanned should be placed somewhere where you can walk around it. Then, the scanning procedure is started as indicated by the app, and the sensors of the camera of your mobile phone collect all the needed data. Once the 3D scanning is finished, and the data is collected, the app turns automatically them into your digital 3D model. After that, you can save the result and 3D print it.

4.1. D scanning applications for smartphones

The 3D scanning apps listed below are all based on photogrammetric method – 3D scanning technology – that creates 3D models out of 2D digital photos. It works by taking overlapping pictures of the object from different angles. Then, the software generates 3D model by combining all these images together.

Trnio

One of the best 3D scanning applications for mobile phones is **Trnio.** This 3D scanning app is available only for iPhones and it offers two scanning modes: the object mode and the scene mode. For the object mode, the user walks around an object and the app captures while the user moves in a circular pattern around the object. The scene mode is used for free formed scanning, meaning it can be used it for 3D scanning outdoors scenes or large items.

Scan 3D

It is used for Android smart phones; the key advantage of this application is its user-friendly interface. Even for a beginner, it is very easy to use it, as it allows instant reconstruction with the 3D model. It works by taking 20 to 30 overlapping photos around the scanned object and then the rendering is performed on the device automatically. The result of the digital scan is ready in a couple of minutes according to the

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sufficient number of the input pictures. Later on, a 3D model is created and can be shared on a Sketchfab account, without any post-processing

Qlone

Qlone is a 3D scanning mobile application that features near real-time 3D scanning and generates results locally, not through a cloud platform. In order for Qlone to be used, users need to print a black and white mat (similar to QR code). They then need to place the object they wish to 3D scan on top of the printed map. Users can print several maps depending on the object's size. The key feature of Qlone is its merging capabilities. The 3D scanning app is able to merge two different positions of the same 3D scanned item for a better overall result. Users can also share their 3D captures with friends on social media platforms such as Facebook, WhatsApp, and other apps. Qlone is a free application, but the exports of the generated 3D scans – that are available in common formats such as .OBJ, .STL, .PLY and .X3D are paid. Fig. 6 shows a small object, 3D scanned by use of Qlone application.

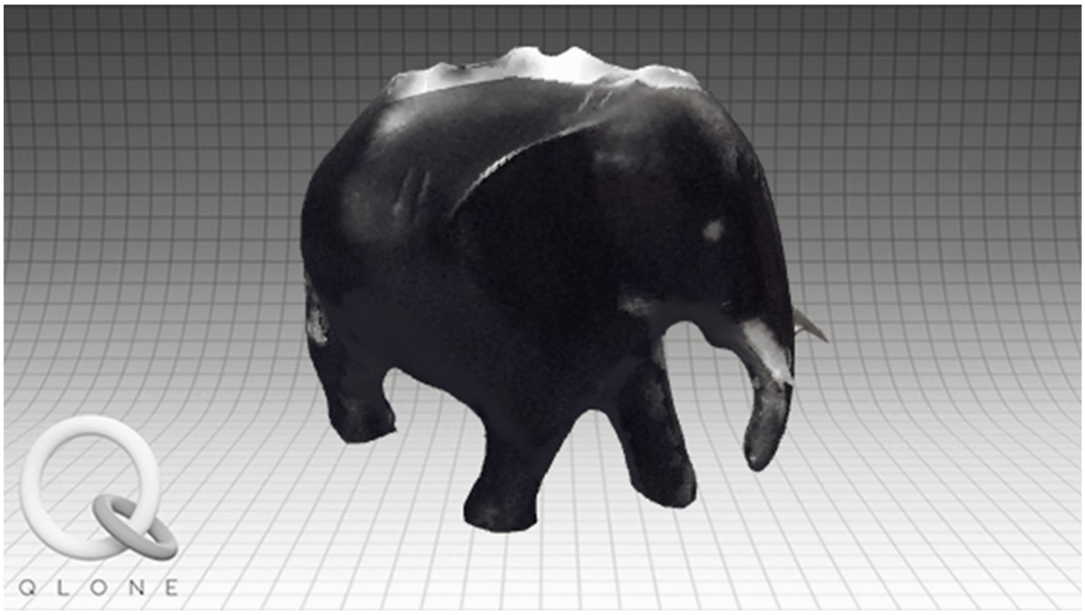

Fig. 6 A small object, 3D scanned by use of Qlone app, Source: Prof. Dr. Arch. G. Georgiev

5. Use of photogrammetry approach in Bulgaria

5.1. Work of Pl. Maldjanski

Regarding the theoretical development and the experimental application of the methods for capturing and processing data in architectural photogrammetry in Bulgaria, the leading contribution of Prof. Plamen Maldzhanski should be noted. His monograph "Development of methods for data capture and processing in architectural photogrammetry" (Maldjanski, 2003) is the most serious study in this field in Bulgaria. The monograph deals with photogrammetric methods for archiving cultural monuments and architecture, developing photographic techniques, coding of photogrammetric information and spatial data, technologies for creating and using digital models, ways of interpreting and publishing data, used equipment, methodology of technological processes, preparation of digital models of surfaces, buildings and voluminous bodies, architectural surveying, facade plans, aerial laser scanning, reconstruction and

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reconstruction upgrading objects according to their photos and prepared models as well as techniques for 3D photorealistic modelling.

Prof. Plamen Maldzhanski has a number of other publications on the topic of photographic surveying of architectural monuments. In one of them - his applied research study "Creating Digital Facade Plans"(Yearbook of the University of Architecture, Civil Engineering and Geodesy - Sofia, 2002-2003) he investigates the application of the method in capturing of architectural facades.

The article highlights that: "... facade shooting is a common task of photogrammetry practice. Facade plans represent an end-product for many activities related to the archiving of architectural sites and cultural monuments. Until recently, the technology used to produce facade plans was analogous. As a final product, an orthophoto map of the facade is used to document the cultural monument and contains complete metric information for individual details. The recent development of digital photogrammetry and the creation of digital imaging systems have enabled new effective digital technologies to create frontage plans where the final product is already digital and façade documentation is more complete and more effective in terms of resource saving and technological time" (Maldjanski, 2003).

Especially important is the conclusion that although the use of laser scanners leads to high accuracy and efficiency of technological processes, the high cost of laser scanners and digital stereo cameras is a prerequisite for searching for cheaper technological schemes to find a reasonable compromise in terms of quality and price when choosing an effective technology for facade plans.

The article offers such technology, consisting of:

1. Taking photos by analogue photogrammetric camera and a digital camera on the individual facades of the building.
2. Obtain a geometric pattern for each facade by using the captured data with the analogue camera.
3. Digital image transformation for individual zones of the images obtained with the digital camera.
4. Application of geometric adjustments of the individual sections and creation of a common mosaic for the façade.
5. Obtaining a digital orthophoto in a geodesic coordinate system.

Experiments were made by capturing the facades of a monument of culture and architecture and applying the proposed technology (Figure 7.). The experiments included shooting the facades of the building with the architectural detail, Plovdiv, 163 Shesti Septemvri Street with SMK 0808/56, with a 40 cm base and a CANON 7.2 Mpix digital camera. Subsequent data processing was performed with ERDAS IMAGINE software.

"Architectural Photographing of Building Facades by use of Digital Photometric Methods" - another article by Plamen Maldzhanski describes the results of an architectural archiving experiment at the Military Marine Club building in Varna. The main objective of the experiment is to formulate the following: investigate the possibility of creating an ortho photo image on the facades of a building decorated with a significant number of architectural elements and frames with the aid of the ERDAS software system based on the use of terrestrial digital photographs taken with a non-photometric camera (photo theodolite). In order to achieve this goal, the following private tasks are solved:

1. Choosing the appropriate method for photographing the building;
2. Experimenting of the appropriate technology and stages of processing of the terrestrial photos obtained.

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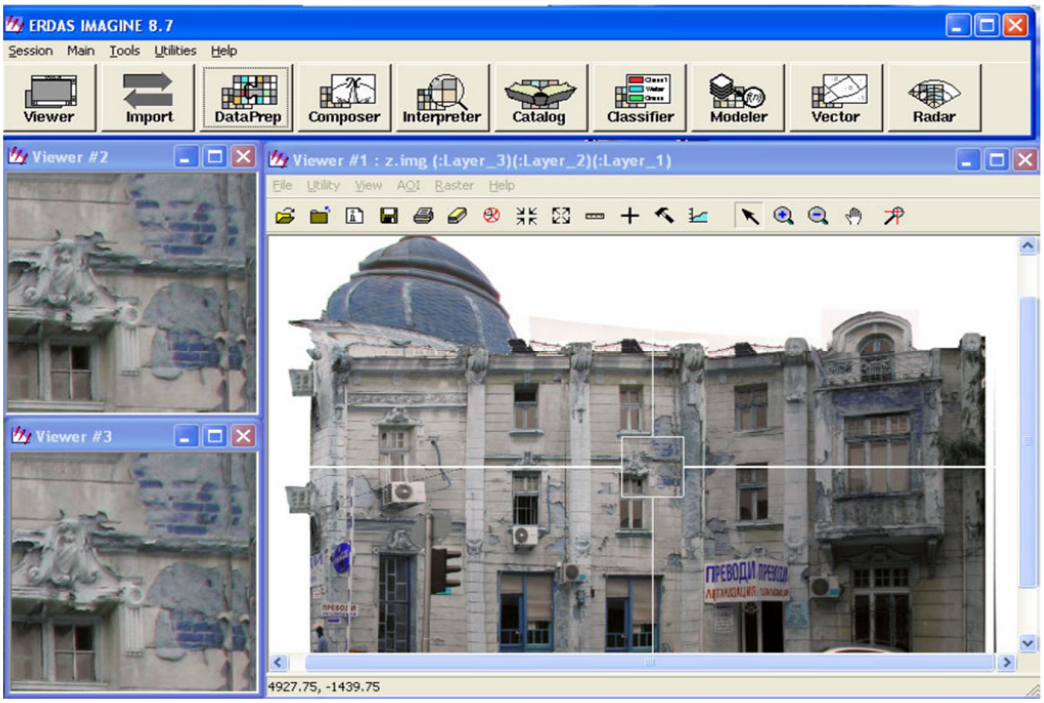

Fig. 7 Capturing of the facades of the building, Plovdiv, 163 Shesti Septemvri Str., Source: Pl. Maldjanski

Another research paper by prof. Pl. Maldjanski, focused on use of photogrammetry approach in research and preservation of architectural heritage, is outlining the advantages of digital photogrammetry versus analogue photogrammetric technologies (Maldzhanski, 2012). In this paper a comparative analysis between analogue and digital technologies in photogrammetry is made. Meanwhile, we highlighted the advantages of digital technologies in terms of the following: greater possibilities for managing and use of various types of data, corrections to the geometric model and introduction of systematic errors locally, process automation, expanded analysis of results of technological process, automatic formation of terrain data, detection of identical areas, etc.

5.2. Project "Heritage: ESPRIT"

The project "Cultural Heritage: Education – Science – Preservation – Integrated in Tourism" (liternet.bg/ebook/kulturno_nasledstvo/content.htm) has won a competition of the Ministry of Science and Culture (2006) and was implemented in 2007-2008 by the Bulgarian National Committee of ICOMOS with several Bulgarian partners: University of Architecture, Civil Engineering and Geodesy, National Academy of Art and Association for Cultural Tourism. It was targeted at creation of exchange, interaction and communication network between different sectors, associated to cultural heritage: science, education, preservation and cultural tourism, by use of the information technologies capacity. The project ambition was to create the missing communication between these sectors. Aiming this, in the frames of the project, an open scientific, educational and expert network was created.

An educational course "New Technologies in the cultural heritage and cultural tourism" was organized under the project. It was directed to students and young specialists in the field of preservation of the immovable architectural and artistic heritage. The course programme consisted of:

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- presenting modern digital technologies promoting cultural heritage, supported by use of new equipment of the Multimedia Laboratory for documentation and presentation of the immovable cultural values, created under the project.
- pilot use of the new technologies for preservation of the cultural monuments

Prominent Bulgarian experts – assoc. prof. Boyan Georgiev, PhD, assoc. prof. Stefan Tupanov, Ivan Delchev and Deliana Kostadinova – presented the lectures. The practical part of the education took part at two sites in the course of restoration – the Rila Monastery and the church St. George in Dolni Lozen village. The participants had documented the sites with the help of the new equipment. The educational program has ended with the processing of the data from the site using special software in the Multimedia Laboratory for Cultural Heritage.

5.3. Multimedia Laboratory for Cultural and Historical Heritage (MMLKH)

In March 2005, a Multimedia Laboratory for Cultural and Historical Heritage (MMLKH https://www.uacg.bg/?p=156&dp=110&l=2) was established at the Faculty of Architecture of Sofia University of Architecture, Civil Engineering and Geogesy. It was created as a technological platform for the research and educational network in the first stage of the project "New Technologies in Training, Preservation and Promotion of Cultural Heritage" with the support of the British Council for the Cultural and Natural Heritage of Southeastern Europe and the British Council, Bulgaria. A research was elaborated and a series of pilot informational products (digitalized monuments of culture, 3D models, a pilot territory for cultural tourism - Rhodopi Cultural Area) were developed.

This was and still is one of the first attempts in Bulgaria to provide a more extensive and resource-assured use of the capabilities of modern digital technologies in exploring material objects of historical heritage, including the creation of three-dimensional models. Through the creation of the Multimedia Laboratory, the Faculty of Architecture of the University of Architecture and Geodesy (UACEG) creates a foundation for modern infrastructure and the training of students in architecture in the field of cultural and historical heritage. Under the project, a training events and a workroom were set up for the preparation of training sessions, storage and management of the laboratory's resources. (Boyan Georgiev "Possible technological solutions for realization of information infrastructure for research, training, preservation, promotion in the field of different cultural and historical heritage", Heritage: ESPRIT, under the general editing of prof. Arch. Todor Krastev, Varna: LiterNet, 2009).

6. Conclusion

ICT tools are relatively well used for systematization, exhibition and promotion of Bulgarian cultural heritage. However, in development of modern digital technologies for constructing and processing of digital spatial images of cultural heritage objects, Bulgaria is lacking the needed scale and advancement of research activities. The application of digital technologies in investigation and preserving architectural monuments is relatively well covered by various specialized scientific publications. However, with the exception of limited in scale and scope projects, developed by Multimedia Laboratory for Cultural and Historical Heritage of UACEG, no other practically oriented activities in Bulgaria exist. The vast possibilities to apply at a large-scale inexpensive digital photogrammetry tools for preserving cultural monuments in Bulgaria are still unexplored. As evidenced in this article such possibilities are real and they need urgent implementation. Therefore, based on the above-mentioned conclusions, a pilot project developed by NBU and supported by Bulgarian National Research Fund, will explore the viable options for creation of digital archive of selected examples of Bulgarian housing architecture from XIX century by use of inexpensive digital photogrammetry approach. Once tested successfully, such approach will reveal a vast opportunity for start of larger scale activities in the area of digitalisation of Bulgarian cultural heritage buildings.

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Short Term Portfolio Investment and BI Rate: Do They Determine the Stabilization of Rupiah Exchange Rate in Indonesia?

Chenny Seftarita[1], Fitriyani[2*], Cut Zakia Rizki[3], Diana Sapha[4], and Abd. Jamal[5]

[1,2,3,4,5] Development Economics Department, Faculty of Economics and Business, Universitas Syiah Kuala, Aceh, Indonesia

Abstract. *This study aims to investigate the influence of short-term portfolio investments and BI interest rate on fluctuation of rupiah exchange rate in Indonesia. The data used is quarterly data from 2010 to 2016 collected from Indonesia Central Bank. Using the Autoregressive Distributed Lag (ARDL) method, the result showed that rupiah exchange rate was strongly influenced by shocks in the private debt securities, joint stock price index, and BI Rate, both in the long run and short run. Moreover, it is found that there was a short-run and long-run balance relationship between Short Term Portfolio Investments and BI rate against the rupiah exchange rate. Thus, it is recommended that in order to stabilize the exchange rate, it is necessary to maintain the stability of short-term portfolio investments.*

Keywords: Short Term Portfolio Investments, Nominal Exchange Rate, BI Rate, ARDL

JEL Codes: C32, E42, G11

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1. Introduction

Volatility in the exchange rate has severely happened in Indonesia in the last few years after the global crisis in 2008. As an open economy country, Indonesia faces a problem regarding the weakening of the exchange rate. Rupiah exchange rate against the US Dollar continued to depreciate and reached its peak in 2018, where the rupiah was Rp15,329 per US dollar, shown in Figure 1.

* Corresponding Author. Tel/Mobile Phone: +62 8113152231;

Email address: fitriyani@unsyiah.ac.id

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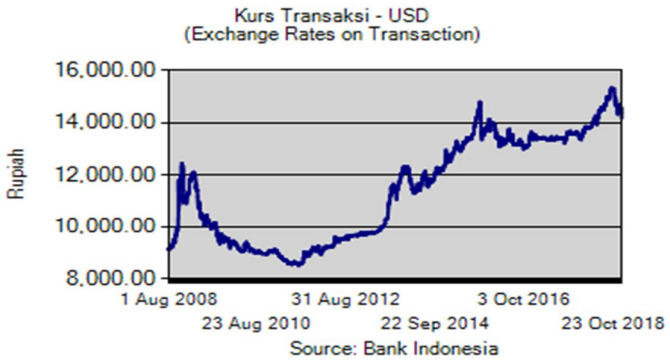
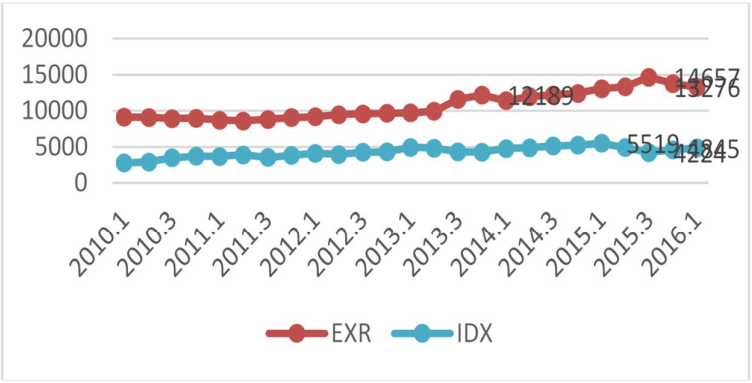


Source: (Bank Indonesia, 2018)

Figure 1. Rupiah Exchange Rate (IDR/USD) Fluctuation from 2008 to 2018

Some of the factors expected to affect the exchange rate include short-term portfolios investment such as debt securities and shares. Change in private debt was expected to affect the exchange rate fluctuation. Moreover, "Hot money", was also prone to cause the changes in the rupiah exchange rate, particularly when there was a significant decline in the composite stock price index in 2013 and 2015 (Figure 2.)

Many studies have examined the relationship between short-term portfolio investments and the rupiah exchange rate. Ibarra (2011) analyzed the influence of capital flows on the appreciation of RER in Mexico with ARDL bound test approach. The results found that the capital inflows caused peso to be appreciated between 1988 and 2008. The influx of foreign capital into the country from various forms, including; foreign debt, portfolio investment in the form of stocks and bonds, foreign trade surplus, and the others were effective on strengthening the domestic currency. Figure 3 illustrate the comparison between Rupiah Exchange Rate and IDX (Indonesian Composite Index) from 2010 to 2016. When the private debt experienced a drastic decline in the maturity of payments, the rupiah exchange rate would be depreciated, and vice versa.



Source: Bank Indonesia, 2018

Figure 2. Rupiah Exchange Rate and IDX (Indonesian Composite Index)

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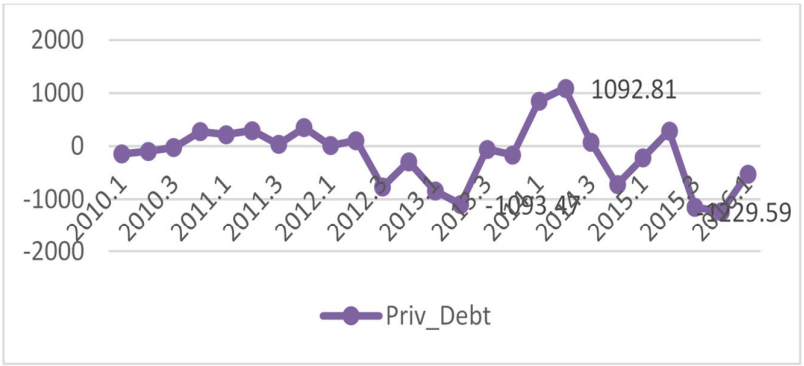
Similarly, Uddin, Rahman, & Quaosar (2014) also examined the factors influencing exchange rate fluctuations in Bangladesh with the co-integration approach. It was stated that macroeconomic variables influenced the Bangladesh currency in the end. The increase in debt, both private debt and government debt cause depreciation in the exchange rate, in contrast, a rise in foreign exchange reserves caused a currency appreciation. In addition, not only economics factors, but also social factors such as political issue had a negative impact on domestic exchange rate fluctuations.



Source: Bank Indonesia, 2018

Figure 3. Short Term Private Debt Securities in Indonesia

In addition, the interest rate is also one of variables that is important in explaining the shock of the exchange rate. Foreign interest rates greatly affected the industrialized countries and eventually affected the economy of a country. Furthermore, the effectiveness of the influence of foreign interest rates was strongly influenced by the regime of the exchange rates adopted by a country (Giovanni & Shambaugh, 2008).

Likewise, Wu & Xia (2016) examined the effect of monetary variables on exchange rates in Asia-Pacific by using the Markov Switching Model (MSM). The Asia Pacific country used a varied exchange rate system and generally set its exchange rate with US dollars. After the 1997/1998 Asian crisis, the exchange rate was hard to be controlled so that the exchange rate tended to be volatile. The variables that determine the change in the exchange rate include money supply, discount rate, and industrial production.

Moreover, Elahi, Salimi, & Masoomzadeh (2016) believed that the inflation Targeting Framework was very instrumental in maintaining the stability of exchange rates and trade balance in the countries. Some other fundamental variables greatly influence exchange rate fluctuations, such as gross domestic product, interest rate, money supply, and inflation.

Therefore, this paper aims to examine the effect of short-term portfolio investments and BI rate on exchange rates in Indonesia. It is remarkable to address this issue, as Indonesia is one of the countries with a highly volatile exchange rate where Indonesia is adopted free-floating exchange rate system.

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2. Literature Review

2.1. IS-LM Model

In the IS-LM model, money supply and money demand are equal. On the supply side, M/P as the real money supply is equal to the demand that is the total number of transactions in the economy (Y). Demand for money, in this case, is strongly influenced by the interest rate. The interest rate is an opportunity cost for the choice of holding bonds or holding money. The change in interest rate is heavily influenced the investor's decision to make an investment (Blanchard, 2009)

M/P = Y L (i).....(1)

In the open financial markets, investors face the choice of whether to hold domestic or foreign assets. The choice is assumed that financial investors, both domestic and foreign, will choose an investment that will produce the highest expected rate of return. The difference in domestic and foreign interest rate greatly influences the investor's decision. The interest parity condition can be written (Blanchard, 2009):

$$(1 + \mathrm{i_t}) = (1 + \mathrm{i_t^*})\left(\frac{Et}{E_{t+1}^e}\right) \quad \text{.....(2)}$$

Where $\mathrm{i_t^*}$ is the foreign interest rate; $\mathrm{i_t}$ is the domestic interest rate; E_{t+1}^e is the future expected exchange rate; Et is the real exchange rate. Hence, the real exchange rate can be written as:

$$Et = \frac{1+ i_t}{1+ i_t^*} E_{t+1}^e \quad \text{.....(3)}$$

This condition shows that domestic and foreign interest rates together with the expected exchange rate are strongly influenced the real exchange rate. Increasing in domestic interest rates will strengthen the exchange rate while rising in foreign interest rates will weaken the exchange rate. The expected exchange rate will also greatly affect the real exchange rate (Blanchard, 2009).

3. Methodology

This study uses a quarterly time series data of exchange rate, short-term private debt, BI Rate, and Composite Stock Price Index (IDX) from 2010 to 2016. The data are collected from Indonesia Central Bank. Auto-Regressive Distributed Lag (ARDL) bounds test method is being utilized to address the main objective issue. Pesaran & Shin (1995) explained that the ARDL procedure have two steps. Firstly, it is to estimate the long-run relationships among the variables. Estimation can be performed using F-test that is the fundamental in assessing the long-run relationship. If the value of F-statistic is greater than the upper bound value, then the null hypothesis is rejected and can be concluded that there is no cointegration and, hence the long-run relationship runs among the variables. Meanwhile, if the value of the F-statistic is lower than the upper bound values, we do not reject the null hypothesis and assumed there is no long run relationship among variables. The second, it is to determine the coefficients of the long-run relationship. ARDL Model used in this study can be written as:

$$\Delta EXR_t = \beta_0 + \beta_1 EXR_{t-1} + \beta_2 IDX_{t-1} + \beta_3 PRIV\_DEBT_{t-1} + \beta_4 BIRATE_{t-1} + \sum_{j=0}^{k} \gamma_{1j} \Delta EXR_{t-j} + \sum_{j=0}^{k} \gamma_{1j} \Delta IDX_{t-j} + \sum_{j=0}^{k} \gamma_{2j} \Delta PRIV\_DEBT_{t-j} + \sum_{j=0}^{k} \gamma_{3j} \Delta BIRATE_{t-j} + e_{1t} \quad \text{.....(4)}$$

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Where; EXR is the nominal exchange rate; PRIV_DEBT is short-term private debt; BIRATE is interest rate of Indonesia Central Bank that reflects the domestic interest rate; IDX is Composite Stock Price Index; β_0 is constant; $\beta_1 - \beta_4$ are coefficient for short term; $\gamma_{1-}\gamma_3$ are coefficient for long term; e_{1t} is error term. In this study, Short Term Portfolio Investments were proxied with PRIV_DEBT (short-term private debt) and IDX is reflecting speculation activities in the capital market.

4. Results and Discussion

4.1. Unit Root Test

Shrestha & Bhatta (2018) explains that if a value of time series data has a tendency to return to its average value in the long-run, and are not changed in time, then a data is called stationary. Nevertheless, if a value of time series data does not return to its average value in the long-run, then it is called non-stationary, which means that the variance and co-variance are not constant and changing over time. Many of the macroeconomic variables including inflation and exchange rate are not stationary. Gujarati (2009) said that if the estimation is conducted with the existence of unit root then the result of the estimation would be spurious regression. Spurious regression is defined as a regression that produces a biased conclusion that indicates the relationship of the variables is meaningless, for example, the R^2 values would result in higher percentage even if the data is not correlated.

There are many types of unit root test included Augmented Dickey-Fuller (ADF), Phillips-Perron, KPSS, etc. Unlike other tests, the null hypothesis in KPSS test is trend stationary and the alternative hypothesis is non-stationary, which means that there is a presence of a unit root in the model (Naiya & Abdul Manap, 2013).

From the results of the unit root test using KPSS-test, all variables used in this model are stationary. The exchange rate, the interest rate of the Indonesian central bank and private debt are stationary at first difference, I(1). On the other hand, the composite stock price index variable is stationary at level, I(0) (Table 1).

Table. 1. Unit Root Test

No	Variable	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) LM Statistic		
		At Level	1st Difference	2nd Difference
1	EXR	-	0.171192**	-
2	IDX	0.135394***	-	-
3	PRIV_DEBT	-	0.500000**	-
4	BIRATE	-	0.125395***	-

: Significant at 5 %, *: Significant at 10%

4.2. Optimal Lag

Iriobe, Obamuyi, & Abayomi (2018) explained that before the ARDL bound test is conducted, the next step of ARDL model estimation step is to determine the optimal lag length of each variable by using Akaike's Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC). Lag length is used as the basis for estimating short-term and long-term variables. In this study, we use the least Akaike's Information Criterion

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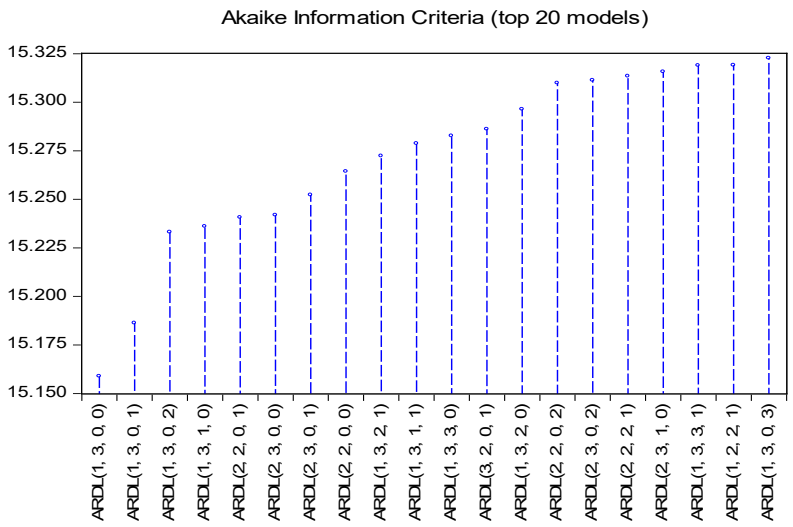
(AIC) value to estimate the best-fitted ARDL model. From these results in Table 2, the selected ARDL model is in lag (3, 2, 0, 0).

Table 2. Estimation Result
Dependent Variable: D(EXR)
Model selection method: Akaike Information Criterion (AIC)
Selected Model: ARDL(1, 3, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(EXR(-1))	-0.261582	0.225610	-1.159444	0.2657
IDX	-0.598825	0.305901	-1.957577	0.0705
IDX(-1)	0.366570	0.448893	0.816608	0.4278
IDX(-2)	1.119615	0.449617	2.490150	0.0260
IDX(-3)	-0.654157	0.312236	-2.095069	0.0548
D(BI_RATE)	209.7185	305.7607	0.685891	0.5040
D(PRIV_DEBT)	0.018577	0.153245	0.121227	0.9052
C	-741.0033	745.3949	-0.994108	0.3370
R-squared	0.671867			
Adjusted R-squared	0.507801			
F-statistic	4.095095			
Durbin-Watson stat	2.097973			

Table 2 describes that IDX is significantly affected the rupiah exchange rate at a confidence level of 5 to 10 percent. Meanwhile, other variables such as BI rate and short-term private debt do not significant affecting the exchange rate.



Figures 4. Lag Length Criterion

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Figure 4 shows the lag length criterion using AIC. There are 20 selected models, and the ARDL model in lag (1, 3, 0, 0) is the best fitted model used in this study. After that, the autocorrelation testing is done by looking at the residual test using the Q Colleogram table as shown in Table 3 below. From the results of the residual UI, the p-value is not significant at the confidence level of 5 to 10 percent, which means that the autocorrelation does not exist in this model.

Table 3. Residual Test

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. *| . |	. *| . |	1	-0.068	-0.068	0.1165	0.733
. | . |	. | . |	2	0.025	0.020	0.1330	0.936
. | . |	. | . |	3	-0.057	-0.054	0.2240	0.974
.**| . |	.**| . |	4	-0.281	-0.292	2.5452	0.637
. |* . |	. |* . |	5	0.197	0.173	3.7487	0.586
. | . |	. | . |	6	-0.027	0.003	3.7731	0.707
. |* . |	. | . |	7	0.113	0.072	4.2209	0.754
. *| . |	. *| . |	8	-0.078	-0.143	4.4532	0.814
. *| . |	. | . |	9	-0.066	0.029	4.6315	0.865
.**| . |	.**| . |	10	-0.211	-0.276	6.5861	0.764
. *| . |	. *| . |	11	-0.121	-0.101	7.2907	0.775
. |* . |	. |* . |	12	0.163	0.079	8.6954	0.729
. *| . |	.**| . |	13	-0.195	-0.220	10.921	0.617
. |* . |	. *| . |	14	0.075	-0.113	11.295	0.663
. *| . |	. *| . |	15	-0.121	-0.090	12.391	0.649
. *| . |	. *| . |	16	-0.147	-0.127	14.282	0.578
. |* . |	. | . |	17	0.149	-0.019	16.630	0.480
. | . |	. | . |	18	-0.019	0.018	16.678	0.545
. |* . |	. | . |	19	0.185	0.059	22.722	0.250
. | . |	. *| . |	20	0.001	-0.069	22.722	0.303
. | . |	. | . |	21	-0.017	-0.019	22.880	0.350

*Probabilities may not be valid for this equation specification.

4.3. Parameter Consistency Testing

Do & Zhang (2016) checked the stability of coefficient using the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ), utilized by Pesaran & Pesaran (1997). The plot of the CUSUM and CUSUM of squares describe about stability of coefficient and the long-run relationship among variables. If the line of CUSUM stays within the 5% significance bounds, then we do not reject the null hypothesis assumed that there is a long-run relationship among variables and thus shows stability of coefficient, and vice versa, if the plot of CUSUM exceed the 5%, critical bounds then, the model is instable. With this result, plot of CUSUM in figure 5 do not exceed the 5% critical bounds, and hence we conclude that the coefficient in this model is stable and have long-run relationships among variables.

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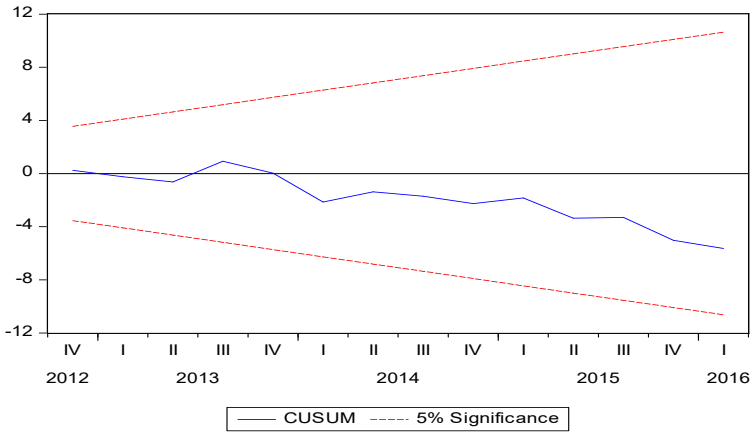

Figure 5. CUSUM Test

4.4. ARDL Bound Test

We used ARDL bounds test approach to investigate the long-term relationships between the variables, namely the relationship between the BI interest rate, short-term capital flows and fluctuations in the rupiah exchange rate. This is important to determine whether BI rate and changes in portfolio investments are significant in affecting the long-term exchange rate. We use F-test to examine this long-run relationship. Simultaneously, since the F-statistic value of 8.749687 is above the lower limit (I0) and upper limit (I1) of the Bounds test (Table 4), then we conclude that all variables used in this study are co-integrated. This means that BI rate is assumed to influence the rupiah exchange rate in the long term. In addition, short-term fluctuations in capital flows, which are the joint stock price index and private debt securities also affect fluctuations in the rupiah exchange rate in the long run. This result is similar with Uddin, Rahman, & Quaosar (2014) which concluded that both private debt and government debts are significant influencing the exchange rate in Bangladesh.

(Shakil, Mustapha, Tasnia, & Saiti, 2018) explains that If long-term relationship occurs between the variables, the error-correction model (ECM) is conducted to estimate the balance that occurs between dependent and independent variables. A negative and significant of ECM value assists the information about the rate of speed adjustment of dependent variables returns to equilibrium after shock. A value of -1.261582 (p-value=0.0001) assumed the speed of adjustments of the exchange rate to equilibrium the when there are changes in BI rate and short-term Portfolio Investments (Table 5).

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Table 4. ARDL Bound Test
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	8.749687	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Table 5. ARDL Cointegrating And Long Run Form
Dependent Variable: D(EXR)

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IDX)	-0.598825	0.305901	-1.957577	0.0705
D(IDX(-1))	-1.119615	0.449617	-2.490150	0.0260
D(IDX(-2))	0.654157	0.312236	2.095069	0.0548
D(BIRATE, 2)	209.718454	305.760721	0.685891	0.5040
D(PRIV_DEBT, 2)	0.018577	0.153245	0.121227	0.9052
CointEq(-1)	-1.261582	0.225610	-5.591876	0.0001
Cointeq=D(EXR)-(0.1848*IDX+166.2345*D(BIRATE)+0.0147*D(PRIV_DEBT)-587.3604)				

Tabel 6. Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IDX	0.184849	0.133077	1.389044	0.1865
D(BI_RATE)	166.234504	233.479025	0.711989	0.4882
D(PRIV_DEBT)	0.014726	0.121775	0.120924	0.9055
C	-587.360406	593.158305	-0.990225	0.3389

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5. Conclusion and Recommendation

As an open economy country, Indonesia faces a problem regarding the volatility of the exchange rate. This paper investigates the influence of short-term portfolio and BI interest rate on rupiah exchange rate in Indonesia. We applied ARDL bound testing and CUSUM to investigate the long run and short run effect and test the stability of the model. The result of ARDL bound testing shows that Indonesia currency was strongly influenced by shocks in the private debt securities, joint stock price index, and BI Rate. Many studies support this finding, which stated that short-term portfolio investments and "Hot Money" because of speculation activities are very vulnerable causing fluctuations of exchange rate. Hence, it is suggested for the government to strengthen the stabilization of the short-term portfolio investments included private debt, capital flows, and to control the competitive interest rates. Moreover, many factors can be done to strengthen the rupiah exchange rate, including enhancing the trade surplus and strengthening domestic industries.

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A Triple Layer Model to Manage Romania's Health Risks and Educational Consequences

Dr. Elena-Iuliana Paşcu-Gabără[1)], Dr. Larisa Mihoreanu[2)]
[1)] *Sanamed Hospital*, Bucharest, Romania, [2)] *ANMDM/King's College London, UK*

Abstract. *This article explores the relationship between education and health from the perspective of revised literature and suggests an exercise combining the scientific theory with applied knowledge to achieve health progress reflected in health indices improvement for individuals and community. The relation between aggregate health condition, food and nutrition receives, through education, a new shape implying a three-way causality analysis to highlight the role of each entity exerting significant influences in the others' good functioning.*
Three important issues are considered for the new and comprehensive definition: a) high level of education implies specific health benefits; b) health affects the level of education of the population; and c) living conditions, especially the childhood, affect both the population's education and the aggregate health of the whole nation.
This paper develops the new model to easier identify health risks, from the individuals' attitude and their behaviour in society, throughout life, within the institutional contexts.
The conclusion shows that individuals and their personal traits are built, shaped and solidified within the first social frame (family), being permanently affected by surroundings. Subsequently, the influence of the community – through consolidation, or disruptive factors – emphasized by political decisions, public establishments and their policies or other institutions – generates different social and cultural contexts whose aggregate consequences will be lasting and influence the national future.

Keywords: Food security, education, model, indicators.

JEL Codes: I30, I32, F60, D69

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1. Introduction

The today society perceives the health outcomes as profoundly influenced by a variety of social factors that do not intrinsically belong to the health or care systems. The major differences in morbidity, mortality and risk factors, in a given geographic territory, are modelled within the classical social determinants of health: • the access to education, • the incomes, • the economic and social characteristics of whereabouts people live, • the existing public policies that govern people future shape. The World Health Organization (WHO) statistical data show that people with a lower level of education have a shorter life expectancy than those with higher degrees of education.

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Financial Express (Apr. 2018). The explanation of a shorter life resides in the very close relationship between poverty, food, nutrition and education (Gheorghiu, 2018). The unequal access to healthcare is also closely linked to the level of education reflecting in life expectancy differences, especially in those countries that report high school dropout (WHO/FE, 2018).

The latest report "*Health at a Glance*" (2018), published by the Organization for Economic Cooperation and Development (OECD) and the European Commission, cites the socio-ecological factors near the deficiencies in the health system and the unhealthy behaviours of the population as basic explanations regarding the unfortunate position of Romania in the hierarchy of European countries compared in the mentioned study. The report documents the health status of citizens and the health systems performances within the European Union countries - quantified by age, gender, ethnic and racial categories and different social groups in terms of life expectancy, the main causes of death, the social and health inequalities and the prevalence of non-communicable diseases (OECD, 2018).

A particular attention is paid to the substantial multi-criteria health-related discrepancies presented in the EU countries and summarized through statistics.

In Romania, the life expectancy reported represents less than 78 years for women and 73 years for men, while the EU average is 81 years and even 83 years in Spain and Italy (OECD, 2018). The analysis of age differences by gender shows that women averagely live five and a half years longer than men do; the data varies across geographic areas and regions, with life expectancy sometimes varying by up to 10 years (OECD, 2018).

The geographic disparities are also sizeable in the analysis of other health-related items and health education: infant mortality, food quality, obesity and diabetes prevalence, cardiovascular disease and other chronic diseases. Regardless of regional locations, these inequalities are caused mainly by the socio-economic status, by the influence of cultural traditions in early childhood education, by the level of education.

The educational level (especially the one dominated by maternal transmission instincts) has been identified as a major predictor of health outcomes, and economic trends in the industrialized world have intensified the relationship between education and health. (Zimmerman *et al*, 2015).

Thus, this paper follows the direction of exploring the relation between education and health united by the topics of food and safety. It starts with the perspective of the revised literature, suggests a political modelling exercise as a useful tool for people working in public administration, in health education to merge the past practices and analyses with this new approach to improve the demographic health, food security and wellbeing for individuals and community sake.

Understanding the complex link between education and health and the reasons of studying differently their relation, do not represent a simple approach or only a new theoretical model. It is also a new pattern to analyze the socio-economic and political priorities, a challenge of a critical need to address the depths of social inequality in order to understand better health inequalities.

The awareness of the importance of education will help to improve the completely educational system by extrapolating the implementation of a long-run health education policy, based on nutrition and food security and risks, by stimulating robust investments in education in general and in health education in particular.

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2. A new definition of the E*du-health* concept

The socio-medical-economic model is meant to identify, manage and adjust the health risks starting with a more concrete definition of the relationship between the level of education and the health status of a community based on individuals as the basic component units. We identify the education-health relationship as a causal *perpetuum mobile*, pointing the food conditions and quality as a main driver influencing and conducting the good functioning of the others.

As shown in table no. 1, there are three aspects to be taken into account for the complete and comprehensive definition of the above mentioned relation: a) a high level of education implies additional health benefits; b) health affects the population education level; and c) the living conditions, the childhood habits, the food and nutrition affect both the health and the level of education of the population (CSH, 2015).

Table no. 1. The causal relationship between health and education

1. Health benefits gained from life safety through adequate education and nutrition
Health behaviours •Accumulation of knowledge, skills, capabilities and abilities •Change the lifestyle, introduce active living principles apply knowledge into the daily behaviour
Social and psychological benefits • Eliminating insecurity, reducing stress • Accumulation of societal expertise and psychological cleverness and frame of mind • Social networks use and influence sound involvement
Incomes, resources, perspectives • More and better jobs**,** improved **positions of employment** • Larger and more diversified incomes • Resources for good health and high social safety
2. Poor health affects the level of education of the population (Ashraf, 2018)
• Inappropriate nutrition, limited access to resources, ignoring individual and social diet tips • Decreased concentration and learning difficulties • Depression, diminishing self-esteem, social isolation, school dropout
3. Living conditions affect health through poor diet and low level of education
• *Contextual factors* • Lack of realistic understanding of the situation at societal level • Lack of skills in using the institutional and administrative tools provided by market and society to improve the current situation • Lack of practice in writing correct public policies and administrative procedures and standards for a correct implementation, evaluation and monitoring • Individual / family features with mutations over time, with individual and national influences (Ashraf *et al.* 2018)

The health benefits could be gained from life safety through adequate education and nutrition:

Accumulation of knowledge, capabilities and skills: The higher education people receive the better and healthier behaviour they learn and apply (CSH, 2015). This happens given a higher receptivity against prevention campaigns, better knowledge of their rights for the periodical health screenings, a deeper knowledge of their health needs helps the easy follow of the prescriber's recommendation, understand the need for a plan recovery, communicate effectively with medical staff (Goldman, 2002). Education is **at the**

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head of changes in beliefs, knowledge and healthy styles. Skills acquired through education sustains the health (through better incomes) an exert influence on the health status (through the ability to follow health regimes and manage illnesses, adapt to the functioning of a health system (Goldman, 2002).

Eliminate the uncertainty and reduce the stress: People with higher education – and hence higher incomes – miss often the stress caused by economic and financial difficulties, which the low-educated population has because of their needed resources to survive (Mc Ewen Stellar, 1993). The lifetime changes and trauma, the inflation, the discrimination, all are sources causing stress and consequently affect health. Over time, the economic difficulties and other stressors can have cumulative, negative effects on health, predisposing individuals to permanent diseases such: asthma, cardiovascular disease, gastrointestinal disorders and infections, all associated with higher rates of mortality in the elderly (Karlamangla *et al,* 2006).

Accumulation of societal expertise and psychological cleverness and frame of mind: The deep the formal knowledge, the more diverse the skills developed – cognition, observation, comparison, critical thinking, problem solving. This assists and encourages the key personality traits development. Education can increase "*the learning efficiency*", including cognitive skills, self-control and problem solving (Palczyńska and Świst, 2018). Key personality traits are successfully associated with education, employment and lower mortality rates (Palczyńska and Świst, 2018).

Adherence to healthy social networks that facilitate the personal development and social involvement: The social networks improve the access to information and exposure to peers who shape acceptable behaviours. The relationship between social support and education may be due in part to social and cognitive skills and greater involvement of civic groups and organizations that come with education (Berkman, 1995). A low social support is associated with higher rates of mortality and impaired mental health.

More and better jobs, improved positions of employment:
While a better educated person that applies for a vacancy is more likely to be employed and get a job with additional health benefits provided (health insurance, paid leave and retirement benefits), individuals who abandoned the school are more likely to have difficulties in finding jobs, working in risky domains, without benefits at all.

More diversified and higher income: Through its results, the education influences and ranks the health inequalities as a major component of the socio-economic status. Its variables help to measure the socio-economic realities, influencing both health and longevity. When referring to the differences between education and longevity, many socio-economic variables - income, occupation, access to Medicare - are directly or indirectly related to education (Kaplan *et al*., 1994). Both the education and the socio-economic status of a person always show connections with income and wealth, with the social position and the role inside the community, pointed out through statistical data proved by life expectancy for all genders, races or ages (Olshansky *et al.,* 2012).

The assets of a good health and a higher societal safety: Households built on high incomes prefer the healthier food, exercise regularly, and afford to pay extra services of care and wellbeing. At the other end, the jobs insecurity, the lack of material and emotional resources caused by lack of achievement and performance in the professional background make people (and their families) more vulnerable, especially in difficult times. This reverberates in inappropriate nutrition, unstable housing, and unsatisfied medical needs (Sobolewski and Amato, 2012). Lower incomes and lack of adequate coverage of insurance represent barriers to meeting health care needs. Access to care also affects the provision of preventive services and care for chronic diseases.

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Health is affected by inadequate nutrition and also affects the level of education of the population:

Inappropriate nutrition, limited access to restricted resources, decreased concentration capacity: The relationship between education and health is complex, with multiple bio-psycho-social aspects, influenced by multiple drivers among which the childhood conditions of living and the nutrition are essential. Hence, patients with chronic childhood onset often have behavioural difficulties in class, lack of concentration, aggressiveness or prefer isolation, low esteem and self-respect for their body, for their knowledge.

Decreased capacity to concentrate and learning difficulties: Health conditions, disabilities and unhealthy behaviours can have, partially or cumulatively, dramatic effects on educational outcomes.

Depression, loss of self-esteem, social isolation and school dropout: The young people with continuous poor results at school never go farther. They prefer to abandon the school and colleagues than fight for a better position in the class. This often cause severe educational trauma that will later interfere with the mental health as well. For example, when compared to other students, patients with Attention Deficit / Hyperactivity Disorder (ADHD) are three times more likely to drop out school before graduation (Barbaresi *et al*., 2007). Disabilities could also affect school performance due to visual, hearing, attention difficulties, inadequate behaviour, absenteeism or limited cognitive abilities. Researches show that chronic pain, inappropriate nutrition, psychoactive substance use and smoking at an early age, infantile obesity, sleep disturbances, impaired mental health, asthma, visual disturbances and attention deficit or hyperactivity have established links with school performance diminished (Suhrcke and de Paz Nieves, 2011). Although the health impact on education (reverse causality) is important, it has often been questioned the extent of the role it plays.

Living conditions affect equally the health and the education level:

The relationship between the level of education and the health status can also be defined by the analysis of living conditions - traditions, family values and habits transferred to children during their early childhood as eating, behavioural habits. The family living conditions, the household socio-economic status, along with other negative contextual factors can create stress and cause the chronic conditions development, children and families deprivation of necessary social resources: school attendance, jobs with major benefits, the acquisition of a healthy life (Barbaresi *et al*., 2017).

Contextual factors can affect people's education and health along their entire life. The influence of biological characteristics, the socio-economic and environmental conditions – poverty, lack of knowledge of organizing the budget, deepening of material shortages – appear to be particularly important in early childhood. In that period of life, the physical health of children and academic success is also influenced by biological risk factors: low birth weight, congenital or chronic conditions (Conti and Heckman, 2010) and socio-economic status (e.g. education and property of parents).

The early childhood is more important as it is the period when the principles of health and education are modelled on the children's living environment, parent involvement in the robust physical and mental stimulation through educational activities fostering the development of social skills, the development of emotional intelligence, and learning abilities (Barnett, Steven and Belfield, 2006).

3. Socio-medical-economic model - Theoretical premise

Starting from the individual's position in society and his/her behavioural pathway in society, we have created a new theoretical model that allows the identification of lifelong health risks in a context of institutional contexts (Smedley and Syme, 2000).

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The individual and personal traits are located within the family (the first social setting), affected by the context, and subsequently influenced by the community and its institutions (for example, school and group of friends, workplace and civil institutions) and policies of society in a wider social and cultural context (Figure 1).

Each element provides access to new opportunities, constraints and risks due to each one's actions. In addition, these levels interact with each other so that family resources mediate or influence available resources within the community. Considering that sociologists agree that unequal social status creates unequal access to resources and rewards, we extrapolate the idea of access to education and health services. The individual values are visible through the personal behaviour, actions becoming part of the community assets and structures, affecting influences, relations and mediations between different domains such as health and education.

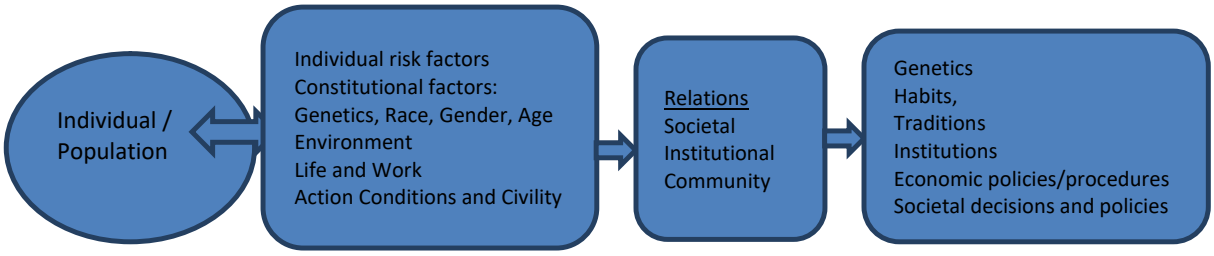

Fig. 1: The graphic representation of the socio-medical-economic model

In such a context, three levels quantify the health benefits:
- at the individual level (individuals' awareness on skills development and access to resources of any individual),
- community-based (health - related features of people 's backgrounds), and
- in a broader social-cultural way (e.g. social policies, religious social centres, unequal access to educational resources).

Education remains an important filtering mechanism that place individuals in certain societal contexts. As a driving force at every level, education has real implications in every decision-making aspect of each person's life – choosing a partner, a job, a health service, a social position in the community hierarchy.
In Romania, at least one third of children live in poverty (Gheorghiu, 2018), with considerable vital shortcomings. Each of these children lacks knowledge or financial resources appropriate to their normal study or health services. Consequently, they are permanently exposed to severe risks, the worst of which is the inability to leave this disadvantaged environment. Recent analyses of Eurostat (2018) fully confirm these conclusions. In its latest analysis of social indicators, Eurostat highlights Romania as the poorest country in the European space, with the largest poorer population accounting for 50% of the total population living and working in rural areas (Gheorghiu, 2018). As a result, children in these disadvantaged geographical areas are exposed to socio-economic and demographic disturbing factors. These have an important influence not only to their lives but also to the future of the country:
a) lack of a minimum level of education,
b) slight abuse of immorality, lack of the most elementary knowledge of hygiene and non-compliance with essential hygiene standards,

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c) suffer from malnutrition and other illnesses that would normally have been eradicated for several decades, d) have an extremely low life expectancy without any prospects of living and decent work (Gheorghiu, 2018).

The evolution of the last years shows that the public medical services in Romania proved to be more and more limited and helpless in the face of the new demographic evolutions and labour market trends. Those are due:

a) to the decrease of the human resources from the medical staff, due to the option to temporarily or permanently residing in other states with highly professional medical systems,

b) to the dissolution of public clinics and hospitals due to lack of adequate infrastructure, authorizations and institutional accreditation, lack of adequate staff, old, used, inadequate facilities,

c) to the difficulties in collecting resources, due to the increased demands for free medical services and much more. Although many categories of population can benefit from free medical services, practically these very numerous social categories cannot access, if necessary, the medical services they are entitled to. The various reasons focus on the lack of knowledge of the theory, of the policy implementation mechanism, of the lack of proper management skills, of the impossibility to intelligent use of budgets or of alternative funding resources.

Beyond the many measures required to revive the two fundamental sectors of any democratic society - the health and the education – the society is in high need to create new skills, new attitudes to use other resources, to define, implement and ensure decent human care conditions and equal access to all values and resources of the society.

Conclusion

The socio-medical-economic model presented here can provide a context for the many ways in which education is linked to our life experiences, including health outcomes. It come also up with support for understanding how educational outcomes are conditioned by the many social and environmental aspects we live in, and how they interact with our individual experiences and reward such values, at community level.

The model can become the foundation of a matrix where the new policy analysis, together with the robust financial decision, health education and societal investment will contribute to the modern transformation of our society.

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Enlarging the Application of the Food Security Index at European Union Regions

Larisa Mihoreanu[1)], Mariana Laura Cismaş[2)], Laura Maria Dănilă (Jianu)[3)]
[1)] KCL, United Kingdom [2)3)] The West University, Timişoara, România[1]

Abstract. *The food security remains a major priority and a typical issue that requires immediate international solutions. Recent studies reveal the increasing complexity of food security issues focusing on the necessity to address formal actions and solve the dramatic situations. New tools are always welcome to facilitate solutions' implementation. In September 2015, the United Nations Assembly adopted the 2030 Agenda of Sustainable Development among the goals of which the followings are fundamental: no poverty, zero hunger, good health and well-being, clean water and climate action. The European Union joined the Program, expressing the full commitment to its implementation. According to the Food and Agriculture Organization (FAO), the number of undernourished people reached in 2017 about 821 million peoples, representing an increase from about 804 million peoples in 2016. The 2018 statistics of FAO state that 22% of children under-five are affected by malnutrition, while over 38 million children in the same age group are overweight.*
Beyond premises, as a novelty, we contribute to food security knowledge by calculating a regional index at European and Romanian levels to better outline the realities and provide the decision-makers with a new tool to find better solutions.

Keywords: Food security, regional index, measurements and indicators, European Union

JEL Codes: I30, I32, F60, D69

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1. Introduction

The concept of food security originated at the World Food Summit in 1974, where it was defined as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (FAO, 1975). According to Maxwell and Smith (1992), about 200 definitions of the concept of food security circulated during 1970-1990. Some of them focused on: "ensuring that all people at all times have physical and economical access to the basic food that they need" (UN, 1975) while others were watching the "access of all people at all times to enough food for an active, healthy life" (WB, 1986).

What initially started with defining the concept continues nowadays with measuring it to all its dimensions, to adapt it to the present world challenges: rapid political, economic and climatic changes and together with a wilder globalization. The main dimensions of food security concept that we consider at the moment are: a) availability, b) affordability, c) utilization and d) stability (Davood, 2017). There are also

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debates on the vertical levels of this concept, from the global to the individual level, about their relevance and suitability. At the individual level, the indicators are easier to highlight and measure; meanwhile, at a regional, national or global level the best indicators to use allow comparing situations between states or regions.

In order to quantify food security, researchers used/calculated different indexes or, combining indicators, tried to better understand a very complex issue of our world (Asih and Klasen, 2017).

One of those indices is the Global Food Security Index calculated by The Intelligence Unit (EIU) on a sample of 113 countries, including most of EU's member states. The index takes into consideration the following four dimensions of the food security concept: • affordability, • availability, • quality & safety, and • natural resources & resilience. Several indicators are associated to these dimensions; indicators that once normalized give a score allowing comparisons between the countries in a certain sample.

The Food and Agriculture Organization (FAO) of the United Nations measured the intensity of food deprivation, which "indicates how much food-deprived people falls short, on average, of minimum food need in terms of dietary energy. It is measured as the difference between the minimum dietary energy and the average dietary energy intake of the undernourished population (food-deprived)". (FAO, 2009, 2018).

FAO in collaboration with other organizations like UNICEF (the United Nations Children's Fund), IFAD (the International Fund for Agricultural Development), WFC (the World Food Programme) and WHO (the World Health Organization) are publishing an annual report titled "The State of Security and Nutrition in the World" about "monitoring the progress towards achieving a world without hunger and malnutrition. They define the following indicators: "prevalence of undernourishment" and "food insecurity", "stunting, wasting and overweight in children under-five years" (FAO, 2018). In September 2015 the United Nations Assembly adopted the 2030 Agenda of Sustainable Development with 17 goals and 169 targets. The Agenda's goals are: no poverty; zero hunger, achieve food security and promote sustainable agriculture; good health and well-being for all; equitable and inclusive education and promote lifelong learning; gender equality; clean water; affordable, reliable and sustainable energy; sustainable economic growth, full, productive and decent work; resilient infrastructure, sustainable industrialization and foster innovation; reduce countries disparities; make cities and human settlements inclusive, safe and resilience; sustainable consumption; combat climate changes; conserve the oceans, seas and marine resources; protect, restore and promote sustainable use of terrestrial ecosystem; promote peace, provide justice for all and build effective, accountable and inclusive institutions at all levels; and to revitalize the Global Partnership for Sustainable Development. In November 2016, the European Union presented its response to the 2030 Agenda, stating that the EU is committed to implement the Sustainable Development Goals. It seems that food security became a top priority on many Agendas and a topical issue that still requires solutions. Recent studies also reviled its complexity and its multiple dimensions. Based on desk research the present paper is constructed as a review of recent literature on the field and includes the current state of knowledge on the food security subject that will be expended to contain the EU framework on this specific topic. We apply the Global Food Security Index knowledge to calculate a new index at NUTS 2 level (Nomenclature of Territorial Units for Statistics - regional level), for EU's regions, using the data provided by Eurostat.

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2. Review of scientific literature

Generic and accessible references make the availability and accessibility of food safe. Concerns in this area existed since the ancient times and civilizations – from The Dynasty Qin in China (220-205 BC) and Egypt, for building and managing food stores to be used in times of famine until the Ottoman Empire where clues about the first food transport and distribution policies have been brought to light (Edgerton-Tarpley, 2017). Other important details about the food security concept dates back in 1943; during the Spring Food and Agriculture Conference, references were made to "a safe, adequate and appropriate diet for all" (Napoli, 2011). Another step forward was the establishment of bilateral agencies by donor countries (USA and Canada in the 1950s) that facilitated the transfer of their agricultural surpluses abroad to countries in need. Since the 1960s, the growth of national consciousness influenced also the implementation of the idea that food aid hinders the progress of nations; it was the time when the concept of Food for Development has been born through self-sufficiency. The concept was institutionalized in 1963 through the World Food Program - WFP (Napoli, 2011). According to Fabio Gaetano Santeramo (2014), "the food security debate is growing rapidly and connects to a wide range of disciplines"; thus, it becomes a major issue for academic and international debates, "its global impact on economic fundamentals being already a matter of concern." In 1996, at the World Food Summit, FAO's definition devoted to the field of food security a wider scientific basis reinforcing its multi-dimensional nature by including in the concept the idea of access to food, availability, food use, and stability. In other words, food security exists when "all people have physical and economic access to sufficient safe and nutritious foods that meet their food needs and nutritional preferences for an active and healthy life" (FAO, 2018).

There are four dimensions of the problem: a) availability, b) food security supply, determined by the level of food production, stock level and net trade; c) accessibility - with reference to the sufficiency and access level to food within a household, to ensure the security of food safety; d) use of food, commonly understood as how the body uses in the own benefit, most of the food different nutrients. The appropriate amount of energy and nutrients consumed by the body is the result of the good practice of care and feeding, of the food preparation. In combination with a good biological use of food, the good practices contribute to the determination of the nutritional status of individuals (Leroy, 2015), to the stability over time for the availability, accessibility and use of food (FAO, 2010). A subsidiary dimension of food security is linked to the food insecurity; the analysts have defined two general types of food insecurity - chronic and transient; their characteristics are described below, in table 1.

An important part of the scientific literature in the field refers to the measurement of food security, from simple indicators like: proportion of children who are underweight, percent of undernourished children, children under five stunting, children at risk of morbidity and mortality, to a series of complex indexes computed (Luca, 2013), such as: the Global Hunger Index (GHI), the Action Aid Hunger Index, the Poverty and Hunger Index, the Hunger and Climate Vulnerability Index, the Composite I-distance Indicator (CIDI), the Global Food Security Index (GFSI), etc.

The Global Hunger Index (GHI) is a score computed by International Food Policy Research Institute (IFPRI), using four component indicators: the percentage of the population that is undernourished (PUN), the percentage of children under five years old who suffer from wasting (low weight-for-height) (CWA), the percentage of children under five years old who suffer from stunting (low height-for-age) (CST), and the percentage of children who die before the age of five (child mortality) (CM). After the values for the

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indicators are calculated using available data for each country, the next step is to standardize component indicators by giving them a standardized score based on thresholds set slightly above the highest country level values observed worldwide for that indicator (Luca, 2013). In the end, the standardized scores are aggregated to calculate the GHI score for each country.

Table no. 1: The two general types of food insecurity

	CHRONIC FOOD INSECURITY	TRANSIENT FOOD INSECURITY
is…	long-term or persistent.	short-term and temporary.
occurs when…	people are unable to meet their minimum food requirements over a sustained period of time	there is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status.
results from...	extended periods of poverty, lack of assets and inadequate access to productive or financial resources.	short-term shocks and fluctuations in food availability and food access, including year-to-year variations of the domestic food production, food prices and household incomes.
can be overcome with...	typical long term development measures also used to address poverty: education or access to productive resources, such as credit. They may also need more direct access to food to get their productive capacity raised.	transient food insecurity is relatively unpredictable and can emerge suddenly. This makes planning and programming more difficult and requires different capacities and types of intervention, including early warning capacity and safety net programmes.

Source: FAO, 2009, Food Security Information for Action. Practical Guides.

$$GHIscore = \frac{1}{3} \times PUNs + \frac{1}{6} \times CWA_z + \frac{1}{6} \times CST_z + \frac{1}{3} \times CM_z \quad (1)$$

Both the undernourishment and child mortality contribute one-third of the GHI score each, while the child under nutrition indicators – the loss of a child and child stunting— contribute with one-sixth of the score. The GHI was calculated in 1992 for 95 countries, in 2000 for 115 countries, in 2008 for 118 countries and in 2017 for 119 countries. Between the 119 countries, there are few European Union member states: Bulgaria, Croatia, Estonia, Latvia, Lithuania, and Romania. The score calculated in 2017 for Croatia, Estonia, Latvia and Lithuania is less than 5, as for Bulgaria is 5.4 and for Romania is 5.2 (IFPRI, 2017).

The Hunger and Climate Vulnerability Index computed by Krishnamurthy et all started with the purpose to quantify the vulnerability to the climatic conditions that „increase the food security risks faced by households or communities in case of a shock". They used a set of indicators selected based on a statistical analysis which determines the correlation between some specific indicators and undernourishment (Krishnamurthy et al., 2014).

The indicators selected are organized under six profiles, as follows:

- climate hazard risk including the indicators: mortality (per 100,000 population), reported economic losses per capita (% of GDP), number of droughts (2000–2010) (per unit), number of floods (2000–2010) (per unit), and the number of storms (2000–2010) (per unit);
- agricultural environment: forest cover (% of total area), Rainfed agriculture (% of total agriculture), and cereal crop production (yield/ha);

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- low elevation coastal zones (LECZ): the population in LECZ (% of total) and the rural area in LECZ (% of total);
- infrastructure: water access (rural population, %), water access (urban population, %), and paved roads (% of all roads);
- socio-economic structure: population growth per decade (2000-2010, %), total population below poverty line (2 dollars per day at power purchasing parity, %), live employment (%), and rural population (%);
- governance: government effectiveness.

As the indicators have different units it was necessary to be standardized. The conversion is realized giving values to each indicator indexed and then represented as percentages of the maximum value" (Krishnamurthy et al., 2014).

$$I_s = \frac{I_r}{I_m} \quad (2)$$

where Is means Indicatorstandardized, respectively Indicatorvalue and Indicatormaximum

The indicator values were then summed to obtain the values of the components as arithmetic mean. Component values have been normalized, "such as the maximum value for each is 1.

$$\text{Component value} = \frac{I_1 + I_2 + \cdots + I_n}{n} \quad (3)$$

The normalized result values then multiplied to obtain the index score using the formula:

Vulnerability score = Exposurevalue x Adaptive capacityvalue (4)

The results show that the majority of countries have „above-average vulnerabilities (vulnerability ≤0.525)", the most common category is medium (0.4 ≤ Vulnerability ≤0.6) and just a few have low vulnerabilities (Vulnerability ≤ 0.2). (Krishnamurthy et al, 2014).

The Economist Intelligence Unit (EIU) is a research division of the Economist Group created in 1946. The division publishes free reports, „each year focusing on current issues affecting specific countries, regions and industries" (EIU). In 2018, the EIU calculated a global food security index for 113 countries. It is based on specific criteria and uses 50 indicators grouped in four pillars: a) accessibility, b) availability, c) quality and safety, d) natural resources and resilience related to the four dimensions of the increase of food security defined by the FAO. The analysis also reported data from several EU countries. The indicators were selected by the EIU experts. The fourth pillar was added in 2017. A country score is calculated, from a simple weighted average of the first three category scores (affordability, availability and quality & safety). The natural resources & resilience category is an adjustment factor that serves as a lens through which the overall food security can be noticed to demonstrate the changes of the overall score when „climate-related and natural resource risks are taken into account"(EIU,2018).

In theirs paper Redressing the Global Food Security Index: a Multivariate Composite I-Distance Indicator Approach (2016), Maricic and collaborators tried to „overcome the issue of subjectivity assigned weights to indicators and categories within the GFSI" and proposed a statistical method (I-distance method) to calculate the Composite I-distance Indicator (CIDI). They used the I-distance method to determinate one entity (country) as referent unit. In theirs analysis „the referent entity was the one with the minimal values". Then for a set of variables which they noted, in order to explain the method, XT =(X1, X2, X3, …, Xk)

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chosen for each country, the square I-distance between two countries er =(x1r, x2r, …, xkr) and the second one es =(x1s, x2s, …, xks) is calculated using the formula below:

$$D^2(r,s) = \sum_{i=1}^{k} \frac{d_i^2(r,s)}{\sigma_i^2} \prod_{j=1}^{i-1} (1 - r_{ji.12\ldots j-1}^2) \quad (5)$$

Where $d_i^2(r,s)$ is the distance between the values of Xi for er and es "e.g. the discriminate effect":

$$d_i^2(r,s) = (x_{ir} - x_{is})^2 \; t \in \{1, \ldots k\} \quad (6)$$

σ_i^2 is the variance of Xi, and rji.12…j-1 is a partial coefficient of the correlation between Xi and Xj with j<i. (Maricic et al., 2016).

According to the authors the I-distance method stands out because of its lack of bias. They also used Pearson's correlation coefficient in order „to measure the importance of each variable for the ranking process" (Maricic et al., 2016). The Pearson's correlation coefficient was determined for each indicator. The new weights are obtained by dividing the Pearson's correlation coefficient at the sum of all correlation coefficients.

The formula is the following: $W_i = \frac{r_i}{\sum_{j=1}^{k} r_j}$ (7)

where ri with i=1,2,…,k is the Pearson's correlation coefficient the i-th input variable and the I-distance value. The sum of weights obtained using I-distance method is 1. (Maricic et al., 2016). Once the new weights obtained, the authors calculated the CIDI scores and ranks, using the official GFSI data.

Hereinafter we present the top 20 ranked countries with their GFSI score and corresponding ranks already compared with the CIDI scores and ranks. There are differences, but the some countries do not change their positions while others slightly change them. For example, United States keep the top position after GFSI score and remains on the same position according to the CIDI score (GFSI score=89.0, CIDI score=89.09). The second placed is Singapore with a GFSI score by 88.2 and a CIDI score by 88.80, which still remains on the same place. Netherlands id placed after the GFSI score on the fifth position and after the CIDI score becomes the third, with a CIDI score higher with 1.80 points to GFSI score. In fourth place after CIDI score is Australia (GFSI score=88.3, GFI rank 9 and CIDI score=86.28), followed by Ireland (GFSI score=85.4, GFI rank 3 and CIDI score=85.80), France (GFSI score=83.8, GFI rank 10 and CIDI score=85.37), Canada (GFSI score=84.2, GFI rank 7 and CIDI score=85.17), Sweden (GFSI score=82.9, GFI rank 12 and CIDI score=85.11), Austria (GFSI score=85.1, GFI rank 4 and CIDI score=85.03), New Zealand (GFSI score=82.8, GFI rank 13 and CIDI score=84.64), Germany (GFSI score=83.9, GFI rank 8 and CIDI score=84.08), Denmark (GFSI score=82.6, GFI rank 14 and CIDI score=83.97), Switzerland (GFSI score=84.4, GFI rank 6 and CIDI score=83.59), Norway (GFSI score=83.8, GFI rank11 and CIDI score=83.40), Portugal (GFSI score=80.5, GFI rank 16 and CIDI score=83.27), Finland (GFSI score=79.9, GFI rank 17 and CIDI score=82.28), United Kingdom (GFSI score=81.6, GFI rank 15 and CIDI score=81.98), Spain (GFSI score=78.9, GFI rank 20 and CIDI score=81.36), Belgium (GFSI score=79.5, GFI rank 18 and CIDI score=80.83), and Israel (GFSI score=78.9, GFI rank 19 and CIDI score=80.20) (Maricic et al, 2016).

Countries changed grades / positions among themselves, but overall they remained in the top 20. In the other sections, the two methodologies used did not change the first 20 positions, with the overall vision for each country remaining the same.

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3. Research methodology

Using the GFSI methodology we have also calculated a regional food security index for all regions of the European Union. To do this, we selected several NUTS2 indicators relevant to food security, using the Eurostat database. The index considers the four dimensions of the concept of food security: • accessibility, • availability, • quality and safety, • natural resources and resilience. For each dimension, there are several associated indicators. The initial index used the weight of the first three dimensions as follows: accessibility (40%); availability (44%), quality and safety (16%). The fourth dimension was added in 2017.

The methodology used by the EIU explains the calculation of the index that followed the steps:

• the indicators have been normalized to become comparable;

• for the aggregation stage, normalized indicators are converted from a value of 0-1 into a score of 0-100. The highest score is 100 for the country with the highest gross data, and the lowest score is 0 assigned to the country with the lowest gross data.

Starting in 2017, it has been added to the natural resource adjustment factor and resistivity designed so that the user has the option to see the results with or without natural climate-related resistance. Starting 2017 they added to the category "Natural Resource and Resilience adjustment factor designed so that the user can opt to view the results with climate-related and natural resilience" or not. The formula for the overall score with the forth pillar accounting is:

$$Score=X*(1-Z) + [X*(Y/100)*Z] \quad (8)$$

Where X represents the initial score, Y is the fourth pillar score and Z is the adjustment factor weighting (meaning 0=0%; 0.5=50%, 1=100%, and the default setting for the adjustment factor weighting being 0.25=25% - EIU, 2018). The indicators on which the GFSI index is based are presenting in table no.2.

For the affordability indicators the data sources are the Nationals Institutes of Statistics, World Bank (WB) and World Trade Organization (WTO) and (EUI, GFSI 2018) for the calculation of EIU qualitative scores.

Table no. 2: The affordability indicators

Indicator	Nominal Weight	Weight
Food consumption as a share of household expenditure	2.750	22.2%
Proportion of population under global poverty line	2.500	20.2%
Gross domestic product per capita (US$ PPP)	2.750	22.2%
Agricultural import tariffs	1.250	10.1%
Presence of food safety net programmes	1.750	14.1%
Access to financing for farmers	1.375	11.1%

Source: EIU GFSI, 2018

For the availability indicators, the data sources are: World Bank, FAO, OECD and again the calculus of qualitative scores of the EIU.

Table no. 3: The availability indicators

Indicator	Nominal Weight	Weight
Sufficiency of supply	3.250	23.4%
Public expenditure on agricultural	1.125	8.1%

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R&D		
Agricultural infrastructure	1.75	12.6%
Volatility of agricultural production	1.875	13.5%
Political stability risk	1.375	9.9%
Corruption	1.375	9.9%
Urban absorption capacity	1.375	9.9%
Food loss	1.750	12.6%

Source: The Economist Intelligence Unit, GFSI 2018

In the case of sufficiency of supply there were two sub-indicators used–average food supply (kcal/capita/day) and dependency of chronic food aid. For the agricultural infrastructure there were three sub-indicators used - existence of adequate crop storage facilities, road infrastructure, sea-port infrastructure –qualitative assessments. (EUI GFSI 2018).

Table no. 4: The quality and safety indicators

Indicator	Nominal Weight	Weight
Food diet diversification	1.500	20.3%
Nutritional standards	1.000	13.6%
Micronutrient availability	1.875	25.4%
Quality of proteins	1.750	23.7%
Food safety	1.250	16.9%

Source: EIU GFSI, 2018

The data sources for the indicators are as mentioned above. For the nutritional standards (Leroy, 2015) there have been used three sub-indicators - national dietary guidelines, national nutrition plans or strategy and nutrition monitoring and surveillance –qualitative assessments. For the micronutrient availability there were used three indicators – dietary availability of vitamin A (qualitative assessment), dietary availability of animal iron (mg/person/day) and dietary availability of vegetal iron (mg/person/day).

The food safety has three other sub-indicators: a) the possibility of ensuring food safety and health, b) the presence of the formal food sector as qualitative assessments, and c) the percentage of the population with access to drinking water as a percentage of the population using at least water Drinking Basic Services. EIU GFSI, 2018).

Table no. 5: The Natural resources and resilience indicators

Indicator	Nominal Weight	Weight
Exposure	3.00	21.8%
Water	2.00	14.5%
Land	2.00	14.5%
Oceans	1.75	12.7%
Sensitivity	1.50	10.9%
Adaptive capacity	2.50	18.2%
Demographic stresses	1.00	7.3%

Source: EIUGFSI, 2018

Each indicator belonging to this category has sub-indicators most of them being qualitative assessments or indexes. The exposure score is based on six sub-indicators: temperature rise (an index

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computed by The Notre Dame Global Adaptation Initiative (ND-GAIN), drought (qualitative assessment 0-5 scale, 5 meaning most risk, from World Resources Institute Aqueduct (WRI)), flooding (an index computed by ND-GAIN), Storm severity from Global Assessment Report on Disaster Risk Reduction 2015), sea level rise (an index computed by ND-GAIN), and commitment to managing exposure (from a research program on Climate Change, Agriculture and Food Security of The Consultative Group on International Agricultural Research (CGIAR)). The water score is based on two: agricultural water risk-quantity and agricultural water risk-quality of WRI- Aqueduct. The land score is based on 1-4 scale for soil erosion/organic matter, where 1 means best soil quality (from Harmonized World Soil Database), on grassland as net emission/removals (CO2) from FAO database, and forest change regarding change in forest area as a percentage of total land area from World Bank database.

The oceans score is based on the eutrophication and hypoxia 0-2 scale, with 2 being associated to healthiest oceans (WRI source). It is to be mentioned here that for Romania it is considered 2, but we only have openness to sea. The second sub-indicator is marine biodiversity as a percentage (Yale Environmental Performance Index), and the third is marine protected areas from World Database on Protected Areas,

The sensitivity score is based on ratio of food import dependency from FAO database, dependence on natural capital (%) from World Bank database and disaster risk management from an EIU risk briefing based on World Bank's indicators on Climate Smart Agriculture, a scale 0-7 where 7 means the best.

The adaptive capacity score is based on two scales: early warning measures/climate smart, a 0-2 scale where 2 is best, and national agricultural risk management system, a 0-6 scale where 6 is best.

Finally, the demographic stresses score is about the population growth and the urbanization percentage, using the research program on Climate Change, Agriculture and Food Security of The CGIAR and World Bank's indicators on Climate Smart Agriculture. The index was calculated at a national level for 113 countries among which there are 20 member states of European Union, and the most of them have a "very good" score (15 out of 20), the rest of them having a "good" score. To compute the regional food security index the first step was to identify regional indicators related to the interest issue. Considering the lack of data on regional level regarding the category of natural resources and resilience we computed the index only for the first three dimensions of food security: affordability, availability and quality and safety. Using EUROSTAT database we selected some indicators on regional level associating them to a certain dimension. We also imputed two qualitative scores computed by the Economist Intelligence Unit, for the quality and safety dimension. This scores are offices to ensure the safety and health of food (qualitative assessment, 0 meaning no and 1 meaning yes), and presence of formal grocery sector a qualitative assessment on a 0-2 scale, where 0 for „minimal presence", 1 for „moderate presence" and 2 for „widespread presence" (EIU 2018). The next step was to normalize the indicators, a different method was used as for some indicators a high level represent a favorable environment, meanwhile for some indicators the lowest value represent the favorable environment. For indicators with a high level as a favorable environment the formula applied is:

$$X=(X-Min(x))/Max(x)-Min(x) \quad (9)$$

where X is the value of the indicator for a European Union region, Min(x) is the lowest value for an indicator among the EU regions and Max(x) is the highest value for an indicator among the EU regions. When the lowest value of the indicator is considered as a favorable environment the normalizing formula is: $X=(X-Max(x))/Max(x)-Min(x)$ (10)

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All the normalized values are 0 to 1 values. From values within the range 0-1 we transformed them into scores from 0 to 100, for each indicator.

Table no. 6: The indicators of regional food security index

Affordability	Availability	Quality and Safety
Disposable income of private households (PPS per inhabitant)	Gross Value Added at basic prices for agriculture	Severe material deprivation rate (% of total population)
Regional gross domestic product (PPS per inhabitant)	Agriculture land used (percentage)	Offices to ensure the safety and health of food*(qualitative assessment, 0=no, 1=yes)
People at risk of poverty or social exclusion (% of total population)	Share of irrigable and irrigated areas in utilized agricultural area	Presence of formal grocery sector* (qualitative assessment, 0-2 scale)
People (0 to 59 years) living in households with very low work intensity (% of total population)	Animal populations (thousand head)	
	Production of cow's milk on farms (1000 tone)	

Source: EUROSTAT database, *EIU qualitative score, own processing

The weighting stage follows the normalization one in order to compute the affordability, availability and quality and safety scores. Inside each domain we applied equal weighting. Then for the overall score we used the first three dimensions weight used for GFSI index: affordability (40%); availability (44%), and quality& safety (16%).

4. Results and discussion

We firstly present below the results of the EIU's Global Food Security Index for the European Union member states, calculated for 20/28 EU countries. Nineteen of them are in the top 40; only Bulgaria occupies the 47th position of the 113 countries. Eleven of the twenty EU's member states are among the first top 20 and only five of them are among first ten ranked (Ireland rank 2, United Kingdom rank 3, Netherlands rank 5, Finland rank 8 and France rank 10).

Ireland has the higher overall score by 85.5 between the twenty member states, but has a low natural resources and resilience score by 69.2, the same as United Kingdom which has the next overall score by 85.0 and the lowest natural resources and resilience score by 64.8 among them. Even looking at the Global Food Security Index it is obvious that there are discrepancies between European Union's member states, and again Romania and Bulgaria are situated at the end of the ranking. Romania has an overall score by 68.9 and Bulgaria's overall score reaches only 64.5.

The Regional Food Security Index has been calculated for 276 NUTSII regions of EU's member states, based on the Eurostat database. All the regional indicators were analyzed. Given the lack of regional data on natural resources and resistance, we have calculated the index for the first three dimensions of food security only: accessibility, availability and quality and safety. The research faced numerous limitations, including: the lack of data at regional level, the lack of data for certain regions and for identified indicators; we have been obliged to let aside some indicators for which too much data was missing. That is why we have attributed some national data at regional level, because the ones for the regions missed. Here are the results of our processing below, in table no.8.

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Table no.7. Global Food Security Index 2018 for European Union's member states

	Rank	Overall score	Affordability	Availability	Quality/Safety	Resilience /Resources
Austria	14	82.1	83.5	81.3	81.0	80.2
Belgium	17	80.2	81.1	79.0	81.2	68.5
Bulgaria	47	64.5	70.1	60.0	63.2	74.7
Czech R.	24	76.1	77.9	75.4	73.7	80.9
Denmark	16	80.9	82.5	79.0	82.3	81.5
Finland	8	83.3	81.3	84.2	86.0	71.8
France	10	82.9	80.5	83.8	86.5	76.0
Germany	11	82.7	82.9	83.6	79.7	75.7
Greece	33	71.6	69.4	69.2	83.7	74.6
Hungary	30	72.8	75.6	70.5	72.0	79.2
Ireland	2	85.5	87.8	83.6	84.8	69.2
Italy	23	76.3	79.2	71.6	81.9	74.3
Netherlands	5	84.7	82.8	86.1	85.1	67.9
Poland	26	75.4	76.4	75.0	74.1	77.7
Portugal	19	79.3	76.7	78.7	87.3	75.7
Romania	38	68.9	67.5	68.8	72.6	74.7
Slovakia	35	70.3	73.6	69.4	64.6	81.7
Spain	21	78.0	79.2	74.9	83.6	71.9
Sweden	12	82.2	82.0	81.7	83.9	77.3
U. Kingdom	3	85.0	82.6	88.8	804	64.8

Source: The Economist Intelligence Unit, the Global Food Security Index 2018

Concerning the quality and safety dimension, we identified only one regional indicator that attributed two EIU qualitative scores, official offices to ensure food safety and quality and the presence of the official food sector. Finally, while the global food security index is calculated for 2018, our available data to calculate the regional food security index is only by 2016. In the following, we present the top 10 and the last ten NUTS 2 regions after the overall score on which I have calculated. Then we will present Romania and its regions.

Table no. 8. Regional Food Security Index for EU NUTSII regions, the first and the last 20

Region	State	Overall score	Rank	Region	State	Overall score	Rank
Lombardia	IT	60.2	1	Sardegna	IT	31.1	257
Weser-Ems	DE	58.4	2	Attiki	EL	31.1	258
Oberbayern	DE	57.3	3	Ciudad Autónoma de Melilla	ES	31.0	259
Lüneburg	DE	56.6	4	Dytiki Ellada	EL	30.8	260
Inner London - West	UK	55.7	5	Anatoliki Makedonia, Thraki	EL	30.6	261
Schwaben	DE	55.6	6	West	RO	29.8	262
Emilia-Romagna	IT	54.8	7	Notio Aigaio	EL	29.3	263
Bretagne	FR	54.6	8	Jadranska Hrvatska	HR	29.2	264
Tübingen	DE	54.3	9	South-West	RO	29.1	265

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				Oltenia			
Veneto	IT	53.8	10	Voreio Aigaio	EL	28.9	266
Pays de la Loire	FR	53.7	11	Ipeiros	EL	28.6	267
Münster	DE	53.6	12	Campania	IT	27.8	268
Stuttgart	DE	53.2	13	Calabria	IT	27.7	269
Detmold	DE	53.0	14	Sicilia	IT	27.7	270
Hannover	DE	52.7	15	Yugoiztochen	BG	27.0	271
Niederbayern	DE	52.5	16	Severoiztochen	BG	26.4	272
Southern and Eastern	IE	52.3	17	Severen tsentralen	BG	26.0	273
Darmstadt	DE	51.9	18	Canarias	ES	24.9	274
Köln	DE	51.8	19	Yuzhen tsentralen	BG	23.5	275
Kassel	DE	51.7	20	Severozapaden	BG	23.4	276

Source: own processing

The data shows that Germany dominates the top twenty of NUTS II regions. But the first ranked is Lombardia (Italy) with an overall score by 60.2 followed by Wese-Ems (58.4). The lowest score is 23.4 for Severozapaden, Bulgaria. Between the last twenty regions there are two Romanian ones - West with an overall score by 29.8 and South-West Oltenia (28.9). As GFSI highlights, along with another indicator, the discrepancies that still exist among the European Union's member states. The Regional Food Security Index highlights also the discrepancies that still exist even at the regional level. For Romania's regions, the situation is as presented in the following table no.9. Among the 113 countries for which the global food security index is calculated is the majority of EU Member States. For most Member States, the situation is very good, and for the rest, the overall score is relatively good. It is noteworthy that, in some ways, the GFSI has its subjectivity. But the statistical method used to reduce subjectivity has shown a similar number of countries.

Table no. 9: The Regional Food Security Index for the regions of Romania

Region	Rank	Overall score	Affordability	Availability	Quality / Safety
North-West	195	37.7	16.0	8.2	13.5
Center	231	34.7	14.2	7.2	13.4
North-East	54	47.8	16.6	16.1	15.2
South-East	250	31.8	10.1	10.0	11.7
South - Muntenia	246	32.7	10.9	9.8	12.0
Bucharest - Ilfov	178	38.7	19.6	6.8	12.3
South-West Oltenia	265	29.1	8.9	7.8	12.5
West	262	29.8	10.4	6.6	12.8

Source: own processing

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Numbers have changed between them, but overall they remain in the top 20. In the other sections, the two methodologies used did not change the top 20 ranking, and the overall vision for each country remains similar.

5. Conclusions

The Regional Food Security Index was calculated for 276 NUTS 2 regions of the EU member states. One of the limits of our study is the lack of regional data. Another limit is the lack of data for certain regions, for specific identified indicators and the fact that we had to let aside some indicators for which too much data was missing. We also had to impute some national data at regional level, as some data are missing in the region of some countries.

On the other hand, for already vulnerable areas, measuring any indicators, given that data is available, is important, but for the rest of the regions, the vulnerability to some changes is more important than their current state. It is also clear that some indicators are more relevant at national level than at regional or global level more than at national level.

As Pinstrup-Andersen has pointed out (2009), individual behavior is the one that, above all, needs to be reconciled as the household.

The idea that deserves to remain is that, before politics, the individual / household represents and defines unity.

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Knowledge Sharing among Employees in Organizations

Haradhan Kumar MOHAJAN
Assistant Professor, Premier University, Chittagong, Bangladesh,
Email: haradhan1971@gmail.com,Mobile: +8801716397232

Abstract. *Knowledge is considered as the basis for developing sustained long-term competitive advantage for every organization. In the 21st century every organization becomes knowledge based for the sustainable development. Knowledge sharing is an important instrument that turns individual knowledge into group organizational knowledge. It is one of the main knowledge processes in a present dynamic and competitive era for the development of organizations. The knowledge sharing practice plays a remarkable role in the development and innovation in many areas of organizations. In this paper an attempt has been taken to discuss techniques, barriers and benefits of knowledge sharing in organizations.*

Keywords: Knowledge sharing, organization, globalization

JEL Codes: D2, L2

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1. Introduction

In the 21st century, due to globalization, increasing competition, technological advancements, and the rapid aging of the population; organizations are facing the need to change their policies and strategies (Shah & Shah, 2010; Shannak et al., 2012). Hence, we need to think on new knowledge management (KM) practices for the sustainable development of organizations. Knowledge sharing (KS) in an organization is necessary and one of the best way to develop KM practices in the organizations (Beijerse, 1999).

Knowledge is a powerful source of organizations. The importance of knowledge for the development of organizations globally took attention to the researchers in the late 1990s. The World Bank (1998) explained that knowledge, specifically the way a society produced, processed, and integrated knowledge into their lives, was a crucial factor for the organizational development. At present, knowledge is considered as an essential issue of production in an organization as like land, labor, and capital. Knowledge is a fluid mix of experience, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information (Davenport & Prusak, 1997). In organizations, knowledge is divided into two types: explicit and tacit knowledge (Nonaka, 1991). Tacit knowledge is the hands-on skills, best practices, special know-how, heuristic, intuitions, and so on. It is personal in origin, context and job specific and difficult to formalize and codify, difficult to capture, communicate and share, and poorly documented but highly operational in the minds of the possessor (Polanyi, 1973; Serban & Luan, 2003).

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Explicit knowledge is easily codified, storable, transferable, and easily expressed and shared. Sources of it are manuals, policies and procedures, and databases and reports (Serban & Luan, 2003).

All the activities related to the transmission and distribution of knowledge among individuals, groups or organizations are considered as KS (Lee, 2001; Ling et al., 2009). KS is defined as the activity through which knowledge, such as information, skills, plans, innovation, ideas, goals, insights, or expertise is exchanged among people, peers, community, friends, families, or organizations (Bukowitz & Williams, 1999). It refers to the exchange of knowledge between at least two parties in a reciprocal process allowing reshape and sense making of the knowledge in the new context (Willem, 2003).

KS is the movement of knowledge among individuals in organizations to help others and to collaborate with others for solving problems, develop new ideas, or implement policies or procedures (Wang & Noe, 2010). Therefore, it is the process by which the knowledge possessed by individuals is converted into a form that can be understood and used by other individuals, and which is beneficial for all. In this process people can exchange explicit and tacit knowledge with each other and can create new knowledge (van den Brink, 2003). It is an activity of sharing experiences and individual information in an organization. It takes place as social interaction that involves the exchange of employee knowledge, experiences, and skills throughout an organization by some form of communication (Teeni, 2006; Lin, 2007).

KS provides huge impacts to the creation of learning organizational culture, knowledge, and innovation (Casimir, 2012). Therefore, KS identifies existing and accessible knowledge in order to transfer and tally this knowledge to solve specific tasks better, faster and cheaper than through other solving methods (Christensen, 2007). It depends on individual factors, such as, beliefs, experience, motivation, expectations, perceptions, attitudes, values, and mind-setting towards KS (Lin, 2007; Volady, 2013). On the other hand, organizational KS depends on feedback and valuable contributions and participation from colleagues, and the level of collaboration in and across the business units. The managerial KS covers the responsibility of providing sufficient training, valuing contributions, giving affirmative feedback, participation and organizational guidelines for using social media tools (Wahlroos, 2010).

A successful KM depends on efficient and fruitful KS among employees in organizations (Wang & Noe, 2010). For the sustainable development and long-term survival of any organization, effective and efficient KS is essential (Gaal et al., 2008). Now, KS in organizations is increasing day by day and is considering as an essential element for successful and effective development cooperation (Kim & Tcha, 2012).

2. Literature Review

Guodong Ni, Qingbin Cui, Linhua Sang, Wenshun Wang, and Hongyi Huang have examined the mechanism to improve knowledge sharing performance (KSP) with a specific focus on knowledge sharing culture (KSC) and project team interaction (PTI) in 78 Chinese engineering management organizations. Their research has shown that there is a significant positive correlation among KSC, KSP, and PTI (Ni et al., 2016). Bader Yousef Obeidat, Ayman Bahjat Abdallah, Noor Osama Aqqad, Abdel Hakeem Oqlah M. Akhoershiedah, and Mahmoud Maqableh have studied the various effects that exist among intellectual capital, knowledge sharing, and organizational performance on 356 employees working in manufacturing companies in Jordan. Their result has revealed that intellectual capital had a positive effect on organizational performance and KS (Obeidat et al., 2017). A. I. Susanty, M. Salwa, A. Chandradini, F. W. Evanisa and N. Iriani indicate how the enabling factors influence KS in 267 employees from three different companies in Indonesia (Susanty et al., 2016). Sheng-Wei Lin and Louis Yi-Shih Lo have found that the rewards and inspirations can enhance the KS among employees (Lin & Lo, 2015). According to Hung-Wen

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Lee and Ching-Fang Yu (2011), KS enables individuals to share knowledge to others, which benefits the organization. Minu Ipe (2003) point out that KS in organizations is a complex process. The authors also indicate that there are four main factors that influence KS process in an organization as: 1) nature of knowledge, 2) motivation to share, 3) opportunities to share, and 4) culture of work environment.

A study conducted by Mccall et al. (2008) reveals that, the four factors that influence KS are: i) individual factor, which is closely related to one's behavior to KS to others, ii) relational factor, which refers to individual relationship in a group, iii) informational factor, that is a complex type of knowledge, and iv) organizational factor, which is related to emotional bond between individual and organization. Karl-Erik Sveiby and Roland Simons have identified fifty factors mentioned in the literature on culture and employee attitude that influence KS, trust, and collaboration. They have highlighted attitudes among employees and teams, the KS behavior of supervisors, and organizational culture (Sveiby & Simons, 2002). Hsiu-Fen Lin (2007) has found bias on gender, age, organizational tenure, job position and ethnicity. His opinion is that these will be critical in KS. He has provided a significant correlation between instrumental ties and KS among women as compared to men.

Sylvie Geisendorf and Felicitas Pietrulla have tried to give a revised definition of the circular economy after having analyzed and compared the most prominent related concepts (Geisendorf & Pietrulla, 2017). Patrizia Ghisellini, Catia Cialani, and Sergio Ulgiati in a review on circular economy have provided that circular economy increases the efficiency of resource use, with special focus on urban and industrial waste, to achieve a better balance and harmony between economy, environment and society. They have stressed on ecological and environmental economics and industrial ecology (Ghisellini et al., 2016).

3. Methodology of the Study

In this article we have used the secondary data. We have taken helps from websites, books, previous published articles, theses, conference papers, case studies and various research reports for the preparation of this article. In the study, we have tried to discuss the various sides of KS technologies within organizations.

3.1. Objective of the Study

The objectives of this study are to represent KS strategies in organizations. We have also taken an attempt to discuss the following points:

- the aspects of KS,
- the importance of KS, and
- the improvement of the KS practices in organizations.

4. Knowledge Sharing among Employees in Organizations

4.1. Types of KS in Organizations

There are two types of KS activities: i) intra-firms, and ii) inter-firms KS (Lee et al., 2016). Intra-firm KS activity is performed within the same organization through formal and informal meetings, dialogs and social networks. As a result knowledge of the organization can be updated for future use (Vij & Faroop, 2014). Inter-firm KS activity is performed in different organizations, which allows firms to create value, share R&D, attain leadership, and access new efficient markets (Anand & Khanna, 2000; Lee et al., 2016).

KS is divided into three generations as follows (Bellefroid, 2012):

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The first generation: It is the traditional way of KS and stands on the basis concept of codification and storage which is supported by information technologies (Hansen et al., 1999). Codification is used as a starting point, were new employees can find out what others know and what knowledge is available.
The second generation: It focuses on the social component and personalization, so that people cooperate and communicate. Mentoring, coaching or face-to-face meetings are opportunities to share knowledge (Hansen et al., 1999). Personalization is the application of the available knowledge in the organization.
The third generation: It is social networks that provide a new way to get in touch with experts and to search for knowledge outside the organization. It deals with the function of knowledge ecology, chaos and the sensing of opportunities (Scharmer, 2001).

4.2. Process of KS in Organizations

KS can be represented as a two-dimensional process with members of staff sharing and exchanging their tacit and explicit knowledge. Regular KS creates new knowledge through the process of knowledge donation and collection (Hooff & Weenen, 2004).
Donation of knowledge: It represents the willingness and eagerness of individuals in organizations to give and share their knowledge with others through listening, talking to others to develop their self-knowledge and solve problems more quickly (Cumming, 2004; Lin, 2007)
Collection of knowledge: It indicates the receiver of knowledge who must consult colleagues through observation, listening or practicing from internal and external sources, and also to encourage them to share their intellectual capital (Hooff & Weenen, 2004; Lin, 2007).

Donation and collection processes increase trust and mutual respect as well as facilitate the flow of individuals' knowledge assets to capitalize for performance development (Kamasak & Bulutlar, 2010).

Peter Holdt Christensen identifies four forms of knowledge which are parts of the KS process: i) professional knowledge, ii) coordinating knowledge, iii) object-based knowledge, and iv) know-who. Professional knowledge is created and shared within communities of practices (CoPs) either inside or across organizational barriers. It is originated from a person's formal education in combination with his experience in performing his job. Coordination knowledge makes each employee knowledgeable of how and when he is supposed to apply knowledge in the organization. It is embedded in rules, standards and routines for how jobs are supposed to be performed. Object-based knowledge is about an object that passes along the organization's production line. The combination of professional knowledge and coordinating knowledge is applied to a certain object such as, a patient, a machine or a customer. Know-who is knowledge about who knows what, or who is supposed to perform activities that influence organizational activities of others. It enables the identification of who might be able to help solve specific problems. These four forms emphasize that knowledge is being shared as a means for efficiently transforming an input to an organizational output (Christensen, 2007).

4.3. KS in Circular Economy

A circular economy (CE) is an economic system that tries to minimize waste and makes the most of resources which are ignored by the traditional linear economy. It aims to develop growth, and focuses on positive society-wide benefits. It promotes 3R (reduce, reuse and recycle) policies (*Geissdoerfer et al., 2017)*. It encourages gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. It helps to reduce pollution, use fewer natural resources, tackle climate change, use waste as a resource, and reduce the environmental impacts of global production and consumption. It is based on three principles:

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- design out waste and pollution,
- keep products and materials in use,
- regenerate natural systems,

KS is very important in order to develop companies that respect the principles of CE. Organizations can save money and make money by applying KS in CE. Because, in CE everything is reused, remanufactured, recycled back into a raw material. It enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows (de Man & Friege, 2016).

KS in CE can increase resource benefits by conserving materials embodied in high-value products, or returning wastes to the economy as high-quality secondary raw materials. As a result, demand for primary raw materials will be reduced and organizations will gain more profits (Meyer, 2011). KS in CE can develop environmental achievements for economic output and social well-being. Waste recycling reduces greenhouse gas emissions. Keeping materials in the loop would also enhance ecosystem resilience and the environmental impacts of mining raw materials (European Environmental Agency, EEA, 2016). KS in CE can find economic benefits. A CE could provide massive cost savings for various industries by recycling the wastes. KS in CE can achieve social benefits. Social innovation associated with sharing, eco-design, reuse and recycling can create sustainable consumer behavior and improve human health. It also creates job opportunities (Wysokinska, 2016).

4.4. Building KS in Organizations

There are five factors that influence the extent to which KS takes place as follows (Gupta & Govindarajan, 2000):

- perceived value of the source's knowledge,
- willingness of the source to share knowledge,
- existence and richness of transmission channels,
- willingness of receiver to acquire knowledge from the source, and
- absorptive capacity of the receiver.

There are four mechanisms in KS within an organization: i) knowledge contribution to an organizational database, ii) KS in a formal interaction or a team or a division, iii) KS in an informal interaction between individuals, and iv) voluntarily KS in a community related to interesting topics (Kharabsheh, 2007).

The potential motivations behind KS behavior are as follows (Davenport & Prusak, 1997):

Altruism: It refers to behavior that costs an individual, and benefits the other individual. People contribute something to other people without thinking of any returns when showing altruistic behavior (Chattopadhyay, 1999).

Reciprocity: It indicates either a positive or negative response for the actions which one should treat others as one would like others to treat one.

Reputation: It refers to a degree of recognition and is increased by information sharing among other users. People who share more knowledge receive a higher reputation.

KS is used in two ways: exploitation and exploration. Exploitation is the processes where existing knowledge is captured, transferred, and deployed. Exploration is the processes where knowledge is shared, synthesized, and new knowledge is created (McElroy, 2003).

4.5. Barriers to KS in Organizations

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Barriers are the hinder of flow of knowledge among employees in organizations. KS practices have not accomplished properly in many organizations due to possible KS barriers. Lack of trust is a significant barrier for KS in organizations. The influence of the organizational culture, lack of proper leadership, and lack of appropriate rewards in the organization are barriers of KS (Zawawi et al., 2011). Lack of communication, inequalities in status, lack of leadership and managerial direction, deficiency of sharing resources in organization, lack of formal and informal mechanisms and spaces to improve sharing activities, missing of sharing initiatives into the organization, deficiency of sharing resources, lack of proper space of KS, unwilling of sharing knowledge of highly skilled and experienced staff, and lack or an exiguity of network connections are barriers to organizational KS (Riege, 2005).

Shortage of skilled personnel, finance, and information and communication technology are also barriers to KS in organizations. Most cases employees in organizations are reluctant to share knowledge among themselves because of lack of time and effort to KS, lack of motivation and credibility, fear of one's KS may lessen job security, poor evaluations by the receiving unit, differences in education levels, and lack of social network (Chiu et al., 2006; Dyer & Hatch, 2006).

4.6. Benefit of KS in Organizations

The KS among employees creates many benefits for an organization and some of them are; allowing the organization to build on previous knowledge and experiences, responding to problems more quickly, developing new ideas, fostering innovation, understanding customer needs, and building competencies (Cyr & Choo, 2010). KS facilitates the spread of knowledge as organizational collective knowledge, and helps the firm use available resources in an efficient and effective manner (Argote & Ingram, 2000). It covers knowledge identification, and access to be transferred and applied to solve problems, so that the organizational tasks can be done effectively and less costly (Shaari et al., 2014).

KS helps to the proper utilization of existing knowledge and is also to create new knowledge (Nonaka, 1994). It improves job performance, increases intellectual capital, changes individual competitiveness, changes organizational competitiveness, and reduces operational costs of the organizations (Jackson et al., 2006). Proper implementation of KS can lead to effective innovation, manufacturing processes, organizational designs, and quality products. Hence, effective KS practices can enhance the development of new products, as well as new quality processes (Cummings, 2003). By KS the employees of an organization connected with external sources, and can gain new information, experience and ideas that might not be found inside the organization (Wasko & Faraj, 2005). KS is important for creating a new knowledge in order to achieve competitive advantage which increase turnover of staff (Gurteen, 1999).

5. Conclusion

In this study we have tried to describe KS activities in the organizations. The authorities of organizations must be sincere for sharing knowledge elaborately to develop the organizations. We observed that during KS some barriers may occur to restrict the effective activities in organizations. These barriers must be overcome using the positive mentality that KS increases the effectiveness and quality of work to improve of their overall performance for the benefit of their organizations. We hope, the top managements of organizations must facilitate the KS system, and encourage their employees to share knowledge among the organizations.

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