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Transfer of Personal Data to Third Countries and the "Equivalent Level" of Protection According to the European Court of Justice

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Abstract

The focus of this study is the transfer of personal data to third countries or international organizations according to EU Regulation No. 679/2016 (GDPR) on the protection of personal data. The primary goal of this Regulation concerning data transfer to third countries is to ensure that the subject's rights and freedoms are safeguarded at the same level as provided by GDPR. According to GDPR, before any transfer to a third country or international organization, it must first be ascertained whether the European Commission has established that a third country ensures an adequate level of protection. Regarding personal data protection in the third state, the Court of Justice of the European Union has intervened on different occasions. In the last decision, in 2020, the Court declared invalid the European Commission's Decision No. 2016/1250 on the adequacy of the protection provided by the EU-US Privacy Shield (CJEU, Schrems II, 2020, July 16) because it does not provide effective and enforceable rights for personal data subjects in cases of interference. According to the Court of Justice of the European Union, the US does not guarantee an "essentially equivalent" level of protection to that provided by the European Union under Article 45(1) GDPR, read in conjunction with Articles 7, 8, and 47 of the European Union's Charter of Fundamental Rights, which guarantee respect for private and family life, personal data protection, and the right to effective judicial protection.

Keywords: GDPR, personal data, transfer, third country, Privacy Shield.

Introduction

The rapid evolution of the digital economy and the considerable changes in international trade have brought new challenges regarding personal data protection. One of the challenges the European Union faces today is data transfer from European Union or Exclusive Economic Area countries to other countries or international organizations outside this area (Kirschen, 2019, p. 262). The European Union Regulation No. 679/2016 (General Data Protection Regulation, hereafter GDPR)

provides that the transfer of personal data outside the European Union or the Economic Exclusive Area is generally prohibited unless the state in question offers the appropriate safeguards (GPDP, 2019; EDPB, 2018). The principal purpose of this provision is to protect personal data and preserve the security provided by EU legislation (Regulation (EU) 2016/679, Recital 6; EDPB, 2018). From this perspective, the transfer of personal data to third countries or international organizations should be accompanied by the protection established for personal data in the European Union (CJEU, Schrems II, 2020, July 16). In this regard, on July 16, 2020, the Court of Justice of the European Union found that the United States does not provide an "*essentially equivalent*" level of protection to that provided by the European Union, invalidating the European Commission's adequacy decision No. 2016/1250.

Methodology

This paper focuses on the transfer of personal data from the European Union or Exclusive Economic Area to countries or international organizations outside this area according to European Union Regulation No. 679/2016.

This research uses qualitative research methods to analyze the transfer of personal data outside the European Union and the guarantees provided for personal data protection. The paper is divided into three sections, where the first part refers to the concept of personal data and the transfer of personal data according to the EU Regulation. The second section of the paper examines the provisions of the EU Regulation governing the transfer of personal data to third countries and all of the criteria that must be satisfied if a transfer occurs. The third part of this paper refers to the jurisprudence of the Court of Justice of the European Union, which has intervened, highlighting the importance of the "equivalent level" of personal data protection in the case of transfer to third countries. The third part of this paper includes discussions concerning the critical issues the Court of Justice of the European Union raised concerning the equivalent level of protection.

Transfer of personal data

The GDPR specifies that personal data signifies any information relating to a particular person that may be identified or identifiable (Regulation (EU) 2016/679, Recital 26). Under the first paragraph of Article 4 of the Regulation, personal data refers to "*any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier, or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural, or social identity of that natural person"* (Regulation (EU) 2016/679, Article 4). In light of the above, any information that may be used to identify an individual, such as a name (See Valsecchi, 2022, p. LII-LIII), phone number, or other information that may be linked to an IP

address or cookie identifier, should be deemed personal data (Regulation (EU) 2016/679, Recital 30; Arnaboldi, 2018, p. 25).

The protection of personal data is a fundamental right under Article 8 (1) of the Charter of Fundamental Rights of the European Union and Article 16 (1) of the Treaty on the Functioning of the European Union (TFEU) (Regulation (EU) 2016/679, Recital 1). On the one hand, these documents provide that everyone, regardless of nationality or residence, has the right to personal data protection (Regulation (EU) 2016/679, Recital 1 and 14). Nonetheless, the right to personal data protection is not absolute, and it must be evaluated in relation to its purpose in society in order to strike a balance with other rights in line with the principle of proportionality. (Regulation (EU) 2016/679, Recital 4; CJEU, C-507/17, 2019, September 24; C-92/09 and C-93/09, 2010, November 9; Schwarz, C-291/12, 2013, October 17; EDPB, 2020, p. 9). In this context, the right to data protection may be restricted when necessary to protect the rights or freedoms of others under EU legislation (CJEU, Schrems II, 2020, July 16, para. 174). In this regard, the European Data Protection Board in 2020 adopted recommendations for controllers and processors based on the principle of accountability, which requires them to ensure the equivalent level of protection guaranteed by the GDPR in every transfer of personal data to third countries or international organizations (EDPB, 2020, p. 5-8).

Pursuant to Article 44 of GDPR, the EU Regulation applies to "*any transfer of personal data which is undergoing processing or is intended for processing after transfers to a third country or to an international organization.*" The term "*transfer*" refers to any type of transmission activity that can take place via any form or device (Kirschen, 2019, p. 264; Piroddi, 2021, p. 621), excluding dissemination and communication in the strict sense (Rich. Imperiali & Ros. Imperiali, 2003, pp. 8 et seq.). The Court of Justice of the European Union has commented on the notion of "transfer" more than once. In the Lindqvist case, the Court of Justice of the European Union has analyzed whether the mere fact of uploading personal data to a website stored by a server located in the same state or another state, should be considered a "transfer". On this occasion, the Court has concluded that the uploading of personal data onto an Internet page does not constitute a transfer of personal data, even when those data are accessible to *"anyone who connects to the internet, including people in a third country"* (CJEU, Case C-101/01). Subsequently, in the Schrims I case of October 6, 2015, the Court of Justice deals with the notion of transfer, including "*any operation or set of operations carried out with or without the aid of automated processes and applied to personal data*" (CJEU, C-362/2014, para. 45).

Conditions for allowing the transfer of personal data to third countries or international organizations

According to Article 45 of the GDPR, several steps must be taken to enable the transfer of personal data from the EU or EEA countries to third countries or international organizations. The first step in the transfer of personal data is to assess whether the

destination country or the international organization provides an adequate level of protection (Regulation (EU) 2016/679, Article 45 (1), Recital 103). In this regard, it is necessary to know whether there is a European Commission decision on the adequacy of the country where the transfer will take place. Through this decision, the European Commission states that the country offers adequate protection for the rights and freedoms related to personal data by allowing the transfer of data if it is under the provisions of the Regulation (Regulation (EU) 2016/679, Recital 103). In assessing the adequacy of the level of protection, the European Commission, based on Article 45, Paragraph 2 of the GDPR, considers various elements such as laws, respect for human rights and freedoms, national security, rules of personal data protection, the existence of a data protection authority, and binding commitments made by the country concerning data protection (Kirschen, 2019, pp. 269-270; Piroddi, 2021, pp. 634-639; Bernardi, 2020, p. 144). Another requirement added by the Regulation is that the Commission conduct a review of the adequacy decision every four years (Regulation (EU) 2016/679 Article 45, paras (3), (2a, 2b, 2c), (5), and Recitals 103 and 104; Arnaboldi, 2018, p. 173).

When a third country, according to the EU Commission, does not offer an adequate level of data protection, transfer to the latter is not permanently prohibited, but some other conditions are provided. It may, however, continue to comply with the provisions relating to transfers subject to appropriate safeguards (Regulation (EU) 2016/679, Article 46 (1), (2), and Recital 108; EDPB, 2020; EU Regulation No. 2018/1725, Article 48) according to Article 46, paragraph 2. Based on Recital 108 of the GDPR, the appropriate safeguards provided for by Article 46[1] must respect the protection of the personal data of the interested parties and ensure effective administrative or judicial remedies together with the possibility of compensation for damages (Recital 108, GDPR; Kirschen, 2019, p. 272; Piroddi, 2021, pp. 642-643; De Mozzi, 2022, p. 141). In the absence of the appropriate safeguards, Article 49 of the GDPR provides for some derogations to the general principle that personal data may be transferred to a third country if the latter provides for an appropriate level of protection. The basic rule for performing any data transfer is that the data exporter must first respect the adequate level of protection under the provisions of Article 46 to guarantee the exercise of fundamental rights concerning the processing of personal

[1] According to Article 46, paragraph 2, the appropriate safeguards consist of: "(a) A legally binding and enforceable instrument between public authorities or bodies; (b) Binding corporate rules in accordance with Article 47; (c) Standard data protection clauses adopted by the Commission in accordance with the examination procedure referred to in Article 93(2); (d) Standard data protection clauses adopted by a supervisory authority and approved by the Commission pursuant to the examination procedure referred to in Article 93(2); (e) An approved code of conduct according to Article 40 together with binding and enforceable commitments of the controller or processor in the third country to apply the appropriate safeguards, including as regards data subjects' rights; (f) An approved certification mechanism according to Article 42 together with binding and enforceable commitments of the controller or processor in the third country".

data and only, in the absence of the latter, utilize the derogations provided for in Article 49 (1) (Arnaboldi, 2018, p. 182). These derogations allow the transfer of data in specific situations, such as based on the explicit, informed consent of the interested party, for the performance or termination of a contract, for the exercise of lawful requirements, to protect the vital interests of the data subject, when they cannot give consent or for important reasons of public interest (See Piroddi, 2021, pp. 675-677; Arnaboldi, 2018, p. 181). Given the fact that derogations do not provide adequate protection or guarantees for the personal data being transferred (Kirschen, 2019, p. 285; Piroddi, 2021, p. 679) and that they do not require prior authorization from a national supervisory authority (EDPB, 2018, p. 4), the rights and freedoms of the data subjects being transferred may be at risk. The condition to be met in the case of derogations is that transfers must be random, necessary, and not repetitive (Regulation (EU) 2016/679, Article 49 (1); EDPB, 2018, p. 4; De Mozzi, 2022, p. 143; Bernardi, 2020, p. 149). In case of application of this derogation, must be informed the Supervisory Authority and the interested party for the transfer and the legitimate interests pursued.

The invalidation of the European Commission's Decision No. 2016/1250 on the adequacy of the protection provided by the EU-US Privacy Shield by the Court of Justice of the European Union

The Court of Justice of the European Union has issued two important decisions on the transfer of personal data from the EU to the United States. The first decision, on October 6, 2015 (Schrems I), declared the invalidity of Decision No. 2000/520 regarding the Safe Harbour Agreement (Commission Decision 2000/520/EC) because it failed to provide an adequate level of protection required by Directive 95/46 for the transfer of personal data from the European Union or Exclusive Economic Area to the United States. And in the second decision (Schrems II), the Court of Justice of the European Union declared the invalidity of the European Commission's Decision No. 2016/1250 on the adequacy of the protection provided by the EU-US Privacy Shield (Commission Decision No. 2016/1250) because it didn't ensure a level of protection for personal data equivalent to the European legislation (See Piroddi, 2021, p. 625; De Mozzi, 2022, p. 151). The European Commission's decision No. 2016/1250, on the adequacy of the protection provided by the EU-US Privacy Shield, adopted in 2016, provided for the possibility of the transfer of personal data from the European Union to the United States. This tool was used by businesses in the EU or EEA to transfer personal data to US companies listed on the Privacy Shield and provided specific guarantees for personal data protection (CJEU, Schrems II, 2020, July 16).

The issue concerns an Austrian national who was a Facebook user whose personal information was transmitted from Facebook Ireland to Facebook Inc., situated in the United States. Mr. Schrems filed a complaint with the Commissioner in June 2013 to prohibit the transfer of his data to the United States, claiming that the latter did not

ensure the same level of protection as guaranteed by the European Union (CJEU, Schrems II, 2020, July 16, paras 50, 51 and 52). Following a reformulation of Mr. Schrems' complaint, the Commissioner published a draft decision stating that the personal data transferred to the US was destined to be consulted and processed in a manner that was incompatible with Articles 7, 8, and 47 of the European Union's Charter of Fundamental Rights (CJEU, Schrems II, 2020, July 16, paras 55 and 56). As a result, the Commissioner took the issue to the High Court.

According to the High Court, the United States processed personal data without ensuring adequate protection as provided for in Articles 7 and 8 of the Charter of Fundamental Rights of the European Union. As a result, European nationals' data was not protected at the same level as American citizens. To begin with, the Court declared that the United States Constitution's fourth amendment does not apply to European nationals. According to the Court, the protection of the personal data of European individuals encounters some obstacles. The first issue is the *locus standi*. The second is the National Security Agency's (NSA) activity, which includes copying and filtering internet traffic flows without being subject to judicial oversight. And the third issue is the Privacy Shield's Ombudsperson, who is not a tribunal in the sense of Article 47 of the Charter (CJEU, Schrems II, 2020, July 16, para. 65). So the High Court brought the case to the Court of Justice of the European Union for a preliminary ruling.

The Court of Justice of the European Union in the case Schrems II examined various issues, concluding that, according to Article 45 GDPR, the transfer of personal data from the EU or EEA to a third country or international organization should be based on an adequacy decision of the Commission. In the absence of the latter, the controller or processor may transfer the personal data only in the presence of “appropriate safeguards” to guarantee the appropriate protection of the subjects’ rights and effective legal remedies (CJEU, Schrems II, 2020, July 16, paras. 91 and 92) under article 46 GDPR. In this sense, the controller or the processor may transfer personal data from the EU or EEA to a third country only in the presence of effective protection of personal data “essentially equivalent” to the GDPR.

The Court considers the role of national supervisory authorities in the protection of personal data in accordance with Article 51 (1) and 57 (1) GDPR, stating that national authorities are responsible for ensuring that the EU Regulation requirements are followed when personal data is transferred from the EU or EEA to third countries or international organizations (CJEU, Schrems II, 2020, July 16, para. 107 and case C-362/14, 2015, October 6, Schrems I, para. 47; Piroddi, 2021, p. 631; De Mozzi, 2022, p. 151). Even if the Commission has issued an adequacy decision allowing the transfer of personal data, the national supervisory authority should be able to investigate a complaint and determine whether the transferred data meets the GDPR's standards (CJEU, Schrems II, 2020, July 16, para. 120).

According to the Court, the European Commission Decision No. 2016/1250 affects the fundamental rights of people whose personal data is transferred from the European

Union to the United States because of the restrictions provided for by this decision. These restrictions are based on national security and public interest considerations as well as US domestic legislation (Commission Decision, No. 2016/1250, 2016, July 12, para. 1.5, Annex II, Recitals 67-137), and are particularly related to the access or use of personal data by US public authorities (CJEU, Schrems II, 2020, July 16, paras. 164-165). However, the Privacy Shield stipulates that restrictions are placed only where they are essential for a legitimate goal and that the subject's rights are protected (Commission Decision, No. 2016/1250, 2016, July 12, Recital 140).

The Court of Justice of the European Union argues that the communication of personal data to public authorities under US law constitutes an infringement on the fundamental rights guaranteed by Articles 7 and 8 of the Charter (CJEU, Schrems II, 2020, July 16, para. 171; De Mozzi, 2022, p. 151). On the other hand, the Court believes that the interferences with the subjects' rights are not limited to what is strictly necessary and do not respect the proportionality principle established by the European regulation (CJEU, Press release No. 91/20).

In this sense, the Court of Justice of the European Union considers that the Privacy Shield does not ensure, in the cases of interference, effective and enforceable rights to the subject whose data has been transferred (CJEU, Schrems II, 2020, July 16, paras 168 and 181) in violation of Article 47 of the Charter of Fundamental Rights of the European Union, which provides the right to an effective remedy and to a fair trial. Furthermore, because the Privacy Shield's ombudsperson is appointed by the Secretary of State, it is not an independent institution and is not a tribunal within the meaning of Article 47 of the Charter (CJEU, Schrems II, 2020, July 16, para. 168).

In conclusion, the Court found that the United States does not provide an "essentially equivalent" level of protection to that provided by the European Union under Article 45(1) GDPR, read in light of Articles 7, 8, and 47 of the Charter, which guarantee respect for private and family life, personal data protection, and the right to effective judicial protection, invalidating the adequacy decision. Accordingly, the transfer from the European Union to the United States should be based on other instruments under Chapter V of EU Regulation, such as Article 46, paragraph 2, which provides appropriate safeguards.

Following the repeal of the Privacy Shield, the European Commission adopted two sets of standard contractual agreements on June 4, 2021, to facilitate the transfer of personal data from the EU to third countries (Commission implementing decision of 4 June, Nos. 2021/914/UE and No. 2021/915/UE). These contractual clauses introduce novelty profiles concerning the number of parties that can adhere to the contract using these clauses and also provide for all the measures required to carry out the personal data transfer following the European Court of Justice's decision in the Schrems II case (De Mozzi, 2022, p. 155).

Discussions

The focus of the debate in the context of personal data transfer is on the level of protection that the third state or international organization provides for personal data. In this sense, according to the EU Regulation, the European Commission decision, which considers that the third state offers an adequate level of protection, is usually based on different elements that evaluate its adequacy. Those elements include legislation, respect for human rights and freedoms, national security, personal data protection standards, the presence of an independent data protection authority, and enforceable data protection commitments made by the country (Regulation (EU) 2016/679, Article 45, para. 2).

In this direction, in Decision Schrems II, the Court of Justice of the European Union addressed critical issues about the degree of personal data protection based on those elements. In this regard, the Court's crucial considerations are specifically connected to the communication of personal data to public authorities under US law. This communication, in the judgment of the Court, constitutes an interference with the enjoyment of the fundamental rights guaranteed by the European Charter of Fundamental Rights in Articles 7 and 8 (CJEU, Schrems II, 2020, July 16, para. 171; De Mozzi, 2022, p. 151).

But the most problematic issue regards the fact that those interferences are not limited to what is strictly necessary as provided for by the Privacy Shield, which limits the restrictions only where they are essential for a legitimate goal and that the subject's rights are protected (Commission Decision, No. 2016/1250, 2016, July 12, Recital 140). In this context, we are in front of an infringement of the proportionality principle (CJEU, Press release No. 91/20), which considers the measure applied in relation to the purpose and goal it seeks to achieve and to what is strictly necessary, and in any case, respecting the rights of the subjects. In this context, unlimited interference infringes on the rights of the subjects whose data is being transferred. On the other hand, the lack of an independent institution, such as an Ombudsman person equivalent to that provided by the GDPR, which can guarantee the rights and freedoms of individuals regarding personal data is a critical issue too, because the lack of this mechanism does not ensure the right to adequate judicial protection (CJEU, Schrems II, 2020, July 16, para. 168).

However, the Court of Justice of the European Union has ruled only on the European Commission's adequacy decision for the transfer of personal data from the EU to the US and not on the other European Commission adequacy decisions based on which personal data is transferred to other third countries, considering the fact that the legislation of those countries may formally fulfill EU criteria on fundamental rights and freedoms (See Meltzer, 2020). Consequently, we had to wait for the impact of the Court of Justice of the European Union decision in practice.

Conclusions

The issue of an "equivalent level of protection" in the third state, provided by the GDPR and subject to two decisions by the Court of Justice of the European Union, represents a problematic matter because different countries offer diverse mechanisms for the enjoyment of the right to personal data protection.

In this context, to ensure an "equivalent level of protection" to that provided by the GDPR, after the repeal of the Privacy Shield agreement, the European Union started negotiations with the United States to reach a new deal for data transfer. In March 2022, the UE and the US agreed in principle on the Trans-Atlantic Data Privacy Framework, based on which they will carry out the transfers while addressing the issues raised by the Court of Justice of the European Union with the Schrems II decision. In line with the Court decision, this mechanism provides US intelligence authorities with limited access to personal data in order to protect national security while adhering to the principle of proportionality[2]. In this context, we have to assess how the new US-EU agreement will address all of the issues highlighted by the court judgment, including the right to adequate judicial protection for the personal data of EU citizens.

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The Structural and Optical Properties of Perovskite Thin Films

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Abstract

Perovskite materials have many interesting properties such as modulation of the optical band gap and the properties of quantum wells. In addition, they have a stable structure. For these reasons, perovskites have attractive properties for optoelectronic devices. Additionally, the structural and optical properties can be changed by means of different halide atoms doped into materials. In this study, the effect of iodine on the structural, and optical properties of perovskite thin films was investigated. $KCaCl_2$ I and $KCaCl_3$ perovskite were prepared by chemical bath deposition on a glass substrate. The crystal structures of the films were determined by X-ray diffraction. X-Ray Diffraction (XRD) analysis revealed that the films had a crystalline structure. In addition, $KCaCl_2$ I perovskite thin film has better crystalline than $KCaCl_3$ perovskite thin films. Linear optical parameters were determined using transmittance and absorbance measurements. And then, the optical band gap values, extinction coefficient, refractive index, and dielectric constants were determined as linear optical properties. It was understood that these properties were affected by iodine.

Keywords: perovskite, thin films, chemical bath deposition, optical properties, structural properties.

Introduction

A perovskite structure has the form ABX_3, where A, and B are cations, and X is the anion (Wiley, et al. 2019; Korkmaz and Ozpozan-Kalaycioglu, 2012). Perovskites can have interesting a lot of properties because of the molecules in their structure (Kangning, et al. 1998). Therefore, studies on perovskite structures, in other words, perovskite thin films have increased in the last few years to improve the performance of devices such as optoelectronic devices. At end of the 19th century, perovskite

structures were formed in an aqueous solution by researchers (Mitzi, 1999; Soto-Montero, et al. 2020). However, these structures contained lead which is so dangerous for the environment (Katsanoulas, 1999). Hence, the research groups have tried to find materials that can be not dangerous to environmental and human health (Daskeviciute-Geguziene, et al. 2022).

Different deposition techniques such as ink-jet printing (Xie, 2018), co-evaporation (Park, 2019), and spin coating (Fong, 2021) have been used to form perovskite thin films.

In this work, the chemical bath deposition technique was used to obtain the perovskite thin films. The technique involves controlled precipitation of a solution of the compound on the substrate. With this technique, the structural and optical properties of the film can be changed by variables, such as solution temperature and precursor concentration. In the CBD method, a film can be formed on any substrate (Güneri, 2019). The aim of this study is to obtain $KCaCl_2I$ and $KCaCl_3$ perovskite thin films using the CBD technique. Additionally, it is to show how iodine affects the structural and optical properties of perovskite thin films.

Experimental Details

The chemicals calcium chloride ($CaCl_2$, Sigma Aldrich 99%), potassium iodide (KI, Sigma Aldrich 99%), dimethyl sulfoxide (DMSO), and dimethylformamide (DMF) were used in this study. The deposition of perovskite films was carried out using chemical bath deposition (CBD). Prior to the deposition of the thin films by CBD, the glass substrates were cleaned with detergent, deionized water, acetone, ethanol, isopropyl alcohol, and deionized water, respectively. To obtain $KCaClI_2$ perovskite thin films, $CaCl_2$, KI, DMSO, and DMF were used in the bath. First of all, the stoichiometric ratio with $CaCl_2$ and KI was separately mixed in DMSO: DMF (3:7). The solvent mixture DMSO: DMF was used to boost the morphology control. To obtain a clear and homogenous solution, these mixes were continuously blended at room temperature for 24 hours. After obtaining homogenous solutions, the solutions were poured into the beaker, where the substrate cleaned was put. The deposition temperature and time were fixed at room temperature and 48h, respectively, to fabricate the film. The chemical reaction of the composition is given as follows:

$$CaCl_2 + Kl \qquad KCaCl_2l \longrightarrow$$

To obtain $KCaCl_3$ perovskite thin films, $KCaCl_2$, KCl, DMSO, and DMF, were used in the bath. The aforementioned process was repeated for $KCaCl_2I$ perovskite thin film as well. The chemical reaction of the composition is given as follows:

$$KCl + KCaCl_2 \longrightarrow KCaCl_3$$

The phase and orientation of the films were determined by XRD using a Panalytical Empyrean Model diffractometer. SHİMADZU & UV-2700 spectrophotometer were

used to determine the optical properties of films. All measurements were made at room temperature.

Results and Discussion

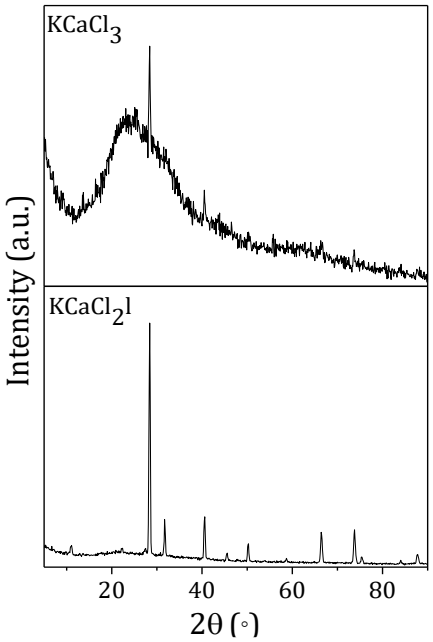


Fig. 1. XRD diffractograms pattern of $KCaCI_2I$ perovskite thin film and $KCaCI_3$ perovskite thin film.

Fig.1 shows the XRD diffractograms of $KCaCI_2I$/glass and $KCaCI_3$/glass, which have crystalline structures. The XRD diffractogram of $KCaCI_2I$ perovskite thin film has four strong diffraction peaks, which are located at the angles 2θ: 28.39°, 40.56°, 66.4639°, and 73.7692°. These peaks didn't index the other materials. In this context, the new perovskite structure was fabricated in this work. The XRD diffractogram of $KCaCI_3$ perovskite thin film has a background due to dirtiness on the glass. Furthermore, there are just two peaks in its spectrum at the angles 2θ: 28.29°, and 40.29°

Fig. 2 shows the transmission, reflection, and absorption spectra of the $KCaCI_2I$ and $KCaCI_3$ perovskite thin films. The transmission ratio of the $KCaCI_2I$ perovskite thin film was lower than that of the $KCaCI_3$ perovskite thin film despite depositing time the same. There can be a lot of reasons. One of them is deposition velocity. The deposition velocity of the $KCaCl_2I$ perovskite thin film can be faster than that of the $KCaCI_3$ perovskite thin film. When the refractive spectrum of both films was investigated, the refractive spectrum of $KCaCl_2I$ perovskite thin films is higher than that of the $KCaCI_3$ perovskite thin film (Fig. 2). The origin of this difference can be iodine. The $KCaCl_2I$ perovskite thin films have two maximum absorption peaks at 307 nm and 362 nm. These values show that there are two transmissions in the films. One of them can be

connected from the lower valence band (VB2) to the minimum conduction band (CB), and the other can be fatigued to the transition from the higher valence band (VB1) to the CB (Al-Asbahi, et al. 2020). The $KCaCI_3$ perovskite thin film absorbed most light below 350 nm.

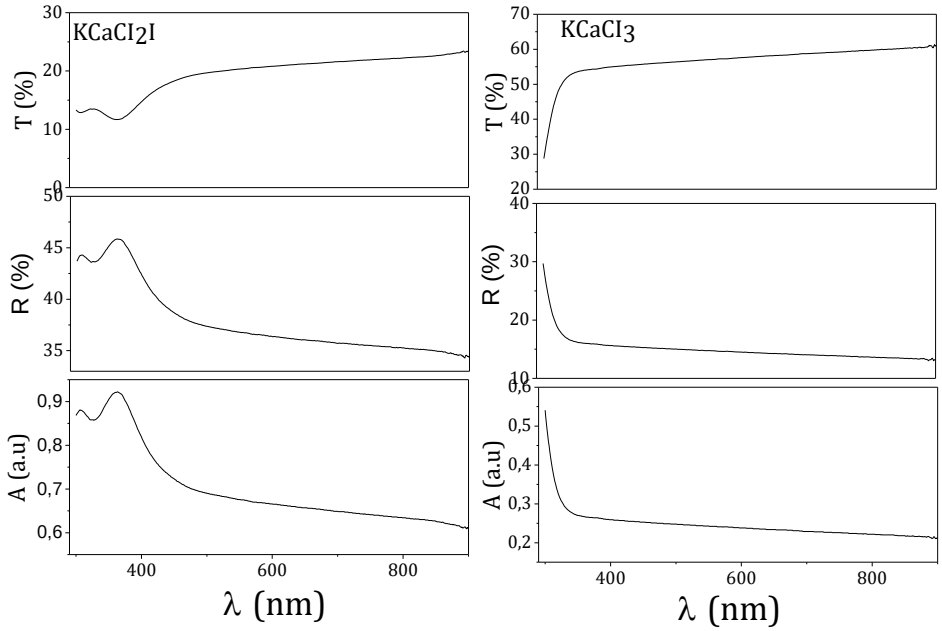


Fig. 2 The transmission, reflection, and absorption spectra of the $KCaCI_2I$ and $KCaCI_3$ perovskite thin films.

The values of the direct energy band gaps of perovskite thin films were estimated from the Tauc plot of the absorption spectrum (Tauc, 1974). As seen in Fig. 3, the band gap values of the $KCaCI_2I$ perovskite thin film are 2.45 eV (VB1 →CB) and 2.65 eV (VB2 →CB) while that of the $KCaCI_3$ perovskite thin film is 3.85 eV. These band gap values show that these films can be used as a window layer of a solar cell (Sharmin, et al. 2019).

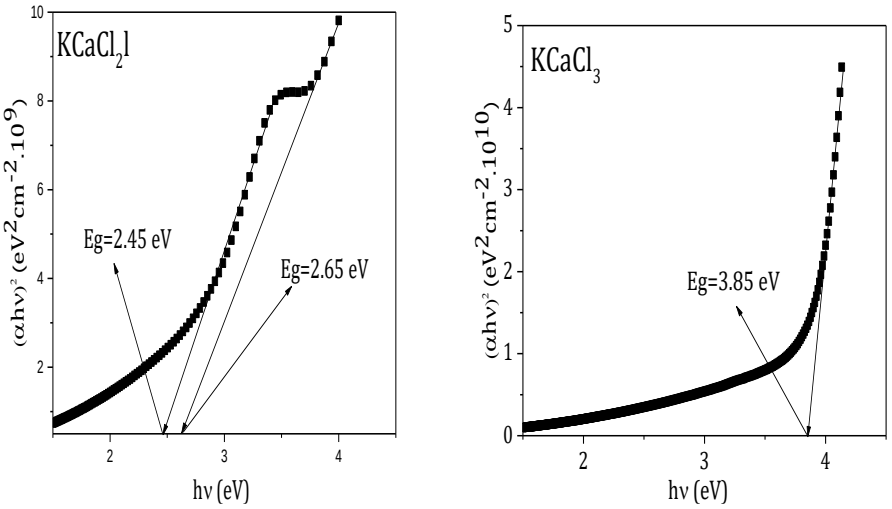
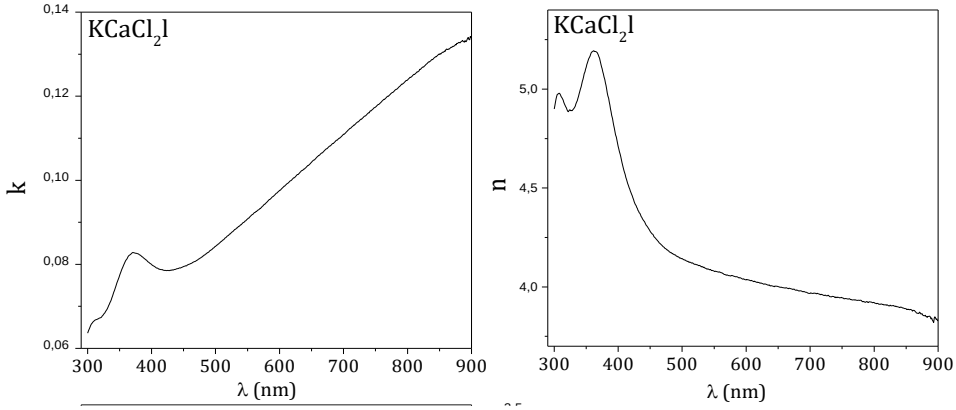


Fig. 3 $(\alpha h\nu)^2$ versus photon energy for the $KCaCI_2I$ and $KCaCI_3$ perovskite thin films.

The refractive index and extinction coefficient of the films were determined using equations (Benramdane, et al. 1997). The non-linear dependence of the refractive index (n) and extinction coefficient (k) on the wavelength at room temperature can be seen in Fig. 4. Fig. 4 shows that $KCaCI_2I$ and $KCaCI_3$ have different behavior for both parameters. The extinction coefficient of $KCaCI_2I$ perovskite thin film increased from 425 nm. The refractive index of this film has also a reverse situation after 362 nm. The extinction coefficient of $KCaCl_3$ perovskite thin films increased from 325 nm. Additionally, the refractive index of $KCaCl_3$ perovskite thin films is almost constant and approximately 2.24–2.18. These values show that this film can be used for antireflection coating (Al-Asbahi, 2020).



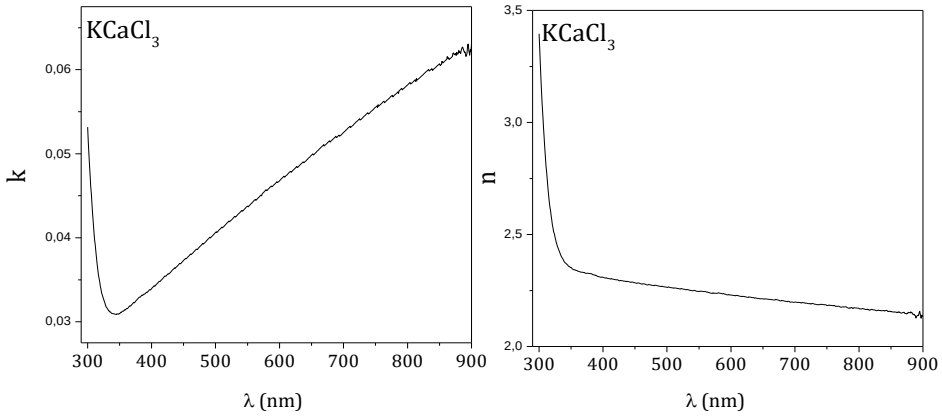
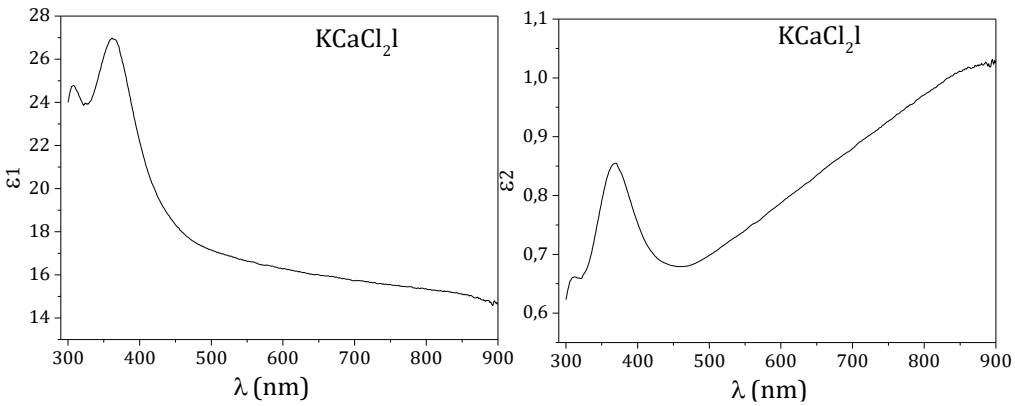


Fig. 4 The refractive index and extinction coefficient on wavelength in $KCaCI_2I$ and $KCaCI_3$ perovskite films.

The real and imaginary parts of the dielectric constant of the films were calculated using the equations (Hodgson, 1970). According to Fig. 5, while the real and imaginary parts of the dielectric constant for $KCaCI_2I$ perovskite films were found to be 16.23 and 0.78 at 600 nm, respectively, the real and imaginary parts of the dielectric constant for $KCaCI_3$ perovskite films were determined to be 4.99 and 20.21 at 600 nm, respectively.



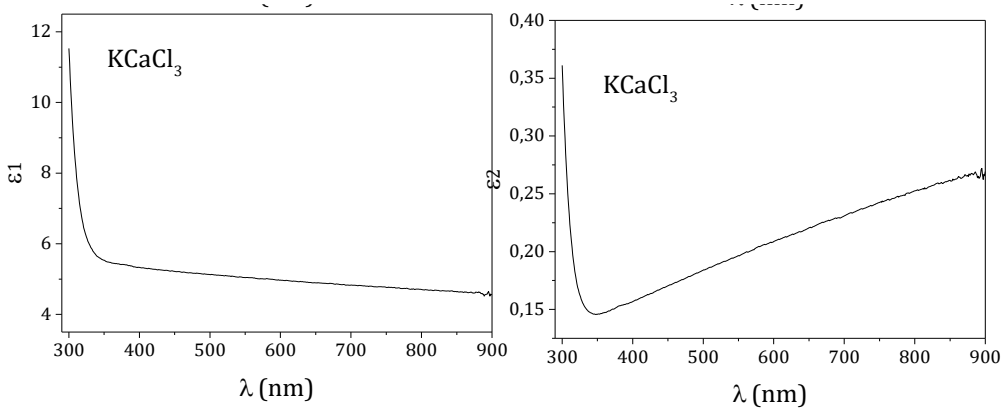


Fig. 5 The dependence of dielectric constants on wavelength in $KCaCI_2I$ and $KCaCI_3$ perovskite films.

Conclusions

In this study, we successfully obtained $KCaCI_2I$ and $KCaCI_3$ perovskite films via the CBD technique and compared the effect of iodine on the structural and optical properties of films by using characterization methods. According to XRD patterns, $KCaCI_2I$ perovskite films have better crystalline structures than $KCaCI_3$ perovskite films. The band gap values of the $KCaCI_2I$ perovskite thin film are 2.45 eV and 2.65 eV. The band gap value of the $KCaCI_3$ perovskite thin film is 3.85 eV. These band gap values show that both films can be used as a window layer of a solar cell. However, the $KCaCI_3$ perovskite thin film can be a better performance than the $KCaCI_2I$ perovskite thin film as a window layer. To understand the effect of iodine on the properties of thin films, we plan to fabricate new films which will include different perovskite. Additionally, we will try using water instead of DMF: DMFO for green chemistry. In addition to all these, obtaining new perovskites using the solid state method and their differences can be investigated.

Acknowledgments

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The New Integral Transform: "NE Transform" and Its Applications

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Abstract

This work introduces a new integral transform for functions of exponential order called “NE integral transform”. We prove some properties of NE - transform. Also, some applications of the NE- transform to find the solution to ordinary linear equation are given. The relationships of the new transform with well-known transforms are characterized by integral identities. We study the properties of this transform. Then we compare it with few exiting integral transforms in the Laplace family such as Laplace, Sumudu, Elzaki , Aboodh and etc. As well, the NE integral transform is applied and used to find the solution of linear ordinary differential equations.

Keywords: NE integral transform, Laplas transform, Natural transform , Aboodh transform , Ordinary diferencial equation .

Introduction

For many decades, the integral transforms play a precious role in solving many differential and integral equations. Using an appropriate integral transform helps to reduce differential and integral operators, from a considered domain into multiplication operators in another domain. Solving the deduced problem in the new domain, and then applying the inverse transform serve to invert the manipulated solution back to the required solution of the problem in its original domain (see, [1–13]). The classical integral transforms used in solving differential equations, integral equations, and in analysis and the theory of functions are the Laplace transform, the Fourier integral transform . Besides, in the mathematical literature, there are many Laplace-type integral transforms such as the Laplace-Carson transform which is used in the railway engineering [14], the z-transform can be applied in signal processing [15], the Sumudu transform is used in engineering and many real-life problems [10,

16, 17], the Hankel's and Weierstrass transform has been applied in heat and 1 diffusion equations [18, 19]. In addition, we have the natural transform [20–22] and Yang transform [13, 23] used in many fields of physical science and engineering.

The New Integral Transform

Definition of the transform

This work introduces a new integral transform as a generalization and unification to Laplace and other existing transforms for functions of exponential order . We begin with following: Now let A be the set of single transformable functions that is :

$$A = \left\{ f(t) | \exists M, k_1, k_2 > 0, |f(t)| \leq M \exp\left(\frac{|t|}{k_i}\right) \text{if } t \in (-1)^i x[0, \infty[\right\}$$

The real function f(t) > 0 and f(t) = 0 for t < 0 is sectionwise continuous,exponential order and defined in the set A. The Natural transform of the function f(t) > 0 and f(t) = 0 for t < 0 is defined by :

$$N\{f(t)\} = R(s,u) = \int_0^{+\infty} e^{-st} f(ut)dt \quad , s > 0, u > 0$$

Where s and u are the transform variables. An other integral transform is the Aboodh transform [19] that is derived from equation :

For the same conditions as above is derived equation :

$$A(s) = N\{f(t)\} = \frac{1}{s}\int_0^{+\infty} e^{-st} f(t)dt$$

Definition 2.1

A function f (t) is said to be of exponential order $\frac{1}{k}$, if there exist positive constants T and M such that, | f (t) |≤ $Me^{\frac{t}{k}}$ ( ), for all t ≥ T . For any function f (t), we assume that a integral equation exist.

The New integral transform is the combination of above integral transform .

For a given function in the set A, the constant M must be positiv number. A new integral transform denoted by the operator E(.) is defined by the integral equation:

$E(s,u) = N\{f(t)\} = \frac{1}{su}\int_0^{+\infty} e^{-\frac{st}{u}} f(t)dt$ (1.1) or

$E(s,u) = N\{f(t)\} = \frac{1}{s}\int_0^{+\infty} e^{-st} f(ut)dt$

. (1.1)

Theorem 1.1. *[Sufficient conditions for existence of a new integral transform]*

If f (t) is piecewise continuous on [0,∞) and of exponential order $\frac{1}{k}$, then E[f (t)] exists for $|\frac{u}{s}| < k$.

Proof. We need to show that the integral

$$E(s,u) = N\{f(t)\} = \frac{1}{su}\int_0^{+\infty} e^{-\frac{st}{u}} f(t)dt$$

converges for $|\frac{u}{s}| < k$. We begin by breaking up this integral into two separate integrals:

$$\frac{1}{su}\left[\int_0^T e^{-\frac{st}{u}} f(t)dt + \int_T^{+\infty} e^{-\frac{st}{u}} f(t)dt\right] \qquad (3)$$

where T is chosen so that definition (1.1) holds. The first integral in (3) exists because f (t) and hence $e^{-\frac{st}{u}}$ are piecewise continuous on the interval [0, T) for any fixed s. To see that the second integral in (3) converges, we use the comparison test for improper integrals. Since f (t) is of exponential order $\frac{1}{k}$, we have for t ≥ T , | f (t) |≤ $Me^{\frac{t}{k}}$ and hence:

$$\left|e^{-\frac{st}{u}} f(t)\right| = e^{-\frac{st}{u}}|f(t)| \le Me^{-t(\frac{s}{u}-\frac{1}{k})}$$

for all t ≥ T.

Now for $|\frac{u}{s}| < k$,

$$\int_T^{+\infty} Me^{-t(\frac{s}{u}-\frac{1}{k})}dt = M\int_T^{+\infty} e^{-t(\frac{s}{u}-\frac{1}{k})}dt = \frac{Me^{-T(\frac{s}{u}-\frac{1}{k})}}{\frac{s}{u}-\frac{1}{k}} < \infty$$

Since ,

$$\left|e^{-\frac{st}{u}} f(t)\right| \le Me^{-t(\frac{s}{u}-\frac{1}{k})}$$

for t ≥ T and the improper integral of the larger function converges for $|\frac{u}{s}| < k$, then by the comparison test, the integral $\int_T^{+\infty} e^{-t(\frac{s}{u}-\frac{1}{k})}dt$

converges for $|\frac{u}{s}| < k$. Finally, because the two integrals in (3) exists, a new integral transform N[f (t)] exists for $|\frac{u}{s}| < k$.

Definition 2.2

For the function E(s,u) ,if exist a function f(t) that is piecewise continuous on $[0, +\infty[$, and N(f(t))=E(s,u) , than f(t) is called the invers integral transform of E(s,u) :

$f(t) = N^{-1}(s) = N^{-1}(E\{s,u\}) = \frac{1}{2\pi i}\int_{c-\infty}^{c+\infty} e^{st}E(us)u^2 sds$ or

$$f(t) = N^{-1}(s) = N^{-1}(E\{s,u\}) = \frac{1}{2\pi i}\int_{c-\infty}^{c+\infty} e^{\frac{st}{u}}E(s)sds$$

New integral transform of some functions :

$$N\{1\} = \frac{1}{s^2}$$

$$N\{t\} = \frac{u}{s^3}$$

$$N\{e^{at}\} = \frac{1}{s(s-au)}$$

$N\{sin(at)\} = \frac{au}{s(s^2+a^2u^2)}$

$$N\{cos(at)\} = \frac{1}{(s^2+a^2u^2)}$$

Theorem 1.2. [Duality relation] Let f (t) ∈ F with Laplace transform F(s). Then a new integral transform E(s,u) of f (t) is given by:

$$E(s,u) = \frac{1}{us}F(\frac{s}{u})$$

Proof: Let f (t) ∈ F, then for $-k_1 < v < k_2$,

$$E(s,u) = \frac{1}{s^2}\int_0^{\infty} e^{-t}f(\frac{u}{s}t)$$

Let $v = \frac{u}{s}t$, then we have:

$E(s,u) = \frac{1}{s^2}\int_0^{\infty} e^{-\frac{sv}{u}}f(v)\frac{s}{u}dv = \frac{1}{us}\int_0^{\infty} e^{-\frac{sv}{u}}f(v)dv = \frac{1}{us}F(\frac{s}{u})$.

Theorem 1.3. [Fundamental properties of a new integral transform] Let E(s,u) be a new integral transform of f (t). Then:

$N\{f'(t)\} = \frac{sE(s,u)}{u} - \frac{f(0)}{su}$

$N\{f''(t)\} = \frac{s^2E(s,u)}{u^2} - \frac{f(0)}{u^2} - \frac{f'(0)}{su}$

$N\{f^n(t)\} = \frac{s^nE(s,u)}{u^n} - \frac{s^{n-2}}{u^n}f(0) - \frac{s^{n-3}}{u^{n-1}}f'(0) \ldots - \frac{f^{n-1}(0)}{su}$ (3)

$N\{t^n\} = \frac{u^n}{s^{n+2}}\Gamma(n+1)$, $\Gamma(n+1) = (n+1)!$ $(Gamma\ function)$

Proof.

1) For n = 1 and 2 in eqn (4) gives the New transform of first and second derivatives of f(t) respectively. To proceed the induction process,assuming eqn (3) true for n and prove it for n+1,using eqn (1),

$$N[f^{n+1}(t)] = N[f^{n}(t)]' = E_{n+1}(s,u) = \frac{sE_n(s,u)}{u} - \frac{f_n(o)}{us}$$
$$= \frac{s}{u}\left[\frac{s^n}{u^n}E(s,u) - \sum_{k=0}^{n-1}\frac{s^{n-(k+2)}}{u^{n-k}}f^k(0)\right] - \frac{f(0)}{us}$$
$$= \frac{s^{n+1}}{u^{n+1}}E(s,u) - \sum_{k=0}^{n}\frac{s^{n-(k+1)}}{u^{n-k+1}}f^k(0)$$

which is true for n+1 and when n = 0 and 1 in previous relation,gives eqns (1) and (2) respectively.Hence the result (3) follows.

4)

$$N[t^n] = \frac{1}{s}\int_0^\infty e^{-st}(ut)^n dt = \frac{u^n}{s}\int_0^\infty e^{-st}t^n dt = \frac{u^n}{s}\int_0^\infty e^{-v}\frac{v^n}{s^n}\frac{dv}{s} = \frac{u^n\Gamma(n+1)}{s^{n+1}}$$

Here st is replaced with v so that $t = \frac{v}{s}$ and hence ultimately the limit changed and Gamma integral is given by $\Gamma(n) = \int_0^\infty e^{-v}v^{n-1}dv$.

New Integral Transform of Integrals Equations

Consider the integration of function f(t) in set A,w.r.t ′ t ′ in the interval(0,t) as w(t) and successive integrals as $w^2(t)$ upto $w^n(t)$ which is :

$$w(t) = \int_0^t f(t)dt, \quad w^2(t) = \int_0^t\int_0^t f(t)(dt)^2 \quad , \dots , \; w^n(t) = \int_0^t \dots \int_0^t f(t)(dt)^n \quad (1.1)$$

Theorem 1.3. New transform of integrals.If $w^n(t)$ is given by (1.1) the New transform of $w^n(t)$ is :

$$N[w^n(t)] = \frac{u^n}{s^n}E(s,u)$$

Proof. From the New integral transform definition eqn (1.1)

$$N[w^n(t)] = \frac{1}{su}\int_0^{+\infty} e^{-\frac{st}{u}}w^n(t)dt = \frac{1}{su}\int_0^{+\infty} e^{-\frac{st}{u}}\left[\int_0^t \dots \int_0^t f(t)(dt)^n\right]dt$$

Applying the integration by parts

$$u = \int_0^t \dots \int_0^t f(t)(dt)^n \,, \quad u^n = f(t)dt \,,$$

$$dv = e^{-\frac{st}{u}}dt \,, \quad v = -\frac{u}{s}e^{-\frac{st}{u}} \,, v_n = (-1)^n(\frac{u}{s})^n e^{\frac{-st}{u}}$$

$$= \left[(-1)^n \left(\frac{u}{s}\right)^n e^{\frac{-st}{u}} w^n(t)\right]_0^\infty + \frac{1}{su}\int_0^\infty \left(\frac{u}{s}\right)^n e^{\frac{-st}{u}} f(t)dt$$

The first part of the previous equation vanishes and the succeeding integral gives

$$\frac{1}{su}\int_0^\infty \left(\frac{u}{s}\right)^n e^{\frac{-st}{u}} f(t)dt = \left(\frac{u}{s}\right)^n E(s,u) = N[w^n(t)]$$

which ends the proof.

Multiple Shift And Convolucion Theorem

When the function f(t) in set A is multiplied with some shift t then,

$$tf(t) = \sum_{n=0}^{\infty} a_n t^{n+1}$$

The New integral transform of tf(t) gives :

$$N[tf(t)] = \sum_{n=0}^{\infty} \frac{(n+1)!\, a_n u^{n+1}}{s^{n+3}}$$

$$= \frac{u}{s}\sum_{n=0}^{\infty} \frac{(n+1)!\, a_n u^n}{s^{n+2}} = \frac{u}{s}\sum_{n=0}^{\infty} \frac{d}{du}\frac{(n+1)!\, a_n u^{n+1}}{s^{n+2}}$$

$$= \frac{u}{s}\frac{d}{du} u \sum_{n=0}^{\infty} \frac{(n+1)!\, a_n u^n}{s^{n+2}} = \frac{u}{s}\frac{d}{du} uE(s,u).$$

The generalization of previous result is :

Theorem 1.4. The function f(t) in set A is multiplied with shift function t^n then,

$$N[t^n f(t)] = \frac{u^n}{s^n}\frac{d^n}{du^n} u^n E(s,u)$$

Proof : The New transform of Maclaurin series function $f(t) = \sum_{n=0}^{\infty} a_n t^n \in A$ is defined by the infinite series,

$$N[f(t)] = \sum_{n=0}^{\infty} \frac{n!\, a_n u^n}{s^{n+2}}$$

So that we have

$$N[t^n f(t)] = \sum_0^\infty \frac{(2n)!\, a_n u^{2n}}{s^{2n+2}} = \frac{u^n}{s^n}\sum_0^\infty \frac{(2n)!\, a_n u^n}{s^{n+2}} = \frac{u^n}{s^n}\sum_0^\infty \frac{d^n}{du^n}\frac{n!\, a_n u^{2n}}{s^{n+2}}$$

$$= \frac{u^n}{s^n}\frac{d^n}{du^n} u^n \sum_0^\infty \frac{n!\, a_n u^n}{s^{n+2}} = \frac{u^n}{s^n}\frac{d^n}{du^n} u^n E(s,u)$$

Theorem 1.5. If $f^n(t)$ is nth derivative of function f(t) w.r.t t' t' ,is multiplied with shift function t^n then,

$$N[t^n f^n(t)] = u^n \frac{d^n}{du^n} E(s,u)$$

Proof. Differentiating defining integral equation $\frac{1}{s^2}\int_0^\infty e^{-t} f(\frac{ut}{s})dt$, we have :

$$\frac{d^n}{du^n} E(s,u) = \frac{d^n}{du^n}\int_0^\infty \frac{1}{s^2} e^{-t} f\left(\frac{ut}{s}\right) dt = \int_0^\infty \frac{1}{s^2} e^{-t} \frac{\partial^n}{\partial u^n} f\left(\frac{ut}{s}\right) dt = \int_0^\infty \frac{1}{s^2} e^{-t} \left(\frac{t}{s}\right)^n f^n\left(\frac{ut}{s}\right) dt$$

$$= \frac{1}{u^n}\int_0^\infty \frac{e^{-t}}{s}\left(\frac{ut}{s}\right)^n f^n\left(\frac{ut}{s}\right) dt = \frac{1}{u^n} N[t^n f^n(t)]$$

multiplying both sides by u^n ends the proof.

Theorem 1.6. *Convolution theorem.*

If F(s,u) and G(s,u) are the New transforms of respective functions f(t) and g(t) both defined in set A then,

$N[(f * g)] = usF(s,u)G(s,u)$ (2.2)

where $f * g$ is convolution of two functions defined by

$$[(f * g)] = \int_0^t f(a)g(t-a)dt$$

Proof. Expanding the R.H.S of eqn (2.2)

$usF(s,u)G(s,u) =$
$\frac{us}{s}\int_0^\infty e^{-sx} f(ux)dx \frac{1}{s}\int_0^\infty e^{-sy} g(uy)dy = \frac{u}{s}\int_0^\infty e^{-s(x+y)} \int_0^\infty f(ux)g(uy)dxdy$

substituting t = x+y

$$= \frac{1}{s}\int_0^\infty e^{-st} \int_0^\infty f(ux)g\big(u(t-x)\big)udxdy$$

setting a = ux and da = udx with ux in [0,ut] and x is in [0,t] thus

$$= \frac{1}{s}\int_0^{\infty} e^{-st}\int_0^{t} f(ux)g\big(u(t-x)\big)d(ux)dt = \frac{1}{s}\int_0^{\infty} e^{-st}\int_0^{ut} f(a)g(ut-a)dadt = N[f*g]$$

The New Decomposition Method

In this section, we illustrate the applicability of the New Decomposition Method to some nonlinear ordinary differential equations.

Consider the general nonlinear ordinary differential equation of the form:

$Lv + R(v) + F(v) = g(t)$, (4.1)

subject to the initial condition $v(0) = h(t)$, (4.2)

where L is an operator of the highest derivative, R is the remainder of the differential operator, g(t) is the nonhomogeneous term and F(v) is the nonlinear term. Suppose L is a differential operator of the first order, then by taking the New Transform of Eq. (4.1), we have:

$$\frac{sE(s,u)}{u} - \frac{V(0)}{us} + N[R(v)] + N[F(v)] = N[g(t)] \quad (4.3)$$

By substituting Eq. (4.2) into Eq. (4.3), we obtain:

$$E(s,u) = \frac{h(t)}{s^2} + \frac{u}{s}N[g(t)] - \frac{u}{s}N[R(v)] - \frac{u}{s}N[F(v)] \quad (4.4)$$

Taking the inverse of the New Transform of Eq. (4.4), we have:

$$v(t) = G(t) - N^{-1}\left[\frac{u}{s}N[R(v) + F(v)]\right] \quad (4.5)$$

where G(t) is the source term.

We now assume an infinite series solution of the unknown function v(t) of the form:

$$v(t) = \sum_{n=0}^{\infty} v_n(t) \quad (4.6)$$

Then by using Eq. (4.6), we can re-write Eq. (4.5) in the form:

$$\sum_{n=0}^{\infty} v_n(t) = G(t) - N^{-1}\left[\frac{u}{s}N\left[R\sum_{n=0}^{\infty} v_n(t) + \sum_{n=0}^{\infty} A_n(t)\right]\right] \quad (4.7)$$

where $A_n(t)$ is an Adomian polynomial which represent the nonlinear term. Comparing both sides of Eq. (4.7), we can easily build the recursive relation as follows:

$$v_0(t) = G(t)$$

$$v_1(t) = -N^{-1}\left[\frac{u}{s}N\left[R\left(v_0(t)\right) + A_0(v)\right]\right]$$

$$v_2(t) = -N^{-1}\left[\frac{u}{s}N\left[R\left(v_1(t)\right) + A_1(v)\right]\right]$$

$$v_3(t) = -N^{-1}\left[\frac{u}{s}N\left[R\left(v_2(t)\right) + A_2(v)\right]\right]$$

Eventually, we have the general recursive relation as follows:

$$v_{n+1}(t) = -N^{-1}\left[\frac{u}{s}N\left[R\left(v_n(t)\right) + A_n(v)\right]\right] \qquad n \geq 0 \quad (4.8)$$

Hence, the exact or approximate solution is given by:

$v(t) = \sum_{n=0}^{\infty} v_n(t)$ (4.9)

Applications to Find the Solution of Linear Ordinary Equations

Example 1 :

Consider the Riccati differential equation of the form :

$\frac{dv}{dt} = 1 - t^2 + v^2(t)$ (5.1)

subject to the initial condition $v(0) = 0$. (5.2)

Taking the New Transform to both sides of Eq. (5.1), we obtain:

$\frac{sE(s,u)}{u} - \frac{v(0)}{us} = \frac{1}{s^2} - \frac{2u^2}{s^4} + N[v^2(t)]$ (5.3)

By substituting Eq. (5.2) into Eq. (5.3), we obtain:

$$v(s,u) = \frac{u}{s^3} - \frac{2u^3}{s^5} + \frac{u}{s}N[v^2(t)] \qquad (5.4)$$

Taking the inverse New Transform of Eq. (5.4), we have:

$$v(t) = t - \frac{t^3}{3} + \frac{u}{s}N[v^2(t)] \qquad (5.5)$$

We now assume an infinite series solution of the unknown function v(t) of the form:

$$v(t) = \sum_{n=0}^{\infty} v_n(t) \qquad (5.6)$$

Then by using Eq. (5.6), we can re-write Eq. (5.5) in the form:

$\sum_{n=0}^{\infty} v_n(t) = t - \frac{t^3}{3} + N^{-1}\left[\frac{u}{s}N[\sum_{n=0}^{\infty} A_n(t)]\right]$ (5.7)

where A_n is the Adomian polynomial which represent the nonlinear term $v^2(t)$. By comparing both sides of Eq. (5.7), we can easily build the general recursive relation as follows:

$$v_0(t) = t - \frac{t^3}{3}$$

$$v_1(t) = N^{-1}[\frac{u}{s}N[A_0(t)]]$$

$$v_2 = N^{-1}[\frac{u}{s}N[A_1(t)]]$$

Then the general recursive relation is given by:

$$v_{n+1}(t) = N^{-1}[\frac{u}{s}N[A_n(t)]]. \quad (5.8)$$

By using Eq. (5.8), we can easily compute the remaining components of the unknown function v(t) as follows:

$$v_1(t) = N^{-1}\left[\frac{u}{s}N[A_0(t)]\right]$$

$$= N^{-1}[\frac{u}{s}N[v_0^2(t)]]$$

$$= N^{-1}[\frac{u}{s}N[((t - \frac{t^3}{3})^2)]]$$

$$= N^{-1}[\frac{u}{s}N[t^2]] - \frac{2}{3}N^{-1}\left[\frac{u}{s}N[t^4]\right] + \frac{1}{9}N^{-1}[\frac{u}{s}N[t^6]]$$

$$= N^{-1}\left[\frac{2u^3}{s^4}\right] - \frac{2}{3}N^{-1}\left[\frac{4!\,u^5}{s^6}\right] + \frac{1}{9}N^{-1}[\frac{6!\,u^7}{s^8}]$$

$$= \frac{t^3}{3} - \frac{2t^5}{15} + \frac{t^7}{63}$$

Then by canceling the noise term from $v_0(t)$, the remaining non-canceled term of $v_0(t)$ provide us with the exact solution. This can easily be verified by substitution.

Therefore, the exact solution of the given problem is given by:

$v(t) = t.$ (5.9)

The exact solution is in closed agreement with the result obtained by (ADM).

Example 2 :

The following examples illustrate the use of a new integral transform in solving

certain initial value problems described by ordinary differential equations.

Consider the first-order ordinary differential equation:

$$y'(t) + by(t) = h(t), \qquad t > 0, \;\; y(0) = a \quad (1)$$

where a and b are constants and h(t) is an external input function so that its a new integral transform exists.

Using a new integral transform of equation (1) we have:

$$\frac{sE(s,u)}{u} - \frac{y(0)}{us} + bE(s,u) = H(s,u)$$

where that E(s,u) and H(s,u) are a new integral transforms of y(t) and h(t).

By applying the initial condition we have:

$$E(s,u)\left[\frac{s}{u} - b\right] = H(s,u) + \frac{a}{us}$$

$$= \frac{u(usH(s,u) + a)}{us(s - bu)}$$

$$\Longrightarrow E(s,u) = a\left[\frac{1}{s(s-bu)}\right] + us\left[\frac{H(s,u)}{s(s-bu)}\right]$$

By the inverse of a new integral transform and convolution theorem we find that:

$$y(t) = ae^{-bt} + \int_0^{\tau} e^{-bt}h(t-\tau)d\tau \qquad (2)$$

The first term of this solution in (2) is independent of time t and is usually called the steady-state solution, and the second term depends on time t and is called the transient solution. In the limit as $t \to \infty$ the transient solution decays to zero if $b > 0$ the steady-state solution is attained, on the other hand, when $b < 0$, the transient solution grows exponentially as $t \to \infty$ and the solution becomes unstable. Equation (2) describes the Law of natural growth or decay Process with an external forcing function h(t) according as $b > 0$ or $b < 0$. In particular, if $h(t) = 0$ and $b > 0$ the resulting equation (2) occurs very frequently in chemical kinetics. Such an equation describes the rate of chemical reactions.

Conclusion

In the present paper, authors successfully introduced a new integral transform "NE transform" and analyzed the novel integral transform. . Authors also presented the fundamental properties (linearity; scaling; translation; convolution) of the proposed transform with its inverse transform. The definition and applications of the novel transform to solve ordinary differential equations have been demonstrated . In future, "NE integral transform" can be considered to solve various complex problems of science, medicine and engineering by developing their mathematical models, also we

will introduce the complex transform and a double" NE integral transform ".

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Digital Generation - Analysis of the Use of ICT by Young Poles

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Abstract

In the Europe 2020 strategy in area of smart growth one of the flagship initiatives is Digital Agenda for Europe. Implementation of this initiative will lead to wide-availability of ICT solutions to society. Young people belonging to Generation Y most often treat the computer as a natural household equipment. Regular use of the Internet is very popular among them. They increasingly use mobile solutions in the field of ICT. The intelligent use of information technology possibilities will lead to sustainable economic growth. The purpose of the study was to cheque changes in the use of ICT among young Poles, and whether related behavioural patterns are similar in other countries of the European Union. The paper concludes with main reasons differencing generations in Poland due to the using the Internet.

Keywords: digital society, ICT, generations Y, X, BB, digital divide

Introduction

In 2010, were determined actions to smart, sustainable and inclusive growth of the economy and society of the European Union. It was Europe 2020 strategy. Each of the three assigned objectives are highlighted by a number of priorities, the implementation of which is constantly checked with use of selected indicators. "Smart growth means … making full use of information and communication technologies and ensuring that innovative ideas can be turned into new products and services that create growth, quality jobs and help address European and global societal challenges" (European Commission, 2010b, p. 11).

The process of smart growth based on social inclusion is very difficult to achieve considering the very different levels of economic development in the EU member states. For example the use of Information and Communication Technologies (ICT) differs in many countries (European Commission 2010a, p. 9). In addition, in the Member States there are differences in the skills of handling and use of ICT by younger and older residents, at work and private life (in European Commission (2010a, p. 10) can be found that "age and education are the two main factors influencing the way people use internet services"). In a dynamic economy based on modern technologies,

limiting access to ICT is the cause of the digital divide, which results in social exclusion (Wykluczenie cyfrowe ..., 2010).

The aim of the study was to find if the purposes of Europe 2020 strategy are fulfil in Poland and to find differences of use of ICT between adult generations in Poland.

Europe 2020 strategy - smart growth

"EU flagship initiative "A digital agenda for Europe" to speed up the roll-out of high-speed internet and reap the benefits of a digital single market for households and firms" (European Commission 2010b, p. 33). Limitation of the availability of ICT can lead to social exclusion, particularly the digital divide.

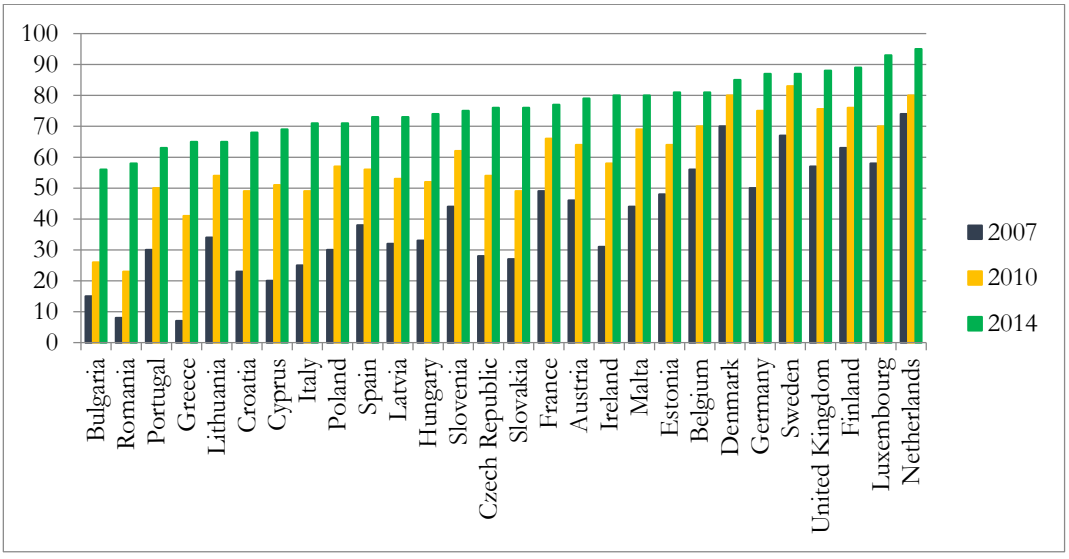
In Wykluczenie cyfrowe (2010) can be found several definitions of the digital divide:

- division of society to having access to ICTs and those who do not have access;
- division due to the possibility of obtaining access to a computer and the Internet and skills of use these technologies in private life and at work;
- complex, global division of individuals, households, countries, regions, businesses, taking into account access, skills and use of ICT.

As seen above division of social exclusion can lead to many difficulties in job search and social acceptance, and in extreme cases to discrimination of individuals.

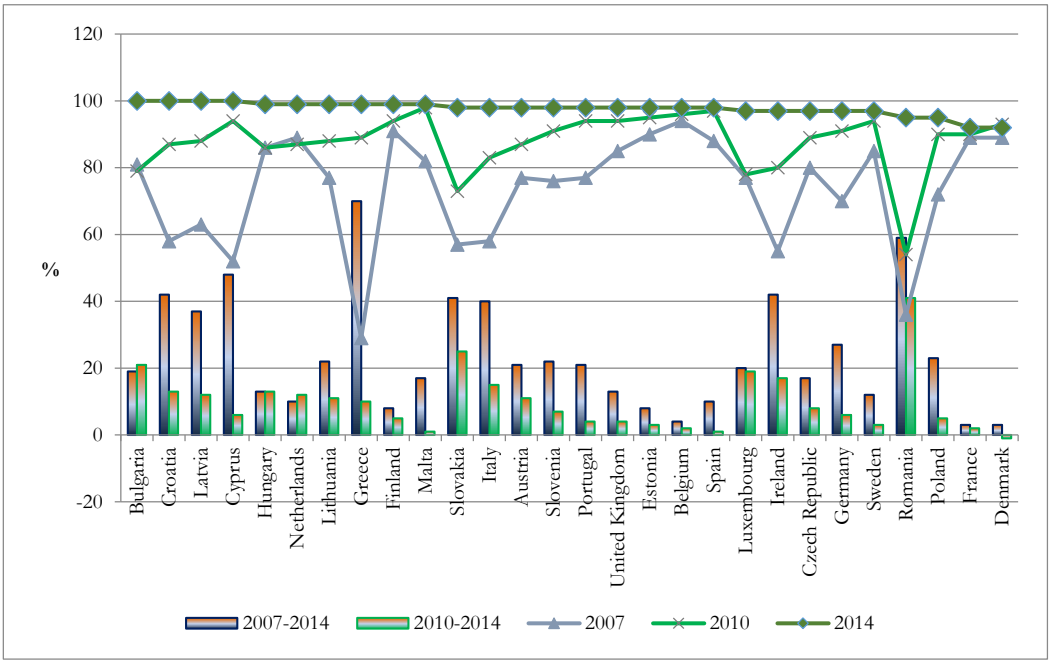
Information society in Poland in 2010 was rated significantly worse than in most member states of the EU (Figure 1). This situation has changed in 2014 years.

Fig 1: Percentage of households with broadband Internet connection



Source: Own elabration on EUROSTAT data (isoc_pibi_hba).

Fig 2: Percentage of households with broadband Internet connection at home[3]



Source: Own elabration on EUROSTAT data (isoc_pibi_hba).

Figure 1 shows the changing number of households with access to broadband Internet. In Poland in 2007, such access was available in 30% of households (20th place among the current 28 Member States of the EU), in 2010 - 57% (ranked 15th), in 2014 -71% of households (20th place). Since 2007 until 2014 the percentage of households with access to a broad band Internet increased by 41 percentage points. This is the 11th result of EU Member States.

The situation is better given access at home of households to broadband Internet (Figure 2). Since 2007 up to 2010 the percentage of households with broadband Internet access increased by 23 percentage points, from 72% in 2007 to 90% in 2010 and then 95% in 2014). By 2014, four countries have 100% of households access to broadband Internet at home, households from six countries have access in 99%, 98% of households in 9 countries, from 5 countries 97% of households, from 2 countries 95% of households (including Poland), from 2 countries 92% of households have broadband Internet access at home. In 2007 the lowest access at home of households to broadband Internet were observed in Greece and in Romania. Both of these

[3] With bar chart are shown increases of access at home of households to broadband Internet (2007-2014 and 2010-2014), with lines are shown Percentages of households with broadband Internet connection at home in 2007, 2010, 2014.

countries made great progress in access to the Internet. In 2014 in Greece 99% of households have access at home to broadband Internet, and in Romania - 95%.

The latest report on the implementation of new Digital Economy and Society Index - DESI (European Commision 2014) shows compressed information about Internet skills, the use of online activities, digital technologies and digital public services. Table 1 and Figure 3 shows ranks[4] calculated of three indices: DESI, percentage of households in 2014 with access at home to broadband Internet (R2014), increase since 2007 to 2014 of access of households with access at home to broadband Internet (R2007-2014). The pair correlations were measured with use of Spearman Index.

Figure 3 presents the rank allocated in three variables for each country. Poland is ordered in the far position for DESI and R2014, but for R2007-2014 Poland is ranked much better. This means that across five main dimensions (Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services) the Poles are a lot worse evaluated in comparison to people in most other Member States of EU. In 95% of Polish households at home have access to broadband Internet, it is only the result lower of 4 percentage points than the best countries, but it shows that in this matter in Poland there is still need for further development. The last indicator R2007-2014, shows a large increase in the number of Polish households having access at home to broadband Internet. Figure 4 presents the correlations between analyzed variables. Highest relationship is found between DESI and R2007-2014. The correlation is inversely proportional. This means that an increase in access to broadband Internet not directly cause an increase, but a decrease in its ability to operate and use. An analogous conclusion can be found in Krajowy Program Reform (2014). There is indicated the need to "improve the quality of education, . . . , make full use of ICT, as well as ensuring that the innovative ideas can be turned into new products and services that contribute to the increasing economic growth, creating new work places and solving social problems" (Krajowy Program Reform 2014, p. 22).

Since the widely used characteristic of Gen Y is constant and natural use of ICT in everyday life and work, so it becomes increasingly important question if there are significant differences in the use of the Internet and other modern technologies for Generation Y and Generation X, Baby Boomers (BB). Combes (2009, p. 31) writes that because " they have never known a world without the Internet and technological change", so their skills in use of technology are almost intuitive. Therefore, the chapter 3 presents an analysis of the use of the Internet in Poland.

[4] The indices were ranked after ordering values from best to worst. The indices were ranked after ordering values from best to worst. After ordering the indices from best to worst ranked. Rank 1 represents the best country, rank 28 - the worst. In the case of variable R2014 occurs many countries with identical values of the indices. In this situation were used linked ranks.

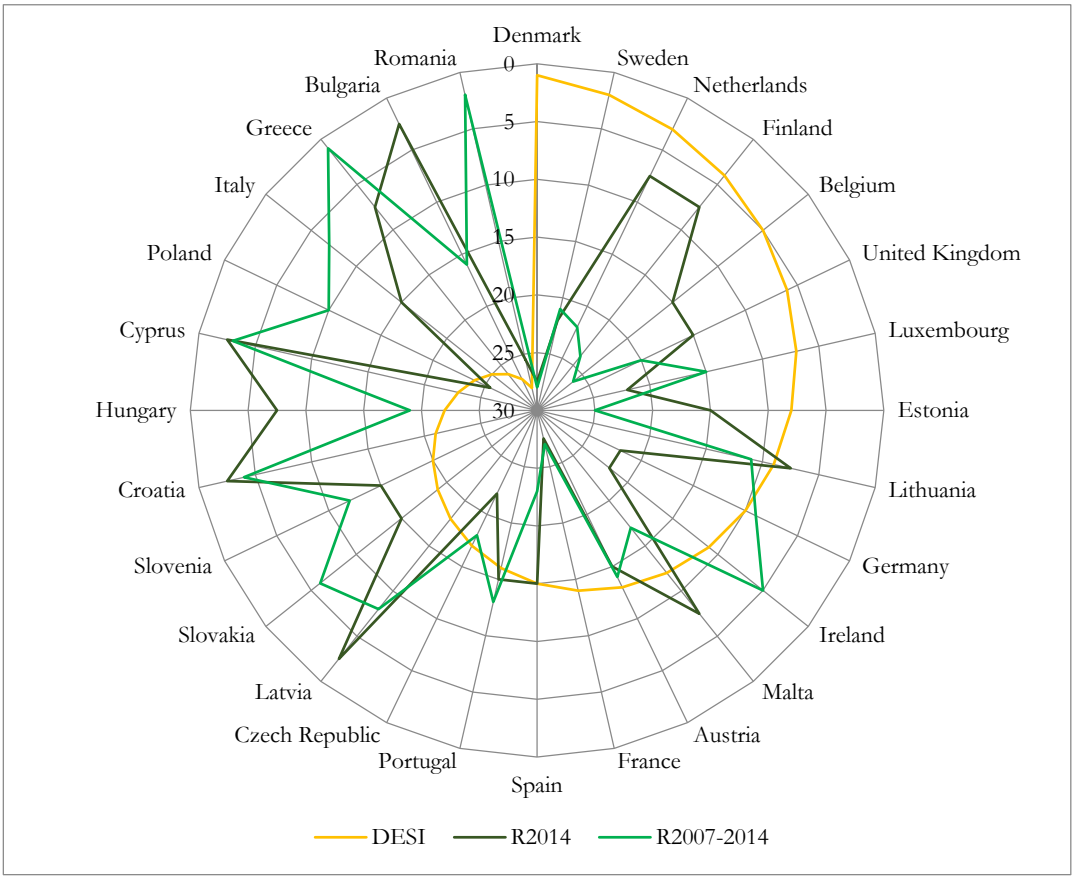
Table1. Ranks of three indexes: DESI, R2014, R2007-2014

Country	DESI	R2014	R2007-2014
Austria	13	15	14
Belgium	5	15	26
Bulgaria	27	2,5	16
Croatia	24	2,5	4
Cyprus	22	2,5	3
Czech Republic	17	22	18
Denmark	1	27,5	27
Estonia	12	15	25
Finland	4	7,5	24
France	14	27,5	27
Germany	10	22	9
Greece	26	7,5	1
Hungary	20	7,5	19
Ireland	9	22	5
Italy	25	15	7
Latvia	18	2,5	8
Lithuania	11	7,5	11
Luxembourg	8	22	15
Malta	15	7,5	17
Netherlands	3	7,5	22
Poland	23	25,5	10
Portugal	16	15	13
Romania	28	25,5	2
Slovakia	21	15	6

Slovenia	19	15	12
Spain	7	15	23
Sweden	2	22	21
UK	6	15	20

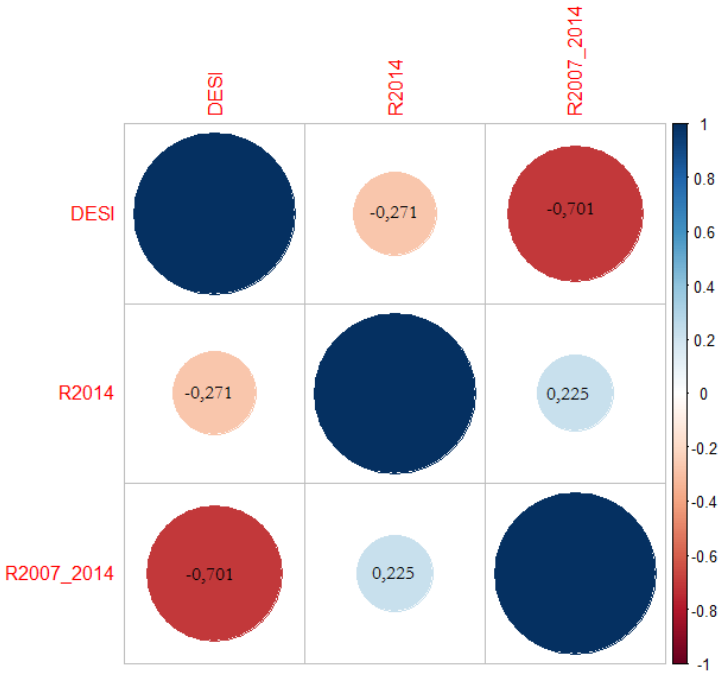
Source: Own elaboration on EUROSTAT data (isoc_pibi_hba) and European Commission (2014).

Fig 3: Ranks of three indices: DESI, R2014, R2007-2014



Source: Source: Own elaboration on EUROSTAT data (isoc_pibi_hba) and European Commission (2014).

Fig 4: Correlations between ranks of three indexes: DESI, R2014, R2007-2014



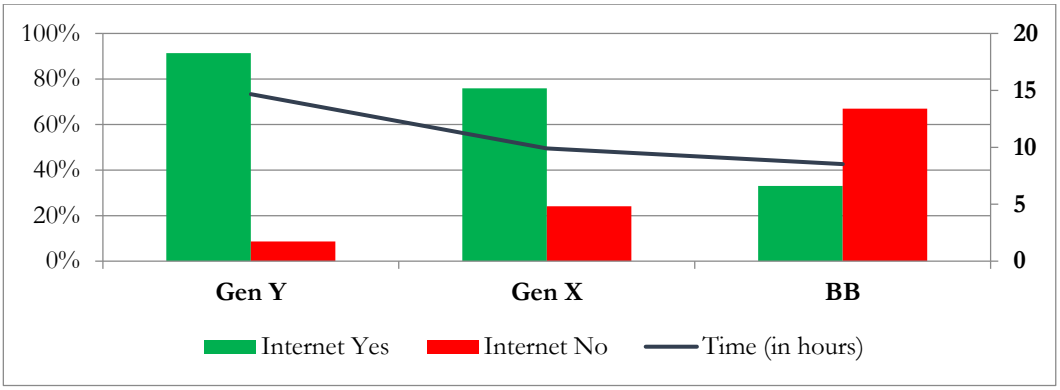
Source: Source: Own elaboration on EUROSTAT data (isoc_pibi_hba) and European Commission (2014).

Use of the Internet – differences between Generations Y, X and BB

Use of the Internet by the Poles were checked on the basis of data from the Diagnoza Społeczna 2013 (ang. Social Diagnosis [Rada Monitoringu Społecznego, 2013]). Analysed age groups were as follow: Gen Y (aged 18-33), Gen X (aged 34-48), BB generation (age 49-67). Firstly, from the respondents were taken only Internet users, because subsequently was checked for what purpose they use the Internet[5]. Figure 1 presents rate of Internet users of three generations and average time spend on the Internet in last week (last week before date of interview). 91% of Gen Y were Internet users and spent in 2013 almost 15 hours per week on the Internet. Among Generation X the rate of Internet users is lower – 76% (10 hours per week spent on Internet). The rate for BB Generation is the lowest. Only 33% used the Internet, but the time spent on the Internet was almost the same as for Gen X - 9 hours per week.

[5] Literal questions: Do you use a computer? and Do you use the Internet?

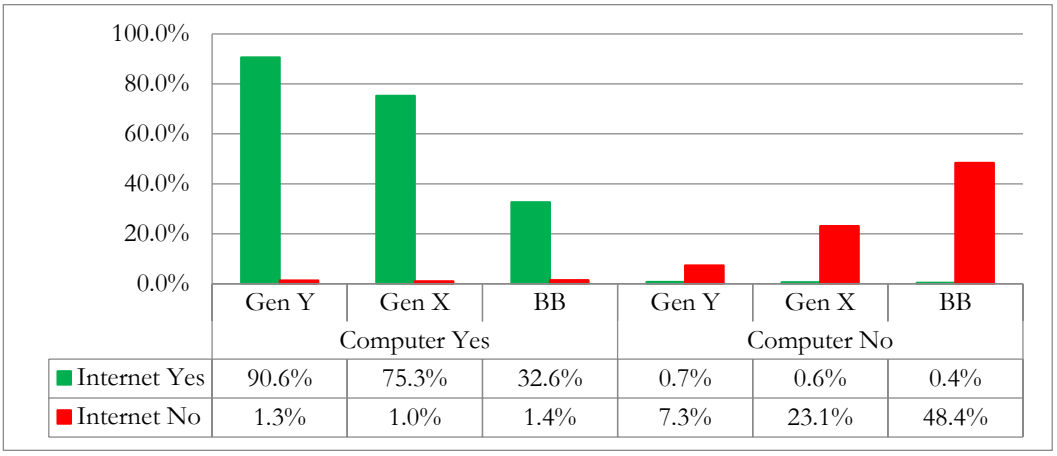
Fig 5: Rate of Internet users and average time on Internet in last week (in hours) in 2013



Source: Own elaboration on Diagnoza Społeczna [Rada Monitoringu Społecznego, 2013].

Figure 6 show the rate of computer and Internet user. Rates of persons who didn't used computer are lower than for users. Some of persons who used computers in 2013 didn't used the Internet: 1,3% of Gen Y, 1% of Gen X, 1,4% of BB.

Fig 6: Rate of computer and Internet users in 2013



	Computer Yes			Computer No		
	Gen Y	Gen X	BB	Gen Y	Gen X	BB
Internet Yes	90.6%	75.3%	32.6%	0.7%	0.6%	0.4%
Internet No	1.3%	1.0%	1.4%	7.3%	23.1%	48.4%

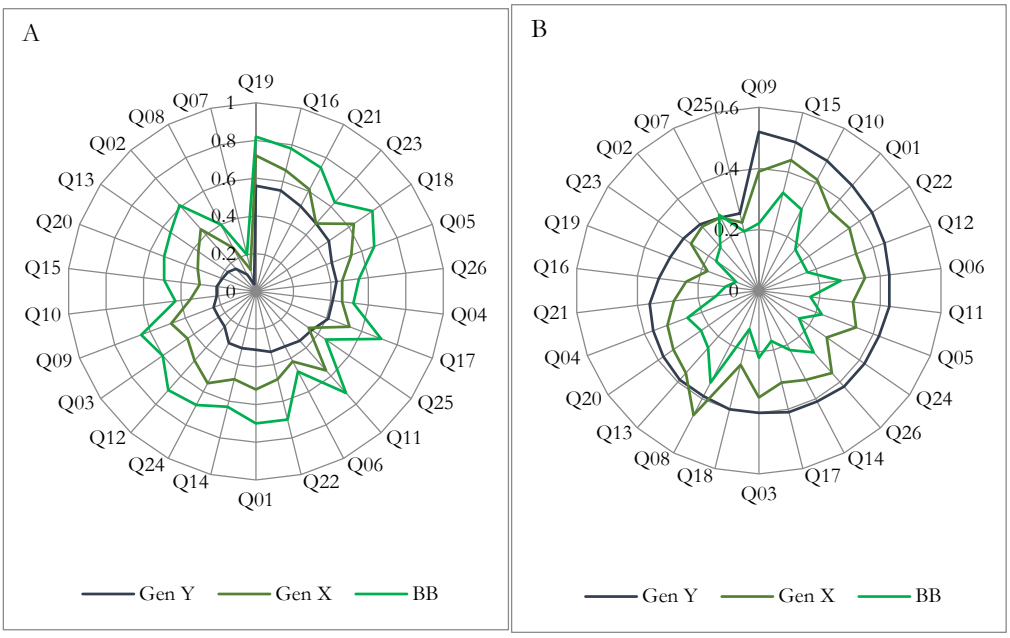
Source: Own elaboration on Diagnoza Społeczna [Rada Monitoringu Społecznego, 2013].

Next analysis was conducted for reasons to use the Internet and frequency of use of the Internet for all reason.

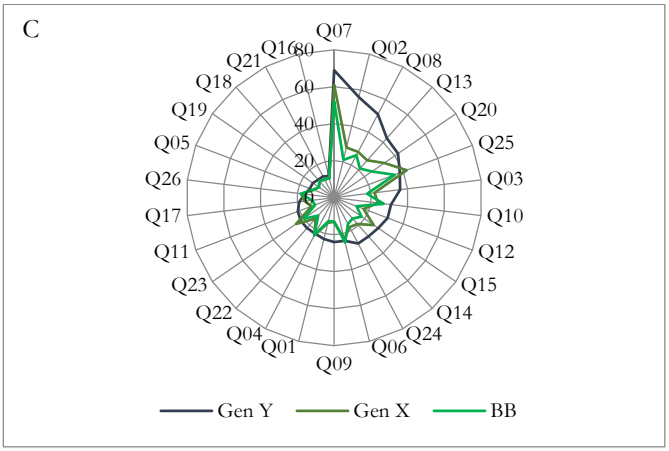
Analysed reasons were grouped in 10 subjects:

- social networking (Q1 participating in discussion groups or forums; Q2 Facebook; Q3 social network);
- searches (Q4 obtaining information from websites of public institutions, Q5 ticket reservation);
- reading (Q6 reading newspapers or books on the Internet);
- communication (Q7 e-mail, Q8 the use of instant messaging, Q9 chats, Q10 phone calls (VoIP, Skype));
- multimedia sites (Q11 free software downloading, Q12 free music and movies downloading, Q13 listening to music or the radio, Q14 watching TV)
- shopping (Q15 purchases of products and services in Poland, Q16 purchase products and services from abroad, Q17 participating in online auctions);
- own creativity (Q18 creating or modifying a web pages, Q19 creating or modifying own texts (eg. a blog, twitter), graphics, music or others);
- learning and working (Q20 collection of materials needed for study or work, Q21 participation in courses or trainings, Q22 job search, sending offers for employment , Q23 home use of the Internet and e-mail for professional purposes);
- online games (Q24 online games);
- official matters (Q25 Internet banking, Q26 downloading or filling official forms).

Fig 7: The reasons for using the internet (A – never; B – ever, C – last week[6])



[6] Last week before date of interview in 2013.



Source: Own elaboration on Diagnoza Społeczna [Rada Monitoringu Społecznego, 2013].

Between *never users* (Figure 7A) from three analysed generations were large differences in 2013. The category *I never use the Internet for refered reasons* was most popular for BB generation in 2013. More than 60% of Gen Y never used in 2013 the Internet for buying products and services from abroad (Q16), creating or modifying own texts (eg. a blog, twitter), graphics, music or others (Q19) and participating in courses or trainings (Q21). Most people of ever used the Internet in 2013 (Figure 7B) belongs to the generation Y followed Gen X, and the lower number of persons ever used the Internet was from BB generation. The highest level of the internet use was for buying products and services in Poland (Q15) for all generations. Many people from Gen Y ever used the Internet in order to chats (Q9). Gen X used ever the Internet for instant messaging (Q8), like BB generation.

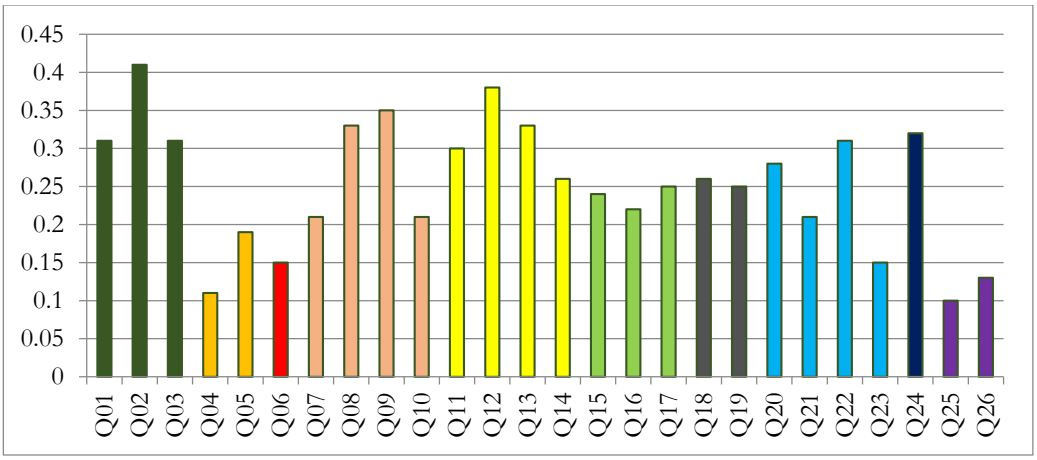
In Figure 7C last week means a few days prior to the interview in 2013. In all age groups in last week very popular reason for using the Internet was communication via e-mail. Almost the same rates of all generations of Internet users in 2013 used the Internet for Internet banking (Q25), reading newspapers or books (Q6), obtaining information from websites of public institutions (Q4), downloading or filling official forms (Q26). The lowest percentage of people in each age group indicated the use of the Internet to ticket reservation (Q5), own creativity (Q19 and Q18), participating in courses or trainings (Q21), buying products and services from abroad (Q16).

Parment (2013, p. 39) wrotes that "Die Generation Y ist daran gewohnt, das Internet als Informationsquelle und Wissensbasis zu nutzen" (Generation Y is accustomed to use the Internet as a source of information and knowledge base). In Poland in 2013 use of the Internet for information searching was quite different: 40% of Gen Y declared that never used the Internet for obtaining information from websites of

public institutions (Q4), 37% used ever the Internet for Q4 reason and only 22% used the Internet for searching information in last week.

In Figure 8 are shown values of Phi correlation coefficient between generations and reasons for using the Internet. The most influencing reasons differencing generations was in 2013 Q2, i. e. using the Internet for connecting with Facebook. Next, very important reasons for using the Internet which differ among generations were free music and movies downloading (Q12), the use of instant messaging (Q8), chats (Q9), online games (Q24).

Fig 8: Phi coefficient of generations versus reasons for using the Internet



Source: Own elaboration on Diagnoza Społeczna [Rada Monitoringu Społecznego, 2013].

Conclusions

The conducted analysis showed that between EU countries are differences in the use of the Internet. During the analysis of the behavior of Poles using the Internet also were indicated differences that reflect the generational change.

Poland has one of the highest indexes of increase since 2007 to 2014 of households with access at home to broadband Internet R2007-2014 and the lowest index of DESI. As Punie, Zinnbauer and Cabrera (2008. p. 7) wrote that between Member States in 2006 were "three clusters of countries: A cluster of “high performing countries” …; A cluster of “average performing countries”…, A cluster of so-called “delayed countries” …". This statement was made for educational system, but may be that the situation in education in 2006 influencing the situation in use of new digital technologies in 2014. In explanation of DESI indices for 2014 may be find the same information about countries and digital society in EU: "According to their performance, countries were grouped in high, medium and low performance clusters" (Digital Agenda, 2015) – Poland is in the last group.

Analysis of reasons for using the Internet (in last week) among constantly Internet users pointed out that there is no generational differences in the use of the Internet to Internet banking (Q25), reading newspapers or books on the Internet (Q6), obtaining information from websites of public Institutions (Q4), downloading or filling official forms (Q26). The biggest differences are in the use of Facebook (Q2), instant messaging (Q8), listening to music or the radio (Q13) – the young Poles use for these purposes the Internet more frequently than older.

The least frequent reason given for not using the Internet is email (Q7). Other causes are arranged in order of priority in the same way for all generations. The share of people never using the Internet for the specified purposes is the highest among BB generation.

The most differentiating generations reasons for using the Internet is a social networking (especially use of Facebook), communication (specially chats), multimedia sites (the most free music and movies downloading). Between generations in Poland there is no difference due to the following reasons for the use of Internet: searches, reading and official matters.

Acknowledgements

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The Three Dimensional Spiral of Sense: A New Paradigm Systemic Applied a Six Areas Disciplinares and Two Axis: Identity and Professionalization

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Abstract

This article introduces a new systemic theory called "The Three Dimensional Spiral of Sense", applied to Identity and Professionalization. The epistemological mainstays of the theory are stressed here, a theory supported by more than 30 years of empirical research at CONICET (National Council of Scientific Research, Argentina), with individuals belonging to different populations, some of them covering periods of over 20 years (intra-generational studies), and others covering three generations in-line (inter-generational studies). This article presents the most specific theoretical frameworks, and it formulates the six disciplinary areas in which the new analysis of the social data was carried out: Education, Health, Science, Media, International Relations and Interculturality. The first area – Education – is dealt with through different levels (secondary level, tertiary level, University and PhD training. Here, we only make reference to the studies carried out, returning to some epistemological issues in this theory. The methodology used was quantitative (statistical analysis, a semi-structured survey) but mainly qualitative (hierarchical evocations, interviews). The approach was macro-micro-meso-macro, micro, not quite common yet. It consists of a kind of sui generis systemism which recovers relationships (links, back and forth) between individuals and contexts, without overlooking neither the former nor the latter, thus, avoiding any type of reductionism. Individuals, organizations and frameworks interplay and feedback themselves. The results, particularly the qualitative ones, show the rich interactions underlying the continuance or innovation processes, which favor or hinder the individuals' development and identity in times of abrupt change; at the same time, these results reveal the need for Professionalization in emerging countries.

Keywords: Systemic *Sui Generis* Paradigm, the Theory of the Three-Dimensional Spiral of Sense, Identity, Professionalization

Introduction: Epistemological Support

This theory or, if someone prefers, pre-theory is the result or synthesis of the principal research works done within the CONICET (National Council of Scientific Research) and since 1995 the Argentine Ministry of Education, Science and Technology.

The research was developed since 1995 along the lines of Social, Labor and Organizational Psychology, and its core issue was Achievement at University and at Work, and their mutual sustained interaction. My interest grew stronger, particularly in relation with the analysis of the impact (explanatory/quantitative level) and comprehension (qualitative level) of the psychosocial factors on achievement within the context of the international patterns related to Quality Assessment at University in its connection with the scientific and productive systems (for a case reference, see Aparicio, 2014 b). The quality criterion leading us was pertinence, i.e., we observed the interactive analysis of the answers provided by the university system to the needs of the socio-productive and scientific world. This criterion was mostly overlooked at the international level. It should be mentioned here that this Assessment was started late in Argentina, in 1995, when the University Quality, combined with context, is first considered a priority. University polices emphasize the need to reach systemic analyses. However, Assessment comes down to figures, statistics, diagnoses, inputs and ouputs, but the human processes, which lie at the base of such figures, remain unknown in the Argentine system and, more globally, within the international framework, as it has been commonly pointed out literature until these days. Boudon, in 1973, invites us to work from a more integrating systematic perspective. It was a challenge to implement a systemic analysis of the factor with an impact on achievement at the macro level, and of the impact of the macro or micro organizational contexts on the individuals. My research is oriented in that direction, i.e., towards the search for a more holistic and comprehensive approach to analyze the "mechanisms" and/or factors that, when acting interactively, anticipate the achievement in three levels or dimensions: psycho-individual, meso-institutional/organizational and macro (Aparicio, 2015 c and d). Such approach will let us surpass diagnosis and identify the interplay between the macro cosmos and the micro cosmos; a kind of resourceful play, such as the one between the individual, culture and society. In other words, our perspective aims at the comprehension of macro and meso organizational results and deals with the micro psychological and meso-institutional processes.

This new approach, which will reveal itself in the scientific production of 2005 and 2006 but which will be published in full in 2015, comprises explanation and comprehension, quantitative and qualitative methodology, macro-micro-macro strategy analysis, processes and results, diachronic and synchronic and retrospective and prospective analyses, transdiscipline. It also includes factors of different kinds which interact and transform mutually into a self-ecosystem.

These theoretical-epistemological mainstays are presented here in this brief Introduction with the purpose of making results reading and interpretation easier.

I cannot retrace a long history or the core issues of the many research works (central or peripheral) developed. Nor can I make an inventory of the theories designed, or expand on the complementarity of certain micro-theories and/or factors which have been dealt with in literature in an isolated way, thus, overlooking the semi-dependence and semi-autonomy typical of the social and human phenomena.

On the contrary, I am definitely interested in emphasizing some key point on the method and other aspects related to underlying principles.

My open-circuit models include, at least, five factors: base, psychosocial, pedagogical/institutional, organizational and structural factors. They offer a double way, or "back and forth movement" between the individual and the (institutional or macro) context with positive and negative effects on the individuals and the institutions.

The research was carried out on populations covering two decades and also, the first studies were intergenerational. The first world study was made on three generations in line, 1977-1980. Large populations: As can be seen in some research presented here, we worked with very diverse populations: individuals who entered University since 1980/1985 (18 study-courses at UNCuyo (Cuyo National University) and 5 Engineering study-courses at UTN (National University of Technology) and, among them, some got their degree; others delayed their studies and another group dropped out studies. Others were developed with researchers, teacher researchers, doctors, university, tertiary level and secondary school teachers, organizations of the Judicial System (magistrates), university graduates working exclusively for the State, etc.

This broad time and space coverage of the research regarding "academic-professional careers" – 20 years in the lives of two universities – and broad also as regards university graduates' and students' predecessors – three generations: grandparents, parents and university students – let us analyze the meso/micro relation (organizations and individuals) within the "framework" of singular, family and group (cohorts) careers with remarkable differences at the macro social, economic and political level in Argentina.

In fact, working with large populations let us, on the one hand, determine the differences among the older university graduats' careers, who enter University in a different moment of our history, a time of prosperity in which they could realize their needs for achievement, their ambitions better than the previous recent graduates, who found themselves within a context of unprecedented institutional and economic crisis. The "back and forth" of the individual/structure system appears very clear (macro/micro level). On the other hand, working in the same organizational contexts, yet with data gathered from different historical, economic, social, educational moments, let us observe better the strong presence or weight of the macro level over

the meso-organizational and micro levels as regards professional insertion and promotion (mobility) and many other variables which we cannot deal with now. The different environments, then, leave their imprint on the individual careers.

The temporality (time) factor played a fundamental role regarding the possibility to observe the "back and forth movements" on the system with different consequences[7]. Moreover, it was a decisive factor in order to grasp the movements and self-substance loops between the three levels or dimensions of our theory, which would have been impossible had we not had small samples or worked only at one synchronic level, leaving aside the diachronic level. Besides, due to the combined methodologies and techniques applied, we could relive each of the actors' past, go over their history, with all that it involves, analyze their socio-professional situation at the time of our research, their projection for the future, their goals, ambitions, frustrations; their positions whether or not accompanied by recognition, their identity strategies in order to face difficulties…

The CONICET helped us reveal the differences and similarities according to factors, times and spaces and reach higher levels of generalization and higher levels of depth. From here, after years of research, emerged the mainstays which I now present in theses lines and summarize, even at the risk of simplification, my perspective, its stages, its transformations, and it theoretical-methodological issues, revealing a unit in dynamic and interactive " metamorphosis".

After analyzing this dynamic interplay in three levels (macro, meso and micro), which is called three-dimensional spiral of sense, and how to interpret this self-sustenance in different fields through the research works which have been by way of example–, finally, we will present a short Interpretation of results which we have referring to along the article and a Conclusion.

Let us stop for a moment in two core theoretical frameworks related to our research works.

The Framework

About Identity and Professionalization

The Professionalization matters (or better, lack of Professionalization) and its impact on personal and professional Identity, regarding their professional "future" and the possible performance of the individuals (Silva & Aparicio, 2015 b). Other issues are dealt with since: a) Career path, like identity, is in my opinion, a meeting place between a certain history, a biography, and the relational/structural level. That is, a context favoring or impairing the realization of different levels (Dubar, 1991; Aparicio, 2009 f). In fact, all identities are interwoven between the individual "the others" recognizing or not, and compel the individual to develop "surviving" identity

[7] See Aparicio, 2005 a and 2009 c. In this research, "Temporality" and its impact on professional achievement and associated careers take up a full chapter.

strategies (Goffman, 1963), given the gap between what is desired and what is imposed/denied; due to the existence of "perverse" mechanisms; b) Identities are not shaped from nothingness but from institutions (family, school, business, etc.). The interplay of individuals, institutional and macro contexts is shown clearly.

We have worked on two core issues: identity related to professionalization in the field of formation, and professional insertion.

Professionalization has been source of long debate since the 80s (Lang, 1999). On the one hand, the effects of "overcrowding" in higher education (Bourdoncle & Demailly, 1998) has emphasized the need to consolidate certain competences and sets of knowledge essential for professional practice and its corollary, social recognition of professional groups (Bourdoncle, 1993). The quick changes within the professional world demand innovative transformations in training institutions and consolidation of new competences valued by the market. On the other hand, as regards this research, the conditions of professional practice in the working world have changed, and professional insertion as well as duration and promotion represent a complex problem..

In the specific field of training, the new professionals encounter various difficulties, in addition to lack of recognition. Some authors even speak of de-professionalization of those graduates on this field (a process of "proletarianization" (Ozga & Lawn, 1981); the "semi-professional" status in a broad sense (Etzioni, 1969), the devaluation of the graduate's image in the field of education (training) along with an ever growing weakening (burnout) (Tardiff & Lessard 1999); Maroy 2006; Aparicio, 2006 a, 2006 b, 2007 a, 2007 b, 2009 a, 2009 b, 2009 c, 2013 a). In general, it can be said that there is a certain tension between the area of work and the area of training, as well as between the expectations at the moment of vocational choice and the actual experience in the professional environment; also, between the "ideal" situation expected by the PhD students and the real one of the PhD graduates; between the representation of the doctors and their world experience. Is there an identity crisis as regards the deep changes in the labor market and as regards expectations? (Goffman, 1963). Is there certain overprescription in the institutions to respond to the changes in the labor market along with underprescription in the means used to such response, as it is usually said? Within this framework, the links between the personal training experience and the professional life become a source of concern in the field of training and, especially, in the studies related to humanities and social sciences.

Besides, this issue involving institutional and even disciplinary identities, as well as the identity reconstruction processes, is accompanied, as it has just been said, by actual insertion conditions, duration and professional mobility; all of them will have an impact on professional careers (Dubar 1991, 2000 a, b and c).

Identity is, then, the result of a history and a certain time marked by specific contextual characteristics (Aparicio, 2013 a). Argentina there appears the existence

of a favorable context to the identity crisis. Uncertainty prevails – within a context in which Professionalization has not developed adequately.

Two final words about this theme: Identity and Professionalization.

As regards Identity, we cannot expand any more at this point. We refer to our own work and other international literature (Aparicio, 2012 c). There the reader will be able to find different form of identity (ethnic, professional, cultural, sexual,…); the different approaches – sometimes opposites – unity, decentration, essentialism vs. constructivism, difference vs. resistance); identity in terms of transaction. The processes related to Identity are also shown (individualization, identification, attribution and introjection, conservation, narcissism, realization); the most prominent perspectives (behaviorism, genetic, clinical, social and psychosocial views…); perspectives associated to cultural anthropology, to symbolic interactionism, to phenomenology, to systemism). Identity appears in the interweaving of history, biography and relations, it always involves an "alter" – other – who may or may not recognize, may or may not accept.

As regards Professionalization, as is widely known, it affects people, job positions, professions, groups, and from it comes the so called Professionalism. There usually exist different approaches to the issue. Once again, we can see here our levels, at least, the micro and meso levels.

Professionalization has 2 purposes: acquiring collective capacities, previously dealt with by Bourdoncle & Demailly (1998), and internalizing cultural and professional rules (autonomy, polyvalence, team work). Thus, those who are responsible within the labor market try the individuals to identify themselves with the aims of the company and get involved with the identity model the company follows. However, conflict often arises between the personal and the collective projects and the individual hast to resort to identity strategies.

In all cases, Professionalization tends to reduce the gap; this gap is smaller in some cases than others.

Finally, finding the link between Burnout and inadequate Professionalization is not difficult, since it refers to a syndrome characterized by a fall in expectations.

Theories of Achievement

There are various causes related to achievement / failure, and in addition to this problem there is the unambiguity of the term "failure": the definitions refer to different aspects, such as poor performance, course repetition, drop-out, poor education quality, school maladjustment, etc. Failure is also linked to physiological, psychobiological and family background factors.

Achievement Related Approaches: Studies by Cabrera and Nora (1994), offer five broad categories to classify the approaches related to dropout and retention, considering

whether the emphasis assigned to the core explanatory variables falls on personal, family, or institutional factors. We can identify five approaches: psychological, sociological, economic, organizational and interactionist, which are supported by empirical research.

Different models show the impulse of adaptation to university life and acceptance of the fashion or "identity" each institution presents; the role of engagement and positive interactions among students and with teachers, as well as the role of perspective, which, as stated by Tinto (1975, 1987, 1993), exhibits an individual side and an academic one. Nevertheless, Tinto is one of the principal writers about this subject and particularly about the causes of drop-out. This relationship between socio-academic inclusion and retention has been also observed in studies with representative samples at the national level in the US (Astin, 1991; Horn, 1998; Leppel, 2002; Thompson, 1990; Tinto, 1998) and in studies on a single institution (Eaton & Bean, 1995; Thomas, 2000).

Bean, 1980; Bean & Metzner**,** 1985 adds the persistence factor to Tinto's model on behavioral intentions within the business labor framework. He states that institutional (external) factors, such as the programs offered by a university or the interrelationship between students and teachers, may have an impact on the student's decision to endeavor to persevere. Satisfaction with the institutional offer could work in like manner. Therefore, we can see that focus is on organizational/institutional, environmental, and non-cognitive personal factors (ambitions, motivations, interests, etc.).

Pascarella (2001; Pascarella & Terenzini, 1991, 2005) suggests, in turn, a model that combines institutional and environmental features, distinguishing five groups: 1) personal features (aptitudes, performance, personality, ambitions, and ethnicity); 2) structural and organizational factors (admission systems, selectivity); 3) environment; 4) interactions within university life; and 5) the quality of students' effort.

A more recent approach, the psychosocial approach, claims that it is necessary to test the relationship among motivation, social and institutional constructs. Studies carried out in the US also show that the best predictors for graduation are academic training and students motivation (Adelman, 2004; Pascarella & Terenzini, 2005)[8].

Compared with the foregoing methods, ours integrate a variety of these factors grouped in the last two approaches: psychological and organizational (see especially Aparicio 2005 a, 2006 a and b; 2008 a and b). Some variables used in the afore mentioned models are incorporated and the impact of these variables on the subjective and objective achievement is analyzed based on quantitative methodologies and predictive models (Aparicio, 2005 a); on the other hand, in the

[8] For more details, see Aparicio (2014 a).

light of qualitative methodologies, we intend to account for the origin and sense of this problem in the students' personal-professional experiences.

In this study**,** we deal, especially and always from a qualitative point of view, with the psychosocial aspects of the problem (processes leading to failure), and the institutional aspects, which have been observed in some typical practices identifying each course of study and, in a more global manner, the university. Both aspects are combined based on an integrating perspective without disregarding educational institution, nor the individuals and their sociocultural background (close and distant), nor the structural present context. However, the latter is part of our analysis only as a secondary aspect, whether from the viewpoint of degree devaluation in the labor world, or from the discontent students express (i.e., from their opinions as regards these poor institutional practices in relation to the higher demands of the labor market). All this has an impact on the perseverance and success in studies and employability. Individuals, institutions and macro-social contexts interweave in this analysis.

The meso-institutional and micro-personal levels within a structural background of crisis (underemployment, high unemployment rated, even for university graduates, etc.) are self-sustainable in this integrating and holistic perspective (Aparicio 2008 a, 2009 a and b, 2009 c, 2012 a, 2012 b, 2015 c and d). Here lies the uniqueness of our quantitative/qualitative *sui generis* model.

General Hypothesis: within achievement at university level there exist different factors: individual (objective and subjective), pedagogical, institutional and structural (labor market). Their interaction operates selection in higher education.

Specific Psychosocial Hypotheses: a) Psychosocial factors (combine aspects of the individuals and their context) favor academic and/or work failure. b) Ambitions, expectations and n-Ach (need achievement) have a specific impact on the selection which operates before and during entering university as well as during the course of studies. c) These factors together with others (pessimism of perspectives, dissatisfaction, anomy, etc.) create achievement patterns which are different according to the courses of study, whether favoring achievement or not. d) All this benefits different institutional identities linked to biographical-contextual identities of the individuals.

The Epistemological Mainstays Applied to Six Disciplinary Areas

We have developed this non-linear, non-determinist, integrating and holistic (systemic *sui generis*) theory after working for over 30 years, researching on complementary areas. At this point, we cannot go into details in each of the research works (Aparicio 2015 c and d). We will simply point out the core disciplinary areas with a brief reference to the self-sustained interplay of the variables; such interplay will eventually let us grasp the "sense" of human and/or social phenomena we have

dealt with. To conclude, we will point out some epistemological issues supporting this theory.

Education, with special application to Professionalization and Identity

This issue is present in several research works (university graduate students, drop-outs, delayed students -1980-2004-; in a second moment, the research is carried out up to present days. We will also worked with students "retained" within the system and PhDs[9]). Teachers and although sometimes Authorities and Officers of the Political/Educational and Labor area are also included.

The studies were carried out at different universities: Universidad Nacional de Cuyo (*Cuyo National University*) – UNCuyo –, Universidad Tecnológica Nacional (*National University of Technology*) – UTN –, and Universidad Austral (*Austral University*), all of them in Argentina (Aparicio 2015 c and d). Finally, we added individuals of Non-University Tertiary Level (i.e., studies with individuals studying at Teacher Training Institutes, INFD). They have quite distinct profiles. Our research showed the differences and similarities related to the interaction of individuals, macrosocial/structural contexts and institutions. This reveals the presence of different institutional and personal/professional identities largely related to excellence at University or in their Study courses and to the level of Professionalization achieved.

Health

It is another field we have dealt with in which the interplay between the macro, meso institutional and micro levels emerge clearly. We have carried out several research works on the three mentioned levels:Burnout in different populations (some are cooperative studies) and Factors operating "para-choc" (measured quantitatively): Engagement, Well-being, Optimism, Pessimism, Resilience, Coping or strategies to cope with adversity (helping improvement and/or controlling it), attributive factors

[9] This research includes doctors in education at National University of Cuyo, 2005-2009), and doctors under training in Adult Education at Cnam (National Conservatory of Arts and Crafts, France). Two research laboratories took part in this work: the Laboratorio de Investigaciones en Educación (Education Research Laboratory, Conicet/UNCuyo, Argentina and the CRF, Centre de Formation sur la Recherche, Cnam). It is expected to find different profiles according to the work/professional contexts in which they are situated together with the differences of the respective contexts in our country and with the contributions from the micro level: the problems, values and priorities appearing in the social representations shared by each of these groups. As we can see, this lets us see different institutional, personal and professional identities as well as different aspects along their professional career.
The results show no obvious differences are noticed between the French and Argentine groups. Doctoral training is valued by both groups; that is, although the general idea is that PhD degrees are devaluated, subjectively, doctors are quite satisfied. Along this line, they expect improvements in their future work life, thus a positive view prevails. On the contrary, other graduates on education without a PhD degree do not show the same prospect. Briefly: doctoral education (Argentine) is still considered an "add-on". The strongest claim against labor market lies on the lack of recognition, especially among the French doctors. Comparatively, the Argentine group has higher expectations as regards the degree. The "plafond" effect linked to the context appears in our research. The self-sustaining movement – the links (back and forth movements) – appear as the result of this interplay (Aparicio, 2015 a, c and d).

such as Alignment, Internality, application or motivational factors (2005 a, 2009 a and b, 2014 d, 2015 c and d).

Among the qualitative dimensions, we can mention: Personal and Professional Expectations, N-ach/Ambitions, Sense of Effort and Engagement, Resilience (importance of building firm and solid bonds). Other aspects related to the importance of Professionalization appear here (teachers' support mechanisms, level of social and for-life competences formation beyond procedural and disciplinary competences, satisfaction – although not always related to economic aspects or hierarchical position, among other aspects) (Aparicio 2005 a; 2007 a and b; Aparicio & Cros, 2015 a).

Once more, each study reveals similarities and differences by educational organizations or institutions which feedback on each other thorough time (we should remember that studies cover large periods of time, which shows theses self-sustaining socio-cultural, psychosocial, organizational and structural variables), both at institutions/faculties/study courses offering unique profiles with predominantly positive or negative aspects, and in individuals. Such self-sustenance also shows institutional selection processes and self-selection.

Science

On this field, we carried out a research work, a replication of *the important research done by the UNESCO (197110, 1979, Knorr, K., R., Mittermeir, G., Aichholzer, R., Waller, G, among others).*

We work with Team Chiefs and Team Members. The statistical analysis clearly shows the existance of "Invisible Schools"; schools referring to institutional and disciplinary identities (Crane, 1972; Aparicio, 2014 b, 2015 d)11. Our work combines the three levels of the theory: macro structural (political-economic), méso organizational (research teams), and micro individual: researchers (Chiefs and Members). Interaction and self-sustenance appear clearly at the three levels within Dr. Aparicio's theory called "Three-Dimensional Spiral of Sense".

The findings reveal the relation between Disciplinary Identity/identities (hard sciences vs. soft sciences, with their rules, values, etc.) and Institutional Identities in an unfavorable macro/structural context, all of which leads to a low level of Professional Satisfaction with consequences at the level of anomy, pessimism, etc. The three levels are again in their self-sustained interaction, in a relation of partial dependence and partial autonomy.

[10] International Comparative Study in Organizations and Perfomance of Research Units, UNESCO (1971).
[11] The Founding Fathers are referred thereto.

Media and Institutional Cultures

This study tests hypotheses included in the psycho-socio-communicational paradigm, which emphasizes the long term cognitive effects of the media and the role of the psychosocial subject as recipient: the hypothesis of "agenda-setting" (Cobb & Elder, 1971; Mc Combs & Shaw, 1972; Gerbner & Gross, 1976; Ettema & Cline, 1977; Iyengar, 1979; Bregman & Missika, 1989; Aparicio, 1995 a).

Institutional homogenization – particularly between different faculties and/or study courses – is surprising and makes us rethink the role of the university in educating for the critical reading and filtering of the material the media provide as (Pasquier, 1994; Aparicio, 2013 b).

As far as we are concerned, we wished to analyze the appearance of the individuals / contexts relation in their sustained interaction. This was possible thanks to the extensive time of our research in a changing structural framework and carried put in several study courses (micro-organizations) of the UNCuyo (Aparicio, 2002; 1980-2004 and 2005-2014).

Objectives: a) To elucidate such effects in audiences with different levels of education, b) To detect levels of manipulation and homogenization of the "mental maps" linked with the centralization of the "fourth power", c) To analyze if institutional affiliation (different faculties and/or study courses) has an impact on the "filter of the news" from the point of view of the prevailing ideology, beliefs, defining purposes, priorities. In other words, we wished to determine if such institutional affiliation influences on the cosmovision of the individuals in them (here, the students), contributing to the design of such mental maps.

Hypothesis: The central hypotheses are offered, taking into account that forty nine were considered: a) there would be a marked correlation between the order of importance assigned to the information by the media and that adopted by youths (high incidence of "mental construing"), b) receptivity of the addressees would vary according to cognitive competence; c) the institutional characteristics could impact on a different interpretation of the social reality, producing certain homogenization in the "mental map" of the individuals in them.

Results show different interpretations and levels of "filtering" in accordance with the pertaining institution. As far as we are concerned, there exists a clear institutional influence in the cosmovision young people as regards the news selection they make of the offers of the media. Individuals and contexts once more in their interplay.

The micro/meso interplay is evident; i.e., personal identities getting feedback from institutional identities (Aparicio, 1995 b, 2005 b).

International Policies, Cooperation and Relations[12]

The purpose was analyzing a study about the impact of Food Allowance – a program implemented by international organizations – within the framework of the fight against hunger in an unpromising context which puts the Goals of the Millennium at risk. It is especially interesting to see how the quantitative variables and the qualitative dimensions appearing at the macro level (political and economic in particular) also occur at the meso level (regional) and, on the basis, at the micro level. The mainstays of the theory appear clearly again, although the areas and disciplines change since work is no longer on-site.

This disciplinary area interweaves with many others, especially, with axis-variables in Social, Community and Health Psychology and Psychosociology (field of research).

Professionalization does not play a direct role, although it does appear when dealing with improving the Management on the Matter, which has an impact on these International Programs and their quality (Cf. Santander Aparicio, 2012).

Interculturality

We work with Native Peoples (Natives) of Argentina (Huarpes, Kollas, Wichis, Aymaras and Mapuches) and Chili (Mapuches). Also with ethnic minorities. The study refers to a more recent issue in our context, although its roots come from long ago, in a history plagued with prejudices, stereotypes, discrimination against those who were different, against the others. All these aspects have often been concealed under words of "acceptance of diversity". Comparative studies from Argentina and other countries are presented here, revealing personal and professional identities always interwoven between the individual and his/her immediate and macro context in a sustained interplay. . In fact, the institutions are not prepared to welcome and nurture "the other one" , "the different one" although international laws spread and this problem is increasingly evident in the public an school policies debate. (See Wieworska, 1996, 2008; Aparicio, 2014 g, h, i, j; 2015 c and d). It can also be clearly observed quasi absence of Professionalization regarding Interculturality and diversity. Finally, it can be observed that Professionalization and Identity have strong implications on practices and, globally, on personal and institutional achievement or failure levels, and deep down, on the macro system.

Interpretation of Results

It would be impossible to deal at this point with the results according to factors, in themselves and their dynamic/systemic interaction or "back and forth" movements between individual and contexts within the different research works. As for the rest,

[12] The author was advisor in theoretical-methodological matters. See Santander Aparicio, 2012.

some of them have been presented in or derived to the work which deals with them in full13.

I will simple remark some theoretical-methodological contributions and limits and the theoretical/model nodes which get us closer to a renewed theory.

In principle, the analysis revealed differences and similarities in relation with the discoveries in Argentina and other countries (particularly, French speaking countries).

This is quite important from the point of view of the construction of our theory. In fact, we could see the change of sense shown by some variables in relation with the findings of other European studies. This could reveal a key aspect in our framework: the importance of the interplay between the individuals and their context (here, the institutions/organizations in the labor market, the State, all this on a macro framework, of different priority origins and problems); it could also reveal the importance of a "contextualized" analysis and of a methodological approach aiming at recovering the sense of human behaviors or actions within the "back and forth" movement between the individuals and their contexts; finally, it could reveal the importance de specific reappropiation of the disciplines involved based on a comprehensive approach. The observed differences, in fact, let us outline new approaches and invited us to review theories and methods.

The similarities found in this work let us infer the existence of a certain disciplinary, institutional, organizational and also and basically cultural homogenization in vivo; a certain "standardization" already appearing in the first research works (descriptive level), which will eventually melt the differences (both at the level of the individuals and the organizational level), with the aim of protecting institutional identity.

In fact, our results gradually showed that there are homogeneous profiles inside the faculties of one University, according to academic units/faculties and academic "areas" ("hard sciences" versus "soft sciences"). Such homogeneity within each institution could be expected to some extent; however, it surprised us due to its extended presence and "power".

From the theoretical-methodological point of view, our framework – multi-referential – has also let us, overcome the barriers that trap thinking with the burden of certain "-isms" (sociologism, psychologism,…), and led us to find points of contact. The different approaches interwoven in our research (psychosocial, psycho-sociological, sociological, in the field of education, human resources administration, management, occupational medicine, …), has finally let us relativize the theses supported within the framework of other theories. They showed that our objective is complex yet not determined.

[13] For a synthesis, see Aparicio, HDR, 2007 a and b.

Finally, it provided us with a comprehensive interpretation of what was our sub-issue in this presentation of the Theory of the Three-dimensional Spiral of Sense: the problem of Identity and Professionalization. We carried out the analysis taking the intergenerational, social and professional careers as one of its guiding themes.

Three-Dimensional Spiral of Sense, a name which makes reference to the non-linear relations within the social and human phenomena, which may be better understood in diverse disciplinary areas (interdiscipline and transdiscispline), until a deep sense is reached in many cases, if we consider three dimensions in a self-sustained interplay: society, culture and the individual, or, in other words, the macro, meso and micro levels.

Let us try to answer the following question: What epistemology we could use to analyze the careers?

A career basically comprises a personal history and the influences of the context. It also confers a certain identity and "speaks" of the levels of professionalization. As a complex phenomenon in which multiple variables participate, it requires a sui generis systemic interpretation, away from the classical and administrative systemism, in which the three aforementioned levels appear in a dynamic way with unpredictable (positive and negative) effects. Thence, I decided to represent (a career) as an open spiral upwards and downwards, with multiple factors and/or dimensions interwoven in a semi-dependence and semi-autonomy relation; a spiral in which there is room for freedom and chance (and the uncertainty this fact involves), in which there is room for a kind of curiously "limited" freedom" yet not determined by context; a spiral comprising society, personality and culture and it is deeply rooted in socialization, in a broad sense (family, organizations, country or cultural ethos).

This interweaving will reveal the presence of the macro in the meso and the micro, and the micro in the meso and the macro; the imprint of the institutional culture on the individuals and, at the same time, the individuals will be the bearers of such culture. Therefore, culture will appear as producer and produced, being at the heart of the interplay.

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Barrier Modification by Methyl Violet Organic Dye Molecules of Ag/P-Inp Structures

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Abstract

This work includes fabrication and electrical characterization of **M**etal/**I**nterlayer/**S**emiconductor (MIS) structures with methyl violet organic film on *p*-InP wafer. Metal(Ag)/ Interlayer (methyl violet =MV)/Semiconductor(*p*-InP) MIS structure presents a rectifying contact behavior. The values of ideality factor (*n*) and barrier height (BH) for the Ag/MV/*p*-InP MIS diode by using the current-voltage (*I-V)* measurement have been extracted as 1.21 and 0.84 eV, respectively. It was seen that the BH value of 0.84 eV calculated for the Ag/MV/*p*-InP MIS structure was significantly higher than the value of 0.64 eV of Ag/*p*-InP control contact. This situation was ascribed to the fact that the MV organic interlayer increased the effective barrier height by influencing the space charge region of inorganic semiconductor. The values of diffusion potential and barrier height for the Ag/MV/*p*-InP MIS diode by using the capacitance-voltage (*C-V)* measurement have been extracted as 1.21 V and 0.84 eV, respectively. The interface-state density of the Ag/MV/*p*-InP structure was seen to change from 2.57×10^{13} $eV^{-1}cm^{-2}$ to 2.19×10^{12} $eV^{-1}cm^{-2}$.

Keywords: Organic dye film; MIS diode; Series resistance; Interface states

Introduction

Electronic and optoelectronic properties of the organic semiconductor devices have been intensively investigated in recent years [1-6]. Organic semiconductor based device technology is relatively cheap and easy to fabricate compared to inorganic devices. These advantages make these kinds of materials attractive for the previously reported applications [6].

Owing to their stability and barrier height (BH) modification features, organic materials have been employed particularly in metal/semiconductor (MS) diodes [7-14]. Campbell et al. [9] inserted an organic thin film to the metal/semiconductor interface and thus modified the effective Schottky barrier height. They found that the changes in the Schottky barrier height were more than 500 meV and the Schottky diodes with thin organic layers were superior to control Schottky diodes. Tunç et al. [10] reported an Au/polyvinyl alcohol (PVA) (Ni,Zn-doped)/n-Si diode with a barrier height value of 0.78 eV and an ideality factor value of 1.83 at room temperature (300 K). Aydoğan et al. [11] discussed the temperature dependent I–V characteristics of Al/Polypyrrole(PPy)/p-Si Schottky diode. Aydemir et al. [12] fabricated Au/n-Si and Au/PVA:Zn/n-Si Schottky diodes to investigate the effect of organic interfacial layer on the main electrical characteristics. PVA:Zn was successfully deposited on n-Si wafer by using the electrospinning system and surface morphology of PVA:Zn was presented by SEM images. The current–voltage characteristics of these diodes have been investigated at room temperature. The experimental results show that interfacial layer enhances the device performance in terms of ideality factor (n), zero-bias barrier height (Φ_{B0}), series resistance (R_s), and shunt resistance (R_{sh}) with values of 1.38, 0.75 eV, 97.64 Ω, and 203 MΩ whereas those of Au/n-Si diode are found as 1.65, 0.62 eV, 164.15 Ω and 0.597 MΩ, respectively[12]. Forrest et al. [13] and Antohe et al. [14] obtained **M**etal-**I**nterlayer-**S**emiconductor (MIS) structures by sublimation of organic thin layers on a semiconductor wafer, subsequently evaporation of various metals and then extracted their ideality factors and BHs.

The electrical properties of MS structures can be modified by organic semiconductors when an organic thin film is placed between the inorganic semiconductor and metal. The studies made in literature have shown that the barrier height could be either increased or decreased by using organic thin layer on inorganic semiconductor [7-14]. The insertion of thin films of organic semiconductors with nanometer thickness in inorganic Schottky diodes introduces a method to control the fundamental device parameters[15]. Methyl violet (MV) with molecular formula $C_{25}H_{30}ClN_3$ used in this work is a typical aromatic azo compound. It is an organic dye molecule used extensively as an acid–base indicator due to its radical colour change with varying pH. Its colour originates from absorbance in the visible region of the spectrum due to the delocalization of electrons in the benzene and azo groups forming a conjugated systemThe molecular structure of the methyl violet is given in Fig. 1. The structure of azo dyes has attracted considerable attentions recently due to their wide applicability

in the light-induced photo isomerization process, and their potential usage for the reversible optical data storage [16].

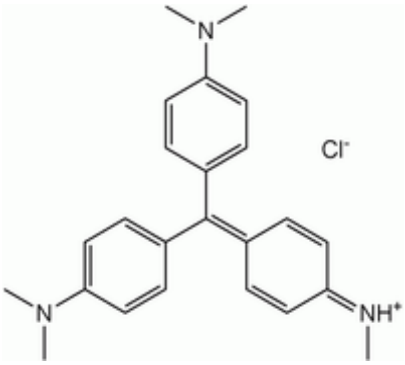

Fig. 1. The molecular structure of MV molecule.

MV organic material has been considered as one of the most stable organic semiconductors for various electronic and optoelectronic applications. Our aim is to investigate the electrical properties of Ag/MV/p-InP diode by the insertion of MV organic film between InP semiconductor and Ag metal by using current-voltage (I-V) and capacitance-voltage (C-V) measurements and is to compare the electrical.

Experimental Details

Ag/MV/p-InP MIS diodes were produced by using one side polished (as received from the manufacturer) p-type InP wafer with (100) orientation. The wafer was chemically cleaned with $5H_2SO_4+H_2O_2+H_2O$ (a 20 s boil). The native oxide on the front surface of *p*-InP was removed in a $HF:H_2O$ (1:10) solution and finally the wafer was rinsed in deionized (DI) water for 30 s. Before forming the organic layer on the *p*-InP substrate, the ohmic contact was made by evaporating Au–Zn (90%–10%) alloy on the back of the substrate, followed by a temperature treatment at 450 °C for 3 min in N_2 atmosphere. MV organic layer was directly formed by adding 9 µL of the MV solution (wt 0.2% in methanol) on the front surface of the *p*-InP wafer, and evaporated by itself for drying of solvent in N_2 atmosphere for an hour. The contacting metal dots were formed by evaporation of Ag metal with diameter of 1.0 mm (diode area=$7.85x10^{-3}$ cm^2). All evaporation processes were carried out in a vacuum coating unit at about 10^{-5} mbar. *I-V* and *C-V* measurements for Ag/MV/p-InP MIS contact were measured by using a Keithley 4200 SCS system at room temperature (see Fig. 2). Photoelectric effect on the Ag/MV/p-InP device was measured under 2000 lux light illumination.

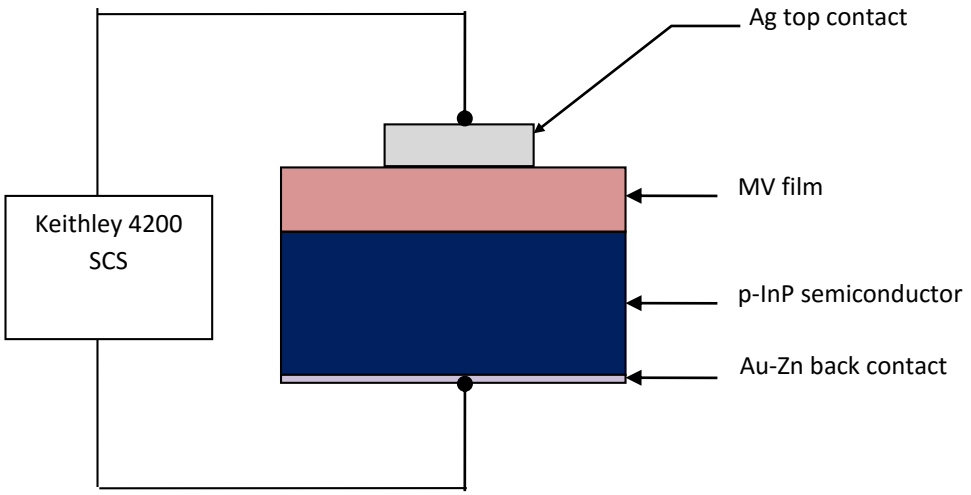

Fig.2. Measurement system connection and the schematic structure of Ag/MV/n-InP diode

Results and Discussion

Current-Voltage characteristics of the Ag/MV/p-InP MIS diode

Fig. 3 shows the *I-V* measurements of the Ag/MV/*p*-InP MIS diode in dark and under light illumination and Ag/*p*-InP control MS diode in dark at room temperature. As seen from Fig. 3, MV organic interlayer reduces the current values of the control diode. The Ag/MV/*p*-InP structure has rectifying property. The voltage dependence of the reverse current and the exponential increase of the forward-bias current are the characteristic properties of diodes. The current curve in forward bias region becomes dominated by series resistance from contact wires or bulk resistance of the organic semiconductor and the inorganic semiconductor giving rise to the curvature at high current in the *I-V* plot. Also, the reverse bias current of the Ag/MV/p-InP diode is strongly increased by the illumination. This suggests that the carrier charges are effectively generated in the junction by illumination. The device shows a good photovoltaic behavior with a maximum open-circuit voltage (V_{oc}) of 0.17 V and a short-circuit current (I_{sc}) of 0.49 μA under 2000 lux light intensity. By using thermionic emission (TE) theory [17,18], the ideality factor (n) and BH (Φ_b) can be obtained from the slope and the current axis intercept of the linear region of the forward bias *I-V* plot, respectively. The values of the BH and the ideality factor for the

Ag/MV/*p*-InP diode have been calculated as 0.84 eV and 1.21, respectively. The ideality factor determined by the image-force effect alone should be close to 1.01 or 1.02 [19-21]. Higher values of ideality factors are attributed to secondary mechanisms which include interface dipoles due to interface doping or specific interface structure as well as fabrication-induced defects at the interface [19-22].

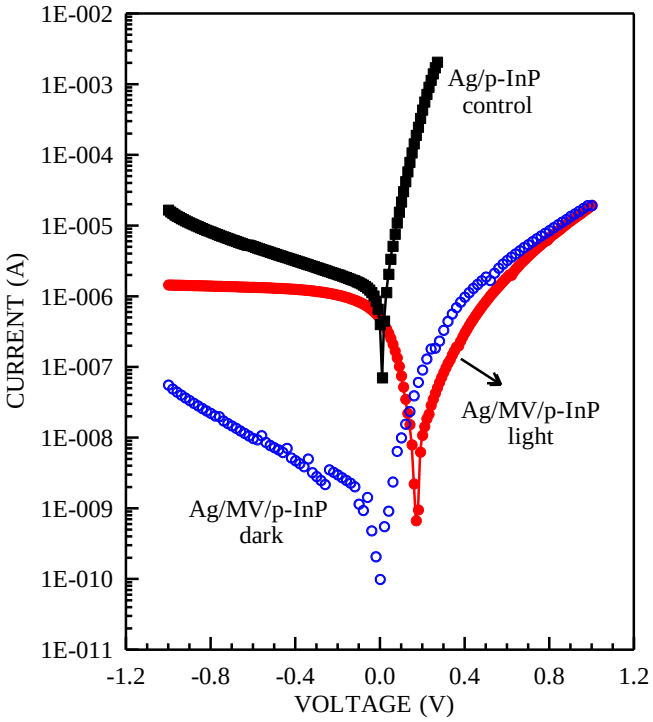

Fig.3. I-V measurements of the Ag/MV/p-InP diode in dark and under light illumination and Ag/p-InP control diode in dark.

The BH value of 0.84 eV that we have obtained for the Ag/MV/*p*-InP device due to MG organic layer is remarkably higher than the value of 0.64 eV calculated for reference Ag/*p*-InP contact in Fig.3. In literature, some experimental studies have been reported for the barrier height modification by using the organic thin films [23]. Recently, Gullu et al. [24] have published a paper about Al/DNA/p-InP diode with barrier height value of 0.98 eV and ideality factor value of 1.26. The obtained barrier height value of the diode was higher than the conventional Al/p-InP [18]. Also, Güllü et al. [16] investigated the electrical characteristics, such as current–voltage (I–V) and capacitance–voltage (C–V) measurements, of identically prepared Al/MV/p-Si Organic/Inorganic (OI) Schottky structures. It has been seen that the methyl violet

organic dye layer on the p-Si substrate has exhibited a good rectifying behavior. The barrier heights and ideality factors of all devices have been calculated from the electrical characteristics. Although the diodes were all identically prepared, there was a diode-to-diode variation: the effective barrier heights ranged from 0.6 ± 0.1 to 0.8 ± 0.1 eV, and the ideality factor from 1.6 ± 0.4 to 3.5 ± 0.4. The barrier height versus ideality factor plot has been plotted for the OI devices. Lateral homogeneous BH was calculated as a value of 0.7 eV from the observed linear correlation between BH and ideality factor, which can be explained by laterally inhomogeneities of BHs [16]. In other study, Karataş et al. [25] have fabricated an Al/Rh101/p-Si/Al contact. The barrier height (0.817 eV) of the Al/Rh101/p-Si/Al contact was significantly larger than the barrier height of conventional Al/p-Si Schottky diode. In another study, Çakar et al. [26] have fabricated the Cu/pyronine-B/p-Si, Au/pyronine-B/p-Si, Al/pyronine-B/p-Si and Sn/pyronine-B/p-Si diodes, and the obtained barrier heights for these diodes were larger than the conventional metal/p-Si contact. They [26] have evaluated that the barrier height could be enhanced or modified by using thin interfacial films. It is seen from the above results that the organic layer can be used to vary the effective barrier height of Al/p-Si Schottky diodes. Furthermore, this case may be ascribed to the organic interlayer modifying the effective barrier height by influencing the space charge region of the inorganic substrate [27-30]. The MV organic dye layer forms a physical barrier between the Ag metal and the p-InP wafer. This organic layer can produce substantial shift in the work function of the metal and in the electron affinity of the semiconductor and in turn, the organic layer gives an excess barrier of 0.20 eV, i.e., the MV organic layer increases the barrier height of Ag/p-InP. The barrier height of Ag/p-InP contact increases by the insertion of a dipole layer between p-InP semiconductor and MV organic layer. Similarly, Zahn et al. [31] have indicated that the initial increase or decrease in effective barrier height for the organic interlayer was correlated with the energy level alignment of the lowest unoccupied molecular orbital with respect to the conduction band minimum of the inorganic semiconductor at the organic/inorganic semiconductor interface. The obtained results and previous studies have shown that the electrical conductivity, preparation process of organic film, film thickness of the organic semiconductor to be used in device fabrication significantly affect the device performance and electronic parameters of the MS devices. As a result, we have evaluated that Ag/p-InP MS diode could be designed to exhibit the desired properties by means of the choice of the organic molecule [23].

The downward concave curvature of the forward bias I-V plots at sufficiently large voltages is caused by the effect of series resistance (R_s), apart from the interface states, which are in equilibrium with the semiconductor [32]. The R_s value has been calculated by using a method developed by Norde [33-36]. Norde proposed a method to determine value of the series resistance [36]. The following function has been defined in the modified Norde's method:

$$F(V) = \frac{V}{\gamma} - \frac{1}{\beta} ln\left(\frac{I(V)}{AA^{*}T^{2}}\right) \quad (1)$$

where γ is an integer (dimensionless) greater than *n*. *I*(*V*) is current obtained from the *I–V* curve and β is a temperature-dependent value calculated with $\beta = q/kT$. Once the minimum of the *F* vs. *V* plot is determined, the value of barrier height can be obtained from Eq. (2),

$$\Phi_b = F(V_0) + \frac{V_0}{\gamma} - \frac{kT}{q} \quad (2)$$

where $F(V_0)$ is the minimum point of *F*(*V*) and V_0 is the corresponding voltage. Fig. 4 shows the *F(V)–V* plot of the junction. From Norde's functions, R_S value can be determined as;

$$R_S = \frac{kT(\gamma - n)}{qI} \quad . \quad (3)$$

From the *F–V* plot by using F(V_0)=0.795 V and V_0=0.20 V values, the values of Φ_b and R_s of the Ag/MV/p-InP structure have been determined as 0.87 eV and 224.1 kΩ, respectively. There is a difference in the values of Φ_b obtained from the forward bias ln*I-V*, and Norde functions. Differences in the barrier height values obtained from two methods for the device may be attributed to the extraction from different regions of the forward bias current-voltage plot [37]. The value of series resistance may also be large for the higher ideality factor values. Furthermore, the value of series resistance is very high for this device. This indicates that the series resistance is a current-limiting factor for this structure. The effect of the series resistance is usually modeled with series combination of a diode and a resistance R_s. The voltage drop across a diode is expressed in terms of the total voltage drop across the diode and the resistance R_s.

The high series resistance behavior may be ascribed to decrease of the exponentially increasing rate in current due to space-charge injection into the MV organic thin film at higher forward bias voltage [37].

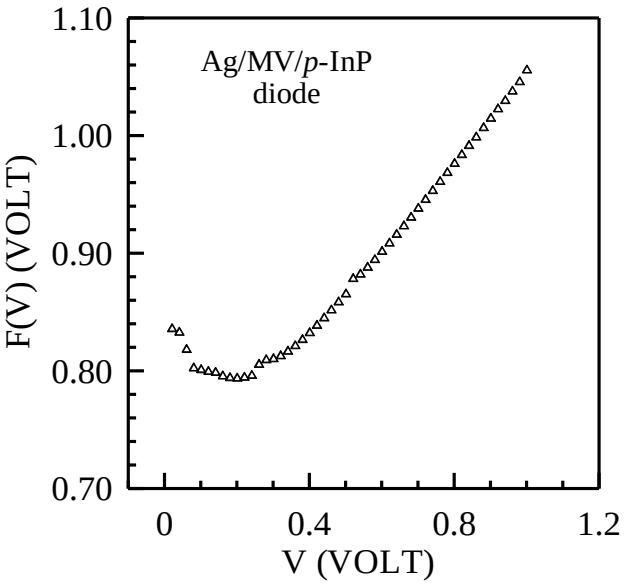

Fig.4. Norde function of Ag/MV/p-InP diode

3.2. Analysis of interfacial features of the Ag/MV/p-InP MIS diode

For a metal/semiconductor diode having interface states in equilibrium with the semiconductor the ideality factor *n* becomes greater than unity as proposed by Card and Rhoderick [38] and then interface state density N_{SS} is given by;

$$N_{SS} = \frac{1}{q}\left[\frac{\varepsilon_i}{\delta}(n(V)-1) - \frac{\varepsilon_s}{w}\right] \tag{4}$$

where *w* is the space charge width, ε_s is the permittivity of the semiconductor, ε_i is the permittivity of the interfacial layer, δ is the thickness of organic layer, and $n(V) = \dfrac{V}{(kT/q)\ln(I/I_0)}$ is voltage-dependent ideality factor. In *p*-type semiconductors, the energy of the interface states E_{SS} with respect to the top of the valence band at the surface of the semiconductor is given by;

$$E_{SS} - E_V = q\Phi_b - qV \quad (5)$$

where V is the voltage drop across the depletion layer and Φ_b is the effective barrier height. The energy distribution or density distribution curves of the interface states can be determined from experimental data of this region of the forward bias I–V plot. Substituting the voltage dependent values of n and the other parameters in Eq. (4), the N_{SS} *vs.* E_{SS}-E_V plot was obtained as shown in Fig. 5. It is seen that N_{SS} value decreases with increasing E_{SS}-E_V value. The density distribution of the interface states of the diode changes from 2.57×10^{13} eV^{-1} cm^{-2} to 2.19×10^{12} eV^{-1} cm^{-2}. Aydogan et al. [32] found that the deposition of polymers on to the inorganic semiconductor could generate large number of interface states at the semiconductor surface, which strongly influence the properties of the PANI/p-Si/Al structure. Çakar et al. [39] have determined interface properties of Au/PYR-B/p-Si/Al contact. They [38] have found that the interface-state density values varied from 4.21×10^{13} to 3.82×10^{13} cm^{-2} eV^{-1}. The interface-state density of the Ag/MV/p-InP diode is consistent with those of above mentioned diodes. It is evaluated that interface properties of Ag/p-InP junction are changed by depending on organic layer inserted into metal and semiconductor. The organic interlayer appears to cause to a significant modification of interface states even though the organic-inorganic interface appears abrupt and unreactive [40-42]. The MV organic layer increases the effective barrier height clearly upon the modification of the semiconductor surfaces and the chemical interaction at the interface of the MV organic layer to the *p*-InP and oxide-organic interface states will give rise to new interface states [23].

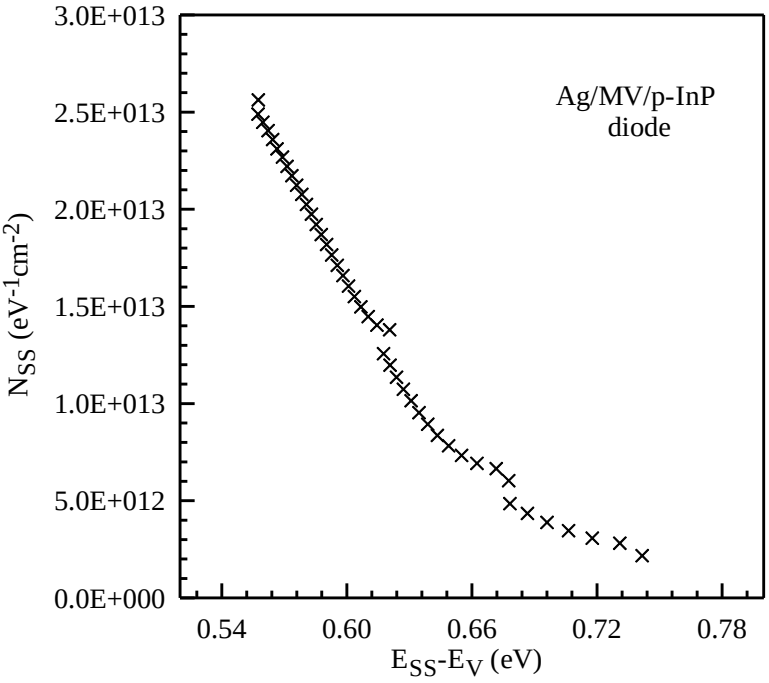

Fig.5. The density distribution of the interface states of the Ag/MV/*p*-InP junction.

Capacitance-Voltage characteristics of Ag/MV/p-InP contacts

The capacitance-voltage measurements provide knowledge about the fixed charge concentration and barrier height for MIS diodes. Any variation of the charge within a p-n diode with an applied voltage variation yields a capacitance which must be added to the circuit model of a p-n diode. The junction capacitance dominates for the reverse-biased diodes, while the diffusion capacitance dominates in strongly forward-biased diodes [43]. Fig.6 shows the C-V characteristics of the Ag/MV/*p*-InP MIS junction for 10 kHz, 100 kHz and 500 kHz frequencies. Capacitance values decrease with increasing frequency. This occurred at lower frequencies because the interface states could follow the alternative current signal and yield an excess capacitance that depended on the frequency [43].

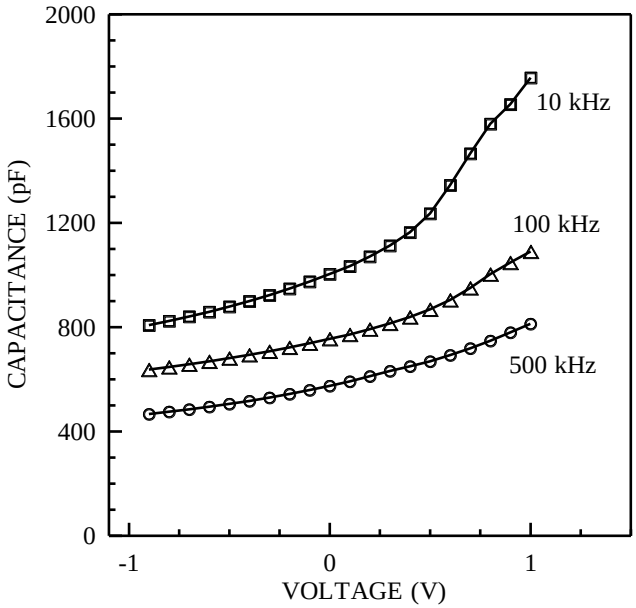

Fig.6. The C-V plots at frequencies of 10 kHz, 100 kHz and 500 kHz for the Ag/MV/p-InP MIS diode.

Fig.7 shows the C^{-2}-V characteristics at frequencies of 10 kHz, 100 kHz and 500 kHz for the Ag/MV/p-InP MIS diode. The C^{-2}-V plots are linear which indicates the formation of Schottky junction [44]. By using standard Mott-Schottky relationship between capacitance-voltage [17,18], the values of diffusion potential (V_d), barrier height and acceptor carrier concentration (N_A) for the Ag/MV/p-InP MIS diode were calculated from the linear region of its C^{-2}-V plot. The values of diode parameters are given in Table 1. As seen from the obtained values, the difference between $\Phi_b(I-V)$ and $\Phi_b(C-V)$ for the Ag/MV/p-InP MIS contact originates from the different nature of the *I-V* and *C-V* measurements. Due to different nature of the *C-V* and *I-V* measurement techniques, barrier heights deduced from them are not always the same. The capacitance *C* is insensitive to potential fluctuations on a length scale of less than the space charge region and *C-V* method averages over the whole area and measures to describe BH. The DC current *I* across the interface depends exponentially on barrier height and thus sensitively on the detailed distribution at the interface [17,45]. Additionally, the discrepancy between the barrier height values of the devices may also be explained by the existence of an interfacial layer and trap states in semiconductor [38,46].

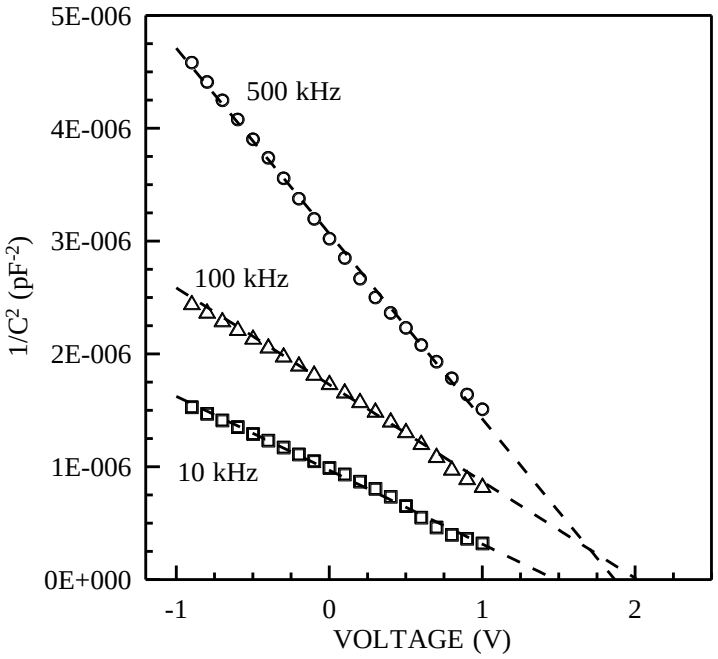

Fig.7. The C^{-2}-V plots at frequencies of 10 kHz, 100 kHz and 500 kHz for the Ag/MV/p-InP MIS diode.

Table 1. Some diode parameters calculated from the C^{-2}-V plots.

Frequency (kHz)	**V_d (V)**	**Φ_b (eV)**	**N_A (x10^{17}cm^{-3})**
10	1.48	1.32	2.79
100	2.01	1.77	2.13
500	1.87	1.66	1.11

Conclusion

In conclusion, we have performed the electrical characterization of the Ag/MV/*p*-InP Schottky diodes. It has been shown that the MV organic film on *p*-InP wafer indicates a good rectifying property. The barrier height and the ideality factor of the diode were calculated from the *I-V* characteristic. We have compared the electrical parameters of the Ag/MV/*p*-InP contacts with those of reference MS diodes. We have reported that

the BH value of 0.84 eV obtained for the Ag/MV/*p*-InP diode was higher than the value of 0.64 eV of the reference Ag/p-InP MS diode. This has been attributed to the fact that the MV organic film increased the effective BH by influencing the space charge region of InP. The interface-state density of the Ag/MV/*p*-InP MIS structure was reported to be in the range of 2.57×10^{13} $eV^{-1}cm^{-2}$ - 2.19×10^{12} $eV^{-1}cm^{-2}$.

Acknowledgements

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A Research Study on Vibrating Elements and Consuming Electricity in Predictive Maintenance

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Abstract

Mechanical looseness is one of the common failures detected on machines and mechanical systems. In this research, resonance effect that is a problem for mechanical systems has been studied within perspective of mechanical looseness failure through a bearing. A test setup has been designed, built and located in laboratory environment. A bearing in the electrical motor, that is one of the elements in the test setup construction, has been chosen for acquiring data throught acoustic, vibration and electrical consumption during the test. The purpose of this research is testing condition monitoring of mechanical looseness failure and resonance for studying comparison of different predictive maintenance perspectives. The test was implemented at the electricity frequency of 40.5 Hz that forced the electrical motor through identified rotation speed. According to the analysis results, inspecting of mechanical looseness failure and resonance problem has been detected as the most effectively by vibration analysis.

Keywords: acoustic, electrical consumption, mechanical looseness, resonance, vibration

Introduction

Mechanical failures mainly face with common problems such unbalance, misalignment, mechanical looseness and so on. These failures consequence changes in vibration and electrical consumption behaviour. Common maintenance techniques applied in production industries are breakdown maintenance, periodic maintenance and predictive maintenance. Predictive approach is the maintenance method which is performed on acquiring data about condition of the machine. Predictive technique is based on analysing symptoms of parameters such as acoustics, electrical consumption, vibration, heat, lubrication and etc. Resonance is one of the important problems for mechanical systems and mechanical looseness is an important failure for cause of the resonance problem. In this research, effect of mechanical looseness

on resonance problem has been studied in the perspective of acoustics analysis, vibration analysis, electrical consumption analysis and results are given.

If predictive maintenance used with proper techniques, it has limitless benefits for production industries [1]. As using an well designed test setup, precious data can be obtained and as transforming the data from time-domain to frequency-domain by Fast Fourier Transform (FFT) method, it assists for finding root causes in the perspective of prognostics [2]. Some techniques are developed in maintenance diagnosis for linear systems which can be transferred to non-linear systems as well [3]. As compared with an traditional maintenance implementation, 30% cost saving can be gained by vibration based maintenance [4]. It is suggested to make some artificial failure tests on systems before the installation in order to have idea about the sensitivity of the signals [5]. Manufacturing industries goes into more productive maintenance techniques respect to the competitiveness and deacreasing market place. So that, more efficient maintenance techniques get more importance to decrease the unit cost [6].

Materials and Methods

Test setup construction has elements as a double inlet fan, AC induction motor, five feet of flexible coupling and frequency inverter. The test apparatus is located on a steel sheet and a steel tripod. The test apparatus is mounted on a double-decker rubber sheet that is oriented between the test system and the tripod; also, a vacuum rubber located below each foot of the tripod on the floor. This system with a data acquisition card and an induction motor is connected to monitoring system through a computer. Testing design in Figure 1 presents an view.

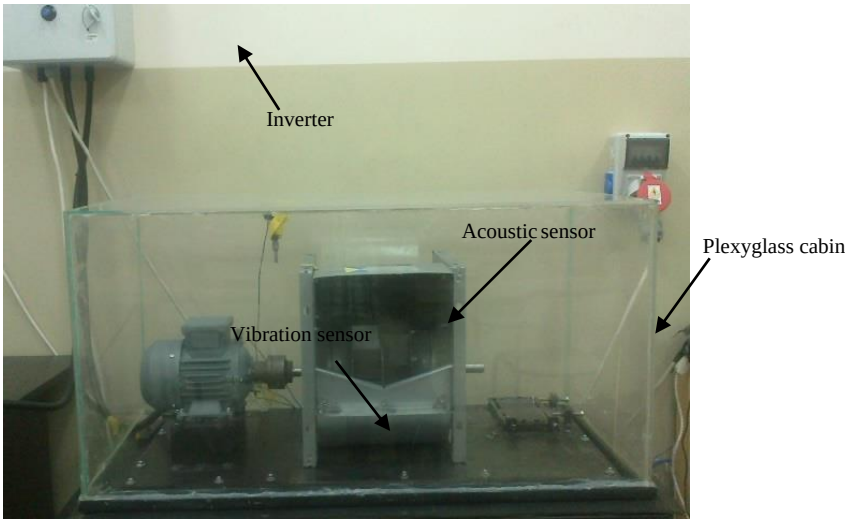


Figure 1. A view from the test setup

Frequencies set on inverter (I) and measured at spectrum domain (S) are shown in Table 1. Theoretical frequencies shows the value set on the digital frequency changer; respect to data during the application, set frequency ranging suffered some losses. Frequency at 1x is a frequency that is fundamental frequency; 2x, 3x and the upper orders are harmonics of fundamental frequency. In Table 1, the frequency is shown with the symbol of f for frequency changer and harmonic order presented with symbol of h.

Table 1. Harmonics

(h) / (f)	1x		2x		3x		4x		5x	
	I	**S**	**I**	**S**	**I**	**S**	**I**	**S**	**I**	**S**
40.5	40.5	39.06	81	78.12	121.5	117.18	162	156.24	202.5	241.56

Measurements were made during the tests at electrical frequency 40.5 Hz and rotational period was measured as 2350 min^{-1}. Frequencies of failures and harmonics are considered during calculation of the bearing and fan-caused vibrations of the test apparatus.

Bearing equations with the fundamental fault frequency calculations and respect to measurements are given in Table 2.

Table 2. Fault frequencies

f (Hz)	ω_s (Hz)	ω_{bpf} (Hz)	ω_c (Hz)	ω_{bpfo} (Hz)	ω_{bpfi} (Hz)	ω_{bsf} (Hz)
40.5	39.06	390.6	14.84	118.74	193.76	76.69

ω_{bpfo}: Outer ring passing frequency (Hz), ω_{bpfi}: Inner ring passing frequency (Hz),

ω_{bsf}: Ball spin frequency (Hz), ω_c: Cage frequency (Hz), ω_s: Shaft frequency (Hz),

ω_{bpf}: Fan blade passing frequency (Hz)

In order to practice condition of mechanical looseness failure, looseness of 0.5 mm is created by using shims under front feet of the electric motor. Tested bearing has been shown in Figure 2.

a) Tested bearing lubricated b) Creating looseness with shim

Figure 2. Tested bearing

In order to decide about the measurements, data from acoustics and vibration methods have been processed with FFT (Fast Fourier Transform) approach and data has been transferred for making analysis. Electrical consumption data has been processed respect to the algorithm of the device software and analysis are made by PSD (Power Spectrum Density) and trend indicators.

Experimental

Vibration measurements are received in radial (vertical) direction in the tests. Acoustic measurements are recieved in omni-directional over the test setup under plexyglass cabin. Vibrational and acoustic data captured with sensors through a DAQ (Data Acquisition Card) and processed with a software. For detection of natural frequencies in order to make comparison, damping tests are practised on test setup when the system is not in rotational movement. Data of electrical consumption has been received through an electronic device connected to electrical circuit of the motor and analyzed with a software.

Acoustic Analysis

Frequencies of acoustic data received based on rotation of shaft and bearing elements has been presented in Figure 3 and the highest five amplitudes are given. The main rotation frequency is 39.06 Hz and the highest amplitude signal has been detected at this frequency with the amplitude of 5.32 Pa. An other order of the main frequency has been detected at 351.6 Hz (9x) that is the third dominant signal in the spectrum domain. Third dominant acoustics signal appeared at 156.3 Hz (4x) with the

amplitude of 0.703 Pa. The other two dominant signals have not integer orders of the fundamental frequency. Fourth dominant signal detected at 410.2 Hz is the harmonic 10.5x and fifth signal detected at 253.9 Hz is the harmonic 6.5x.

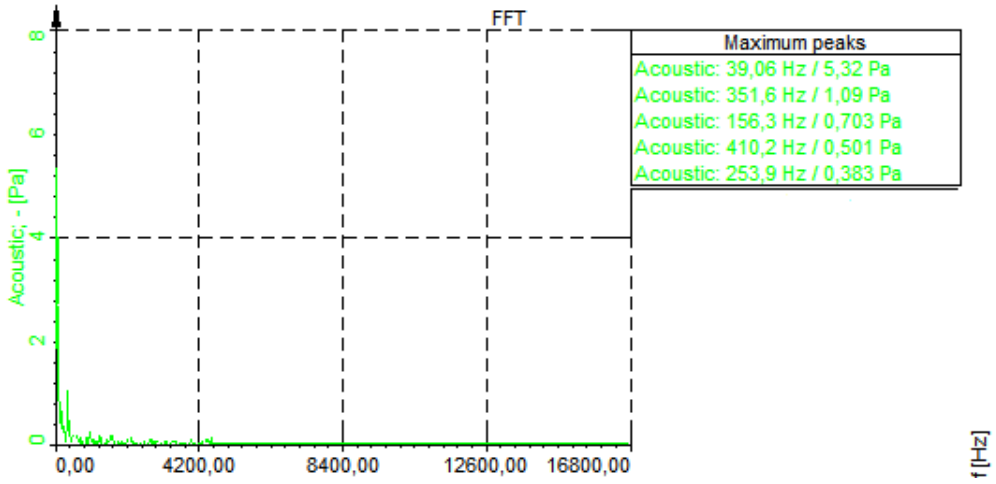


Figure 3. Spectrum in acoustic data

Vibration Analysis

Unbalance harmonic 1x has been detected as the most dominant signal in radial direction with the amplitude of 1.19 m/s^2. In radial direction, signal at 860.72 Hz that is the upper harmonics of cage frequency (58xω_c) excited a signal at the frequency 866.7 Hz which is a natural frequency and consequently superharmonic resonance has been observed with the signal amplitude as 0.278 m/s^2. The other resonance effects are detected at second and third dominant signal in frequencies of 947.3 Hz and 120.8 Hz. Signal in upper order of cage frequency at 949.76 Hz (64xω_c) has excited the natural frequency at 947.3 Hz and subharmonic resonance has been appeared with the amplititude of 0.4 m/s^2. Signal at 117.18 Hz (3x) has excited the natural frequency at 120.8 Hz and superharmonic resonance has been detected with the amplitude of 0.298 m/s^2. Signal at harmonic 2x has been appeared as the fourth dominant signal.

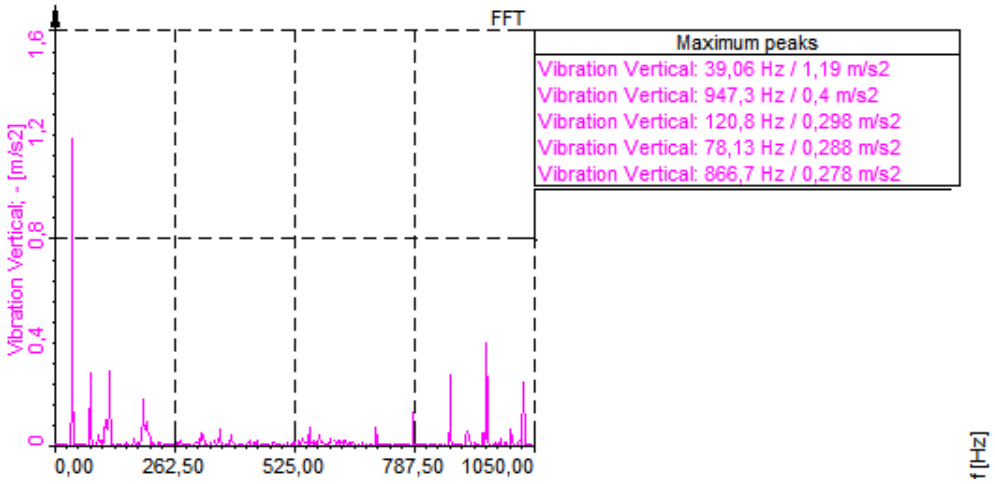


Figure 4. Spectrum in vibration data

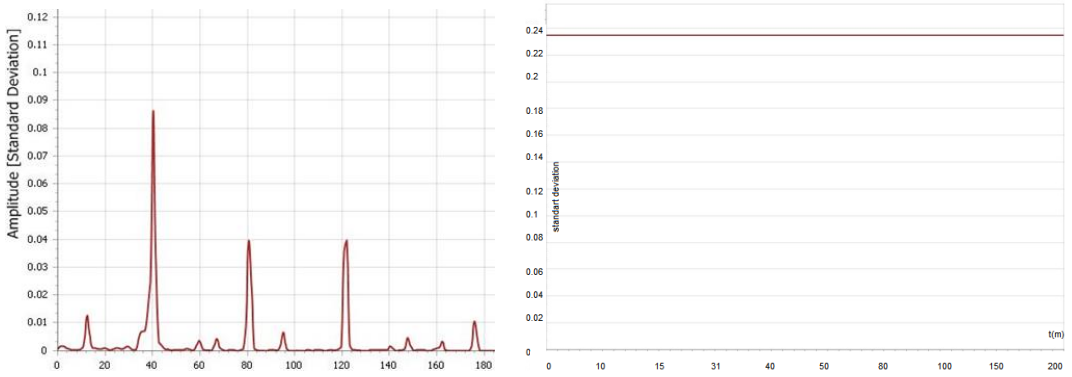
Respect to the Figure 4 and Table 3, mechanical looseness increased the vibration magnitude of signals at the rotor zone.

Table 3. Harmonics respect to dominant vibration signals (S:Signal)

MEASUREMENT	1.S	2.S	3.S	4.S	5.S
Mechanical loosenes	1x	f_n (64xω_c)	f_n (3x)	2x	f_n (58xω_c)

Electrical Consumption Analysis

Standart deviations in measurements are evaluated in perspective of electrical consumption, data is given in PSD analysis and trend analysis. Respect to PSD analysis in Figure 5, peaks can be seen at the orders of 40.5 Hz. Highest three amplitudes are on 40.5 Hz, 81 Hz and 121.5 Hz. According to the methodological approach of device software, band at the main frequency represents the condition of the rotor, band at the second order represents the condition of bearing and band at the third order represents the any other failure. The PSD analysis takes attention to rotor and bearing.



a) PSD data b) Trend data

Figure 5. Electrical consumption data

According to evaluation of trend analysis in Figure 5, mechanical looseness indicator has not detected fluctuation in the condition of the bearing respect to the mechanical looseness failure.

Results and Discussion

In this test based research, resonance features of a test setup have been researched under the mechanical looseness condition effect on a bearing. Focusing with predictive maintenance perspective; methods of acoustics, vibration and electrical consumption analysis are studied in order to detect the condition of a tested bearing.

According to analysis results of acoustic measurement; symptoms are appeared partly on effect of mechanical looseness failure but bearing frequency and resonance frequencies are not found in the acoustic data.

Respect to vibration analysis, bearing failure frequencies and resonance frequencies are detected in spectrum data under the mechanical looseness failure.

Electrical consumption analysis is successful in detection of mechanical looseness failure in PSD respect to the band of rotor, but not in trend analysis.

In comparison of acoustic, vibration and electrical consumption analysis results; vibration analysis has been decided as the most informative and accurate tool for inspecting the resonance features of the tested system in the condition of mechanical looseness failure at the level of 0.5 mm.

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Consent to Treatment and Anamnesis as Problem of Communication with Minor Patients in Healthcare Decision-Making

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Abstract

Lately lawyers and medical professionals pay more attention too the process of minor patient healthcare. The research shall address the issues of legal relationship between minor patients and medical professionals, consent to treatment of minor patients and communication problems including the scope of information which the doctor can provide to the minor patient's relatives to protect themselves and patients. Legislation prescribes that the information provided by the medical professional to the minor patient must be not only easy-to-understand, but also be consistent with the patient's age maturity. However, in Latvia, for example, there are no guidelines that specify how medical professionals can determine the patient's maturity. In the course of provision of medical services to the minor persons legal disputes involving communiucation failures between the minor patients, their relatives, legal representatives and the doctors arise increasingly frequently. The research will look into issue of communication problems in healthcare. The aim of the research is to provide insight into challenges of legal relations betweem minor patients and medical professionals and communication problems in healthcare.

Keywords: consent to treatment, minor patient, healthcare professionals' rights, human rights, communication in healthcare

Introduction

The research covers such important issues of the relations between minor patients and medical professionals as relevance of communication in the process of medical treatment, areas of concern related to rights and obligations of the parties and their solution.

The choice of the topic of the research was prompted by practical issues encountered by medical professionals both in Latvia and in the other countries of the European Union. Working with the minor patients it is necessary to take into account a number of aspects, such as restrictions pertaining to treatment of this group of people and peculiarities of communication.

The aim of the research is to provide insight into regulation of legal relations between minor patients and medical professionals in order to study communication problems of the parties' interaction as part of the process of medical treatment and most common instances pertaining to the minor patients' rights and obligations.

The research reviews in general terms the cases when a minor patient has the right to accept or to refuse medical treatment, what may influence his choice. Particular importance is attached to the concept of minors and its relevance to the process of medical treatment. At the same time the research paper reviews the provisions of the Latvian legislation and European legislative framework on this issue.

Treatment of the minor patients also depends on the behaviour pattern of the medical professional and the ability to explain the situation to the patient. The way and the manner in which the medical professional communicates with the patient determine the progress and the results of medical treatment. Due to the fact that minor patients are a special group of patients it is important to be aware of the potential risks and significance of the incomplete communication process. Therefore in order to address the issue of the importance of communication communication process has been analysed taking anamnesis of minor patients.

The research operates mainly with analytical and comparative methods. It provies the opportunity to accomplish the objective targeted by the research more accurately. Alongside with that theoretical research method is employed in the paper.

The concept of minor patients and miscellaneous age theresholds in the enjoyment of the rights.

In actual practice medical professionals increasingly frequently must consult the rights of the minor patients. How to respect the rights of the minor patients, be deferential to the minors' opinions, views and beliefs.

Medical professionals are not always sure up to what point the minor patients are allowed to make decisions on their own, in which cases the consent of some other person to the treatment of the minor person is required and starting with what age the minor is authorized to make decisions with regard to the process of his treatment by himself. The scope of obligations of the healthcare professionals in accordance with the specifics of the activities are included in the regulatory enactments regulating the procedure of healthcare services provision (Slokenberga, Gusarova, Lieljuksis, Mucins, Stanislavska, Saberte, Slisere, Taurina, 2015). However, the answers to these questions can be also found by reviewing the regulatory enactments

of the Republic of Latvia unrelated to medicine. In particular regard must be also paid to international regulatory enactments.

Article 219[14] of the Civil law of Latvia prescribes that minority of persons continues until they attain the age of eighteen. In exceptional circumstances the person may be declared as being of age of majority at the age of 16 already.

Until the achievement of the age of 14 minors have only the right to be heard and to participate in making of the relevant decision related to treatment according to their age and maturity, however, they cannot give consent to their treatment. Treatment of such persons is permitted only upon receipt of the consent of their lawful representative.

However, upon the achievement of the age of 14 minors have the right to give consent to their treatment themselves and only in case of the refused treatment by the minor, if the doctor believes that the treatment is in the best interests of the patient, the doctor is authorized to request consent of the minor's parents or other lawful representatives. It follows from the above-mentioned that irrespective of the achievement of the age of 14 the person's rights to refuse treatment are limited. It must be noted that in Great Britain the approach is different.

In 1983 the criteria for establishing whether a child is capable of giving consent to treatment were defined - 'Gillick test'. This test shows whether children under 16 are able to fully understand what the proposed treatment involves including its purpose, risks, likelihood of success, etc.[15].

Sexual and Reproductive Health Law[16] of the Republic of Latvia with regard to termination of the patient's pregnancy presribes other age restrictions than the Law On the Rights of Patients[17] of the Republic of Latvia. Age restriction determined in Article 27 of the Sexual and Reproductive Health Law[18] of Latvia is 16 years. Until the achievement of the age of 16 the patient has the right to be heard to by the doctor and the doctor must pay due consideration to the patient's beliefs taking into account the patient's age and the degree of maturity. Consequently, if the patient herself expresses a wish to terminate pregnancy, the decision about termination of pregnancy is actually adopted at least by one of the parents or by the guardian giving a written consent. Part four of Article 27 of the Sexual and Reproductive Health Law of Latvia [19] provides the answer to the question what are the options of the patient who cannot convince her parents or guardian to allow termination of pregnancy; namely – the patient is authorized to ask the Orphans Court to deliver the judgement. Probably the

[14] Article 219 of the Civil Law, date 14.10.1998., as amended
[15] Gillick respondent and West Norfolk and Wisbeck area Health authority first applellants and department of Health and Social security second appelants, http://www.bailii.org/uk/cases/UKHL/1985/7.html
[16] Sexual and Reproductive Health Law, date 31.01.2002., as amended
[17] The Latvian Law On the Rights of Patients No 205, dated 17.12.2009, as amended
[18] Article 27 of the Latvian Sexual and Reproductive Health Law dated 31.01.2002., as amended
[19] Article 27 of the Latvian Sexual and Reproductive Health Law dated 31.01.2002., as amended

legislator believes that the decision of the parents or the guardian sometimes may be based on prejudice and the Orphans Court can render a more comprehensive assessment whether preservation of preganancy is in the best interests of the patient. This naturally brings up the question as to how long it will take the Orphans Court to consider the issue. It may happen that the judgement of the Orphans Court is delivered at the time when from the standpoint of the patient's health pregnancy termination is no longer permitted.

Whereas if the patient herself has not expressed a wish to terminate pregnancy, then the consent of one of the parents or the consent of the guardian is not sufficient. The approval of the council of physicians that the patient has medical indications for the pregnancy termination is needed, or a certificate issued by the police, prosecutor's office or the other law enforcement institution in case of the patient's pregnancy resulting from rape.

Therefore it follows from part four of Article 27 of the Sexual and Reproductive Health Law of Latvia [20] that also in the event when the parents or the guardian have given their consent to termination of pregnancy and there exists additional relevant condition (i.e. the approval of the council of physicians that the patient has medical indications for the termination of pregnancy, or a certificate issued by a law enforcement institution in case of pregnancy resulting from rape), the patient is entitled to address the Orphans Court and ask for the injunction to perform termination of pregnancy. The law does not specify what the doctor must do in case when the patient submits to the doctor an application addressed to the Orphans Court containing a request not to allow termination of pregnancy with the stamp of the Orphans Court testifying to the receipt of the application. On a formal level in the event of presence of the above-mentioned criteria prescribed by the law the doctor must perform termination of pregnancy. On the one hand, this would be logically reasonable, because in separate cases the doctor cannot wait until the Orphans Court renders a judgement, however, on the other hand, terminated pregnancy cannot be reversed and the Orphans Court even if it finds the parents' or the guardian's decision incorrect shall not be in the position to restore the previous condition.

Therefore the national regulatory enactments secure the patient's right to be the master of his health and life. However, these rights are limited as well (Šulce – Rēvele, Līkanse 2013).

International legislative framework

The tendency shows that cooperation between minor patients and healthcare professionals becomes more associated with human rights.

The research based on the human rights issue helps to gain a greater understanding of the scope of the patients' and healthcare professionals' rights and obligations. More

[20] Article 27 of the Latvian Sexual and Reproductive Health Law dated 31.01.2002., as amended

importantly is to understand to what extent the parties can exercise certain rights. (Exster, 2002).

One of the international master documents that must be reviewed is the Convention for the Protection of Human Rights and Dignity of the Europe's Convention for the Application of Biology and Medicine [21]. Second part of Article 6 of the Convention prescribes that if according to the legislative instruments the minor cannot give consent to performance of actions related to his health, then these actions can only be performed upon receipt of the permission of the minor's representative or the permission of the authorities, persons or instutitions determined by the law. Whereas Article 6 also prescribes that in adoption of the decision key attention must be paid to the minor's opinion with due regard of his age and degree of maturity.

Similar regulation is contained in the Convention on the Rights of the Child, where in part one of Article 12 it is mentioned that the member states must ensure that every child who is capable of forming his opinion has the right to express it freely with regard to all issues pertaining to him, furthermore due attention must be paid to the opinon of the child according to the child's age and degree of maturity.

If follows form the foregoing that the rights of the minor patient to provide his opinion in the course of the treatment process expand with the increment of the minor's age and the degree of his maturity. This means that the rights of the lawful representative to adopt decisions on behalf of the minor become relatively abridged.

Peculiarities of communication during the process of medical treatment

Cooperation of the patient with the medical professional begins with the visit. It should be noted that taking of the children's anamnesis is a more complicated process and involves a number of specific aspects. Intake of the children's anamnestic data includes interviewing of their parents or the persons who take care of the child. One of the major problems a medical professional may face when interviewing a child, i.e. a minor, is how the parents and the child himself look upon their health problems and are capable of reporting them. Quite often a situation may be observed when a mother or any other lawful representative describes the child's health problems and the medical professional listens only to the lawful representative. Whereas the patient is a minor and it is him who is experiencing somatic problems and can decsribe them more accurately than the lawful representative. Minors obey their parents and usually trust them, which may result in a situation when a child after having listened to his mother's or the other person's story may develop false memories about his health condition. This happens due to complicated interaction of miscellaneous memories, beliefs and anticipations in the patient's mind. Owing to the memory the patient can remember and answer the doctor's questions when they are asked. Studies show that a lot of people believe that our memory functions very much like a tape-recorder,

video-camera or a DVD, namely, human memory in the same way as these devices stores and plays back the events exactly in the way we experienced them (Alvarez, & Brown, 2002; Lenca, & Mills, 2009; Loftus, & Loftus, 1980, as mentioned by Lilienfeld, Lynn, Ruscio, & Beyerstein, 2010). Unfortunately human memories do not exist in a vacuum, they are more likely to interfere with one another in most complicated ways (Green, 1992).

Human memories are by no means the exact replicas of the past events (Clifasefi, Garry, & Loftus, 2007). Human memory is a much more complicated process than it may initially seem. However, it is the patient's memories of his illness that is the first and the most important way to take the anamnesis. Simply stated, memory is the ability of the human brain to encode, save, maintain and later retrieve the information and past experience (Andrade, 2008). Episodic memory is stored in the brain in such a way as to enable the person to remember an event of his life that he experienced a few minutes ago or even a few years ago, also remembering a number of aspects related to the event, for instance, such as perceived details, thoughts, conclusions and emotions (Gonsalves, & Paller, 2002). Neural circuitries that activate the retrieval of these memories, however, do not secure exact recording of any event. Just the opposite, episodic memory retrieval is a reconstructive process where the person starts to use the retained information which is often limited and incomplete. In the reconstructive process at the moment of the event retrieval the memory is deformed (Barlett, 1932; Schacter, 1995; Schacter, Norman, Koutstaal, 1998, as mentioned by Gonsalves, & Paller, 2002). Fundamentally memory consists of the person's background knowledge (Mitchell, & Johnson, 2009), current mental state (Jacoby, Wahlheim, Rhodes, Daniels, & Rogers, 2010) and current emotional state (Brainerd, Reyna, & Aydin, 2010). This is exactly why memory is not the ideal record-keeping of the ouside world. Episodic memory involves a reconstructive process that makes it more prone to errors and distortions and false memories are the "by-product" of the constructive memory system (Gallo, 2010).

Studies prove that memory is not reproductive – it does not reflect the bygone information accurately, but reconstructs it. It means that what the patient remembers today is blurred precise memories intermixed with the patient's beliefs, needs, emotions and anticipations. These ancticipations rest upon the patient's knowledge of himself, the event he is trying to remember and similar situations from the patients's experience (Clifasefi, Garry, & Loftus, 2007).

In one of their experiments Loftus and Pickrell (Loftus, & Pickrell, 1995) manipulated with the fact that an elderly relative was telling the participants of the experiments the four events, the three of which were real and one unreal, however, the events were described in a way as if the experiment participants took part in them. Later during the interviews the participants revealed that actual events are retieved by the memory as real in 68% of the cases, while unreal events are reproduced as true in 25% of the cases. If this effect can be observed with the adults, then it can be affirmed

with fair certainty that the effect similar to the effect on the adults can be observed with the underage children. The experiment similar in concept to the experiment of Loftus and Pickrell (Loftus, & Pickrell, 1995) was repeated by Hyman, Husband and Billings (Hyman, Husband, & Billings, 1995). In that experiment noone of the research participants recognized false memories as real during the first interview, but when the same participants were interviewed for the third time, already 25.5% of them described the event as real memories. Various researchers in the experiments with the false memories of the event that had never taken place manipulated with miscellaneous factors and discovered that a man can be convinced to be involved in the events that he had never experienced, for instance, medical procedures (Porter, Yuille, & Lehman,1999). From neurocognitive point of view there is a similarity between the way how the imagined and perceived events are encoded (Johnson, Hashtroudi, & Lindsay, 1993), which actually means that if the person imagines or overinterpretes the experienced event, both pieces of information are encoded in the brain in a similar fashion. Exactly the same may happen to the minor patient. For instance, if the mother has a track record of her child's usual illnessses, she may subconsciously adjust her story to her anticipations. Human memories can be affected and therefore can be modified with any information that the person receives already after the experienced event (the so called postactive interference), or with the information that was available to the person before the same event (the so called proactive interference) memories of which were formed (Green,1992). In practice quite often it can be observed that the patients when visiting a doctor have anticipations about their potential diagnosis and therefore the patient adjusts his symptoms to the invented diagnosis. This may be called proactive interference and it affects the intake of anamnesis. In the same manner it may happen that the doctor first tells the patient his anticipations and the patient after having received this information may imagine the details without being aware of it himself. This may be called postactive interference, which also affects the anamnesis. All this is especially dangerous if working with the minor patients, therefore medical professionals must be particularly observant and cautious when taking anamnesis, due attention must be paid to questioning the child.

Usually the intake of anamnesis starts with questioning. Taking anamnesis of the minor patients the medical professional for the most part puts these questions to the child's lawful representative in the presence of the child. In practice quite often it can be observed that doctors ask very precise questions, for instance, such as "Can you say that the child's left side hurt more?" Research shows that asking very specific questions may affect the patient's memory which respectively affects the patient's answers and may distort the anamnesis. In the experiment of Loftus and Palmer (Loftus, & Palmer, 1974) the participants of the experiment were offered to watch the film featuring several car accidents, then they were split into three random groups and each group received a different set of questions. Research results showed that the wording of the questions affects the response. This misleading effect demostrates that

when suggestive and more detailed information is received after formation of the real memories it may replace or transform the old information (Okado, & Stark, 2005; Loftus, & Hoffman, 1989; as mentioned by Straube, 2012). It means that while taking the anamnesis a medical professional must aim at asking more general questions, for instance, such as "Which of the child's sides hurt more and what can it be evidenced by?".

Conclusions

As reflected by the research, there exist several problems in the relations of medical professionals and minor patients. On the one hand, the law protects minor patients, yet at the same time it abridges the rights of medical professionals. Healthcare professionals are unable to provide high-quality care unless their rights are respected. Medical professionals must work under decent conditions, yet maintaining professional independence. (Hervey, McHale 2015).

Responsibility of the healthcare professionals for the health of the patient is enormous. However, the doctor's responsibility for the observance of the patient's rights and obligations is equally important. Performing his daily functions the doctor does not merely have to act as a specialist, but he must also be familiar with the legislative changes and their trends.

Reviewing the issue of the minor patients' rights and obligations in the process of medical treatment in Latvia and the issue of peculiarities of communication with the healthcare professionals allows for the conclusion that::

1.the patient who has reached the age of 14 has the right to refuse medical treatment and to adopt any effective resolution provided further that the doctor anticipates hazard effects of the patient's actions;

2.the patient who has reached the age of 14 on the one hand, is mature enough and is authorized to take a decision about his treatment himself, on the other hand, assessment of the degree of maturity of the patient is an extremely complicated process that is not regulated by the Latvian legislation;

3.working with the minor patients lays enormous responsibility on the medical professional. On the one hand, the doctor must be concerned with the health and survival of the patient, on the other hand, he must respect the human rights of the minor patient.

4. increased attention must be paid to the minor patients themselves, questioning must begin with the minor patient and not with the child's lawful representative.

5. in the course of communication with the minor patient and the patients's lawful representative it is necessary to refrain from announcement of the presumable diagnosis, if there is no absolute certainty about it, also when taking the anamnesis of

the minor patients it is necessary to refrain from specific questions aiming at asking general questions without specific indications.

It should be noted that if the relations between patients and medical professionals were viewed in the context of human rights, exclusive right to life would be taken as a governing principle (Abraham, Lewis, 2000).

In view of the above-mentioned it must be concluded that the Latvian statutory enactments regulating the rights of the minors in the process of medical treatment are incomplete. Proficient and professional communication of the healthcare practitioners with the minor patients are not sufficiently secured either at the legislative level or from a practical standpoint.

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Implementing a Simulation Model for the Evaluation of BGP Updates Impact on Real-Time Applications

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Abstract

Border Gateway Protocol (BGP) is the actual routing inter-domain protocol in the Internet. The size, heterogenity and changebility that characterize todays Internet put always increasing requirements on BGP performance. The research community has already reported the unwanted characteristics of BGP like low integrity and slow convergence through theoretichal analyzes andd empirical measurements. Simulations allow for more realistic and flexible experiments than the theoretichal approach and also lower costs than the measurements in real life environments. The first part of this work describe theoretically characteristics and problems related to BGP nd also expectations of the today Internet users to real time applications (like VoIP). The second part concentrates in identifying and implementing of the elements for creating an integrated simulation environment for evaluating dhe effects of slowconvergence of BGP in these applications. At last it is evaluated the created environement through some small scale simmulations that try to model the now days Internet Structure.

Keywords: AS, BGP, QoS, Simulation, NS2.

Introduction

The Routing Modeling

Using the topology generator offers us the possibility of obtaining topologies closer to reality and is a practical tool. The problem lies in the fact that GT-ITM generators provide network topology but does not allow modeling of how packets are transmitted in the network. Therefore it is necessary for this part to be implemented by the user himself.

In this case, the interest falls on the routers which enable communication between the Autonomous Systems that implement BGP routing protocol. What should we model is exactly how these routers communicate with each other through e-BGP sessions, routing tables that build the way how they share the information.

Unfortunately, BGP doesn`t offer a prepared module for the implementation of the BGP. Consequently, referring to Figure 1, you need to make some modifications to the code ns2 in order to install the appropriate module. BGP for ns2 module, known as ns-BGP, is adopted to ns2 in 2004 [14] initiated by the BGP and TcpSocket modules from SSFNet [26] and implementing this protocol version 4 (BGP-4). SSFNet is a network-based simulator that enables Java language simulations through a configuration known as DML (Domain Modeling Language). With that SSFNet is based on Object Oriented language, its BGP module was a good starting point for ns2 module.

In ns2, unicast routing is achieved using tracking plans and control. The first plan makes the classification and the forward of the packets to the destination using the classification and routing modules. Classifier module manages routing node and provides an interface for the routing plan. Classifier are two types: address classifier and ports classifier. Packet classifier controls the address and sends it to dmux if it is the node itself the destination node of the package or transmits it to the following node. Dmux passes the packet to an agent in accordance with a specified destination port. While the second plan allows for the creation of the road, processing, routing algorithms and management of routing tables. Figure 1 illustrates the structure of ns-BGP unicast based on the initial structure of unicast for ns2.

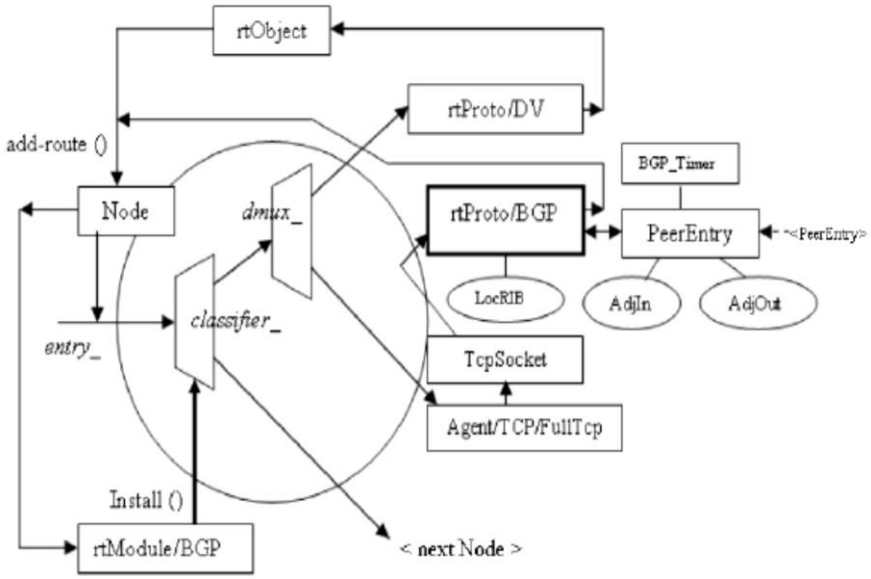


Figure 1: *unicast strcture of ns-BGP*

As shown in the figure, the classification modules as classifier of the gate and the address send incoming packets to the respective agent or an outgoing link. These modules themselves are managed by the routing module.

Control plan consists of the following components: the logic path, the routing object, the side of the path and routing protocol. The central routing table is sustained by routing logic and routing facilities used in simulations with dynamic routing. Routing Objects encapsulate routing protocol by capturing and holding the attributes of each route announced. Finally, from the components of the routing protocol have been implemented and some specific routing algorithms.

Moreover, since the node BGP derives from a node unicast ns, Figure 1 shows and the inclusion of specific modules of the BGP and TcpSocket BGP. rtModule / BGP module manages the IPv4Classifer object while the new protocol rtProto / BGP is located in TcpSocket modules for transmitting the packets.

For each communication part BGP, is allocated an object used to establish the connection, exchange BGP messages and close the session. Four key classes used in the implementation of the BGP are:

TcpSockets

A socket is an Application Programming Interface (API) used in communications network. Applications treat socket connection to the network as the UNIX file descriptor. Similarly with the files, communications ends can be written by providing reading or erasure opportunities.

TcpSocket class is added as an implementation of the API socket, similar to the UNIX implementations. Its main functions are obey, hear, connect, close, read, and write.

IPv4Classifier

IPv4Classifier derives from Classifier class. It is implemented as a doubled class in ns2 (in C ++ and OTcL). This class uses the map from the standard libraries of C ++ models to store and look in the routing tables. To classify an incoming packet IPv4Classifier controls destination address of the packets and uses the information in the routing table to identify the paths.

rtModule / BGP

rtModule / BGP is a new routing module implemented in Tcl that provides a registration interface. When a node is created the information must be registered and the existing objects *classifier* in the joints must be replaced.

rtProtoBGP

rtProtoBGP Class (Agent / rtProto / BGP) is implemented as double class in ns2. An instance of this class implements BGP-4 in a node. This new routing protocol realizes most of the actions of BGP, setting communication session BGP between the parties,

learning different paths through BGP speakers , selecting the best route and its preservation in the table (IPv4Classifier), and management of BGP situations.

Finally we can say that ns-BGP is in accordance with RFC 1771.

This module offers the option of setting BGP timers and the ability to implement the path deliberators.

Data model building

The traffic model type that is used to understand the traffic flow in the network and the approximation level with the reality, are vital parametres for the network.

Traffic analyse offers informations of average loads type, requests about the bandwidth in different applications etc. Traffic models helps network designers to make suppositions about the newtwork based in an passed experience and also performance forecasts in accordance with the future requests.

In this paper our goal is to disinguish the effects that BGP update moments have in real time applications and specifically in VOIP.

Unfortunately ns-2 doesn´t have a prepared already integrated module for VOIP.

In this concret occasion is chosen the simplest way to model a traffic in real time, based also in the below sceme for the VOIP traffic.It´s structure is shown in the picture.

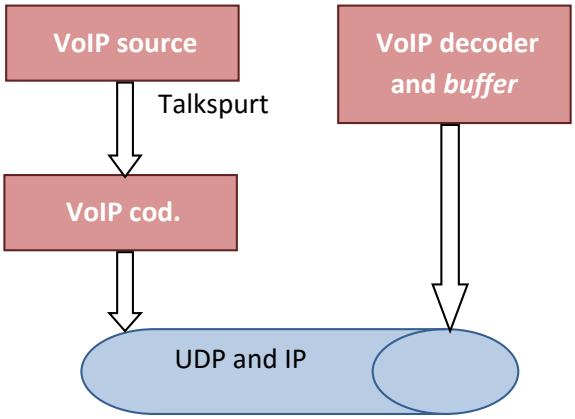


Figure 2: *VoIP module structure*

If we could simplify this sceme in ns2 level we can tell that the easiest way for generating VoIP traffic is by creating an UDP agent whom is putted a traffic agent in application level, CBR.

To define CBR parametres is used the settings table of different codifiers of VOIP.

Table 1: *Parametres for different codifies of VoIP*

Parametres	G.711	G.723.1	G.729
Bit rate (Kbps)	64	6.3	8
Interval between frames (ms)	20	30	10
Data size (Bytes)	160	24	10
Packet/s, Np	50	33	100

At the end we can say that for this paper purpose VOIP traffic is modeled as a data flow with a certain packet dimensions and transmission order.

The network state and the performance evaluation

Acccording the chart in the picture after is defined the network and the data model ,we can obtain the network state.

Ns2 is a simulator which depends from time and events. For this reason the network state is obtained by defining a start and end moment of the simulation and the events that will happend in this time.

In this paper the simulations are chosen that the average running time of a simulation is 80s. Simulations start at moment 0 and then are developed in order different events.

The first events group is exactly the information exchange of the routing between nodes. After nodes exchange information with each other, begins the CBR traffic transmission.This traffic will continue to be sent until the simulation time ends.

The second events group is the repeal and the continous announce of a path of a router. This normally will be accompanied with a refresh of the routing tables and will create delays in the network as consequence of the time of routers convergence. This is the moment where will be checked two of the quality main parametres packet loss and delays, so is realised the performance validation.

Model changes

In order to appreciate as exactly as possible the performance, according with the posed problem, several times is required that some of the models parametres to be changed.

This includes changing the nodes number,simulation scennario, etc.

Simulations and results

The simulation results for the created architecture are evaluated through different generated files. The used Software is Nestwork Simulator version 2.34 (ns 3.34) on the Ubuntu 8.10 operating system.

Routing Model chosen authentification

To verify the implemented routing protocol behaviour is done a simple test with the following specifications. Th epicture below shows the network topology used for simulation. The network consist of 3 AS where each of them is represented from a node AS 0, AS 1, and AS 2 (nodes 0,1 dhe 2 respectively). IP adress of each node is shown in the table.The adressing scheme is 10.(AS nr).(nodenumber).1.

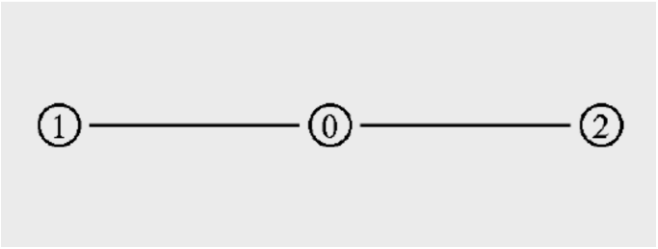


Figura 3: Network topology

***T*able 2** : *IP Adress*

node 0 10.0.0.1	10.0.0.1
node 1 10.1.1.1	1 10.1.1.1
node 2 10.2.2.1	2 10.2.2.1

BGP agents are configured in each of the three nodes (0,1 and 2). For the nodes 0 and 2 the interval values of *hold timer* and *keep-alive timer are* those by default specificated in RFC 1771 [15] (*hold time*: 90 s, *keep-alive* : 30 s). To see the situation in reconnection situation, the intervali of *keep-alive timer* for the agent BGP in node is kept in the 200 s value. This way the BGP agent in node 0 wonn´t receive the message ´´keep the connection alive´´during the time and will requesthe reconnection.

In the 0.25 s BGP agent in node 0 advertises a new path for the adress 10.0.0.0/24. In 0.35 s, the BGP agent in node advertises a new path for the adress IP 10.1.1.0/24. In 0.45 s, BGP agent in node 2 advertises a path for the dresën IP 10.2.2.0/24. In 28 s, 90.38 s, and119.0 s, ns2 shows routing tables for the BGP agents.The simulation ends in 120.0 s. *tcl* file for this simulation is attached in **Shtojca 1.**

time: 28
dump routing tables in all BGP agents:
BGP routing table of node0
BGP table version is 10, local router ID is 10.0.0.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 self - - -
> 10.1.1.0/24 10.1.1.1 - - - 1
> 10.2.2.0/24 10.2.2.1 - - - 2

BGP routing table of node1
BGP table version is 16, local router ID is 10.1.1.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 10.0.0.1 - - - 0
> 10.1.1.0/24 self - - -
> 10.2.2.0/24 10.0.0.1 - - - 0 2
BGP routing table of node2
BGP table version is 10, local router ID is 10.2.2.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 10.0.0.1 - - - 0
> 10.1.1.0/24 10.0.0.1 - - - 0 1
> 10.2.2.0/24 self - - -
time: 90.38
dump routing tables in all BGP agents:
BGP routing table of node0
BGP table version is 23, local router ID is 10.0.0.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 self - - -
> 10.2.2.0/24 10.2.2.1 - - - 2
BGP routing table of node1
BGP table version is 42, local router ID is 10.1.1.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.1.1.0/24 self - - -
BGP routing table of node2
BGP table version is 23, local router ID is 10.2.2.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 10.0.0.1 - - - 0
> 10.2.2.0/24 self - - -
Time: 119
dump routing tables in all BGP agents:
BGP routing table of node0
BGP table version is 30, local router ID is 10.0.0.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 self - - -
> 10.1.1.0/24 10.1.1.1 - - - 1
> 10.2.2.0/24 10.2.2.1 - - - 2
BGP routing table of node1

BGP table version is 56, local router ID is 10.1.1.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 10.0.0.1 - - - 0
> 10.1.1.0/24 self - - -
> 10.2.2.0/24 10.0.0.1 - - - 0 2
BGP routing table of node2
BGP table version is 30, local router ID is 10.2.2.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
> 10.0.0.0/24 10.0.0.1 - - - 0
> 10.1.1.0/24 10.0.0.1 - - - 0 1
> 10.2.2.0/24 self - - -

As it can be seen from the routing tables, every BGP agent learns about other agents during the 28 second. In the 39.0 second the session falls out between nodes 0 and 1 and nodes 0 and 2 remove the path toward the net 10.1.1.0/24 from their tables. Also node 1 deletes the paths that had for 0 and 2. After is reestablished the session nodes 0 and 1 exchange all the information that had in the routing tables and converge for the second time.This test verifies the correctness of the routing protocol model.

5.2 Stub-Domain with CBR traffic topology simulation

The topology used in the simulation is given in the picture below:

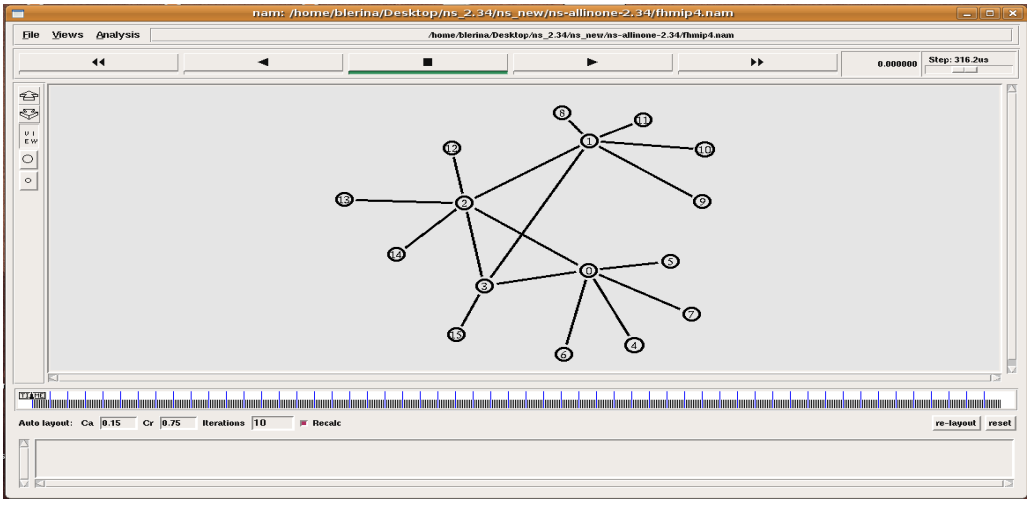


Figure 4: *Network topology according the stub-domain model*

As we mentioned above the topology is generated through GT-ITM according the model Transit-Stub of the Internet. The routing Module does not offer many adopting chances in case of a large number of nodes and as a result we have chosen the option of modeling a subgraph of the Internet.

This subgraph consists of a transit *domain* which has 4 nodes (BGP routers) and 12 terminal domains which are modeled with a router each one.

Tabela 3 : *graph settings*

Lloji i AS	AS number	Node number	Nodes
AS transit	1	4	0,1,2,3
AS terminal	12	12	4,5,6,..15

This topology is generated from the input file in the GT-ITM .

In the total we have 16 nodes. As shown in the table the transit domain is modeled with 4 nodes that exchange BGP communication with each other. All four these are (edge) routers. Transit AS is organised with a *cluster* and two path reflectors which are nodes 2 and 3. For terminal AS is chosen the logic of showing them through a node.This is in accordance with the AS definition. The adressing scheme is chosen in the form 10.0.$i.1 for the routers inside the transit AS where *$i* is the node number (0,1,2 or 3) and 10.$j.$i.1 for the routers in AS stub, where *$j* is for the AS number and *$i* for the node number (4,5..15).

The network configuration is realised as below:

BGP Agents are configured in each of the nodes. Interval values of *hold timer* and *keep-alive timer* are default (*hold time*: 90 s, *keep-alive* : 30 s).

UDP Agents are configured in nodes 0 (burimi) dhe 1. The traffic in these two nodes passes through node 2, according the routing tables.

CBR traffic is modeled with these settings: packetSize_ 160, interval_ 0.02 and rate_ 64kb.

After the node configuration, the following step is defining the scheduled events. In this simulation we want to see the convergence time of the three routers included in the communication which are n15, n3 and n2. The events are scheduled as it follows:

In 5.0 fillon transmetohet trafiku CBR

In 6.0 agent 15 shows the routing table

In 30.0 agent 3 shows the routing table

In 30.0 agenti 2 shows the routing table

In 35.0 agent 15 announces the net fall 10.12.15.0/24"

In 36.0 agent 15 shows the routing table

In 36.0 agent 3 shows the routing table

In 36.0 agent 2 shows the routing table

In 36.0 agent 15 network 10.12.15.0/24"

In 55.0 agent 15 no-network 10.12.15.0/24"

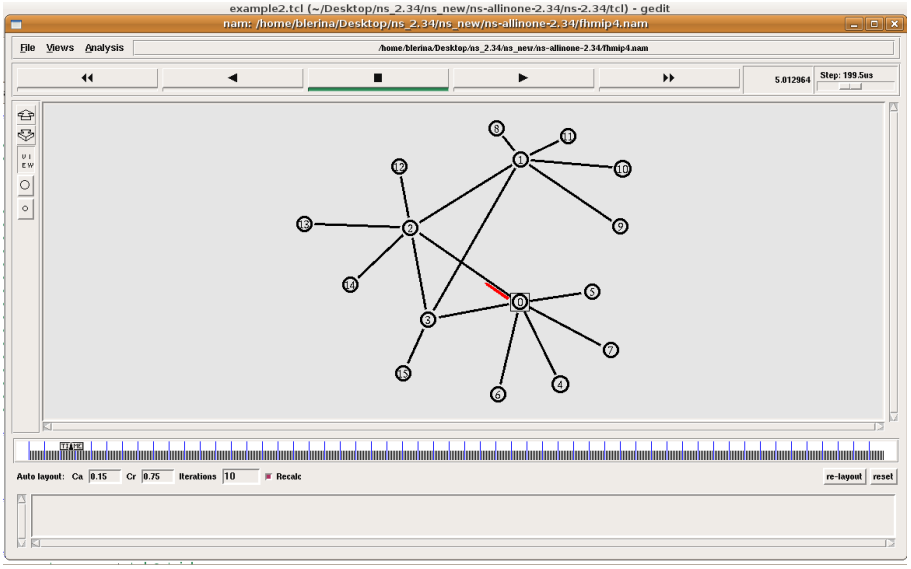
In 62.0 agjenti 3 shows the routing table

In 62.0 agent 2 shows the routing table

The last event is realised with the goal to see the system behaviour in a situation where a path is shown and is disconnected again and again during a short period of time (route flapping).

In this way it will be seen if there are lost or dalys in packets during BGP routing tables updates.

5.3 Simulation results



Through Nam, we see that the first packet CBR is generated in the 5.0 second:

Figura 5.-a: Is sent the first packet *CBR*

In the 35.0 second we see that is sent the information for a falling path from node 15.

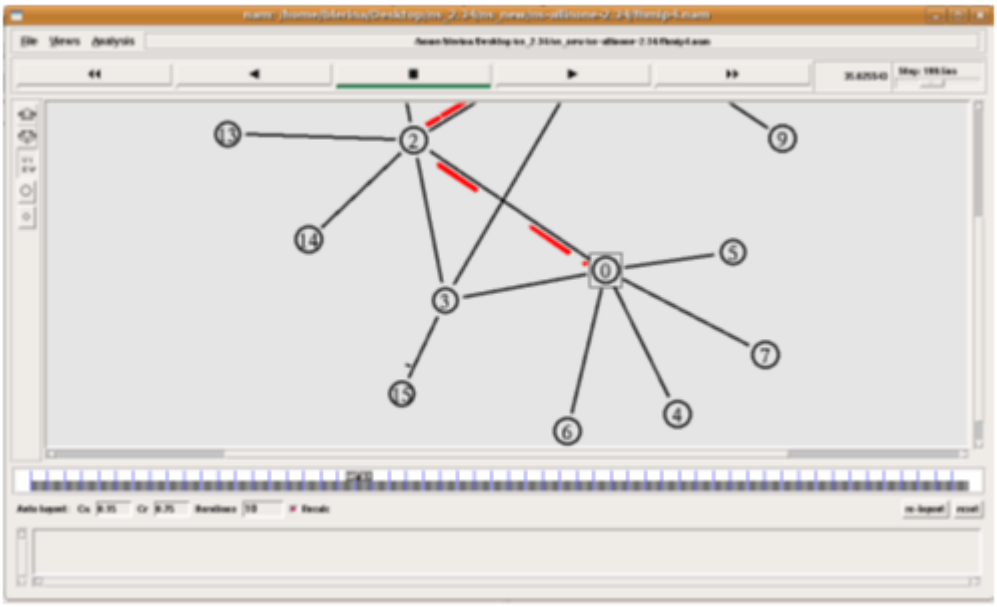


Figura 5.-b: Is sent the routing *information*

Node 3 learns about the node 15 fall and passes this information to its neighbours:

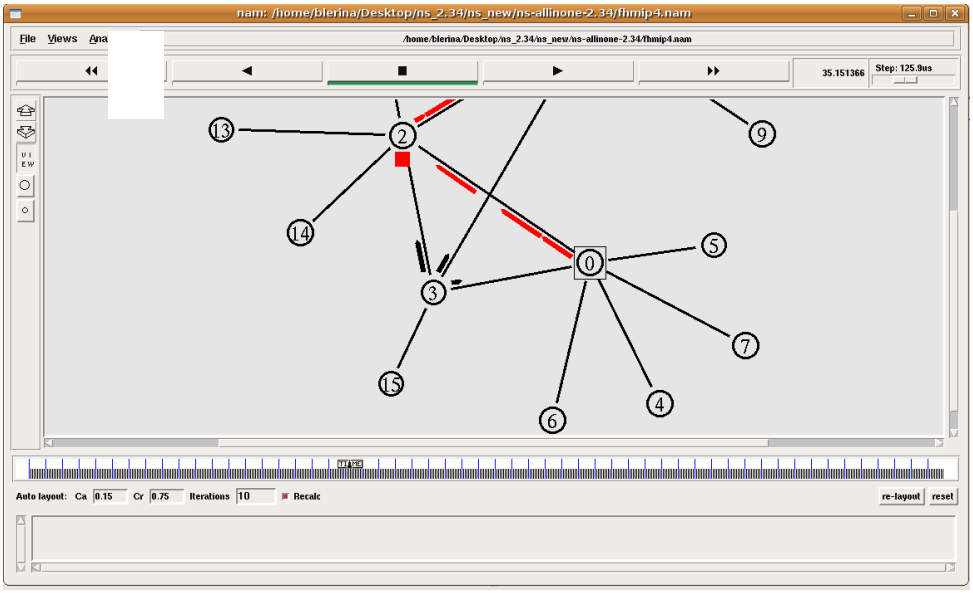


Figura 5.13-c: *Shpërndahet informacioni rrugëzimit*

During running time in the scrren we have this data about the routing tables.

Node 2 advertises node 13 about the changes in the routing as shown in the picture :

Figura 5.-d: The routing information is distributed from node 2

Meanwhile the routing tables in different moments are shown below :

Time: 30

BGP routing table of n3
BGP table version is 14, local router ID is 10.0.3.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
10.0.0.0/24 self - - -
10.1.4.0/24 10.0.0.1/32 - - - 1 i
10.2.5.0/24 10.0.0.1/32 - - - 2 i
10.3.6.0/24 10.0.0.1/32 - - - 3 i
10.4.7.0/24 10.0.0.1/32 - - - 4 i
……..

……..

10.10.13.0/24 10.0.2.1/32 - - - 10 i
10.11.14.0/24 10.0.2.1/32 - - - 11 i
10.12.15.0/24 10.12.15.1/32 - - - 12
BGP routing table of n2
BGP table version is 12, local router ID is 10.0.2.1
*Status codes: * valid, > best, i - internal.*
Network Next Hop Metric LocPrf Weight Path
10.0.0.0/24 self - - -
10.1.4.0/24 10.0.0.1/32 - - - 1 i
10.2.5.0/24 10.0.0.1/32 - - - 2 i
……..

……..

10.10.13.0/24 10.10.13.1/32 - - - 10
10.11.14.0/24 10.11.14.1/32 - - - 11
10.12.15.0/24 10.0.3.1/32 - - - 12 i

Based on this data we see that in the 30 second agents 3 and 15 have converged and have a clear information about the network.

In the 35 second is announced the network fall 10.12.15.0/24. Nodes 2 and 3 remove the path to this network from the routing tables.

In the 36 second the path is established again and nodes 2 and 3 must convergence in second 60, but in second 55 the path falls again. Node 15 adevrtises the network again

that the path is set up. All these falls and raises of the paths cause often packets sending which consume the bandwidth and the nodes elaborating abilities. Because the programmed module does not have mechanisms for "route flap damping" the network passes from a divergence state which can not be solved between 80 seconds chosen for the simulation.

After finishing the simulations the first element which is taken in consideration is the number of lost packets before to schedulate the unstainability event and after schedulation of this event.

From the registration file we see that in the case where the simulation is done without the events presence that cause path fluctuation lost packets are in the level 776. After the mentioned events this number goes in797. This means that the loosing level in packets is increased with 21 in 100 seconds of simulation.

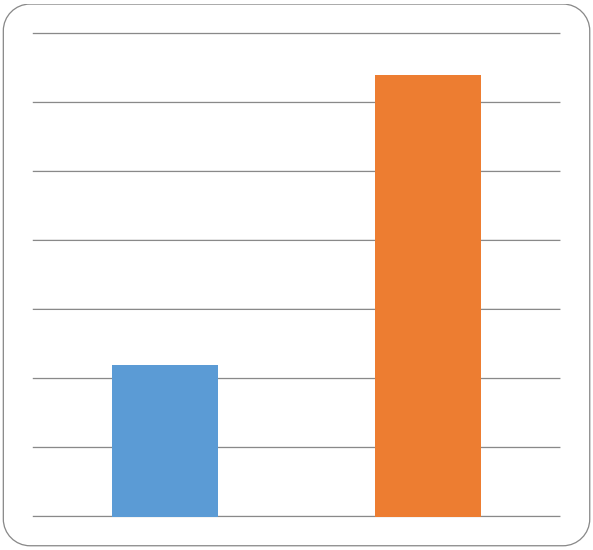


Figure 6: *Packet loss*

Conclusions

In this paper is offered an integrated environment for the simulations realisation which ai mis to study the convergence problem of BGP in the traficc of real time communications *croos-domain*. For this environment is followed a metodology which starts with the network model definition, ns2 modulesrmination and continous analysis "What-If".

Network topology modelation is a very important step. Internet modelling often is turned in a challenge as a result of its diversity nature, dimensions and heterogenity. To create a model near the reality are preferred to be chosen the random generators, but which models partly the internet hierarcy.

The realised simulations shows that the convergence time of BGP are in accordance with the base requirements for BGP. Also it shows that the convergence time problem affects directly in the traffic which permeats the networks. In a large simulation this affect will be multiplied in accordance with the network sizes taking in consideration the fact that the consumed bandwidth from the packets BGP is in related with network dimensions.

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Transforming Radio, Changing Listener

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Abstract

The new media concept, which emerged with the rapid change of technology, has also changed the perception of society to mass media. It is an absolute reality that the changing radio concept in the digitizing period has changed and transformed the listener along with it. It has also reformed the new media audience, which has been reformed with the convergence of mass media with technology, not only as an audience but also as a participant. As a result of convergence, new concepts such as interaction, synchronicity and mass unification have emerged. While interaction in the traditional media is provided at a limited level, content in the new media is often determined by the audience. From the point of view of new media and user relations, radio has become the medium of communication that can adapt to this change in the easiest way and change contents in this direction. the Internet has offered a radio technology to radio listeners that allows the radio to establish its own radio. All these technological developments and the activation of the audience have reshaped the radio and listener relationship. The main aim of this study is to reveal how the radio, a warm communication medium, is shaped its own language and the relationship established with the audience through technology. In this direction, a structured in-depth interview will be held with 24 people working at Anadolu University in February 2018. These people will be randomly determined according to their socio-economic status. According to the Socio-economic Statutes, 8 faculty members, 8 civil servants and 8 workers will be selected. The selected sampling will ask questions such as radio listening habits, why they listen to the radio and what the effect of participating in radio programs for a democratic society will be in order to define the link they establish with the radio.

Keywords: media, radio**,** mass communication

Introduction

Radio, once a threat to the popularity of written press, has now become a target of the same dangers with the emergence of television. Although the birth of new technology is usually considered as a threat to the popularity of the previous one, in this case, the

television having visual qualities lacked by other mass communication tools, radio never lost its ability to impact the masses. In other words, the spot held by radio as a tool of communication was never downplayed (Kırık, 2013: 2). Radio, due to its dynamic nature, has always managed to meet the continually changing demands of the public by adapting and updating itself. To this end, there have been changes in the functions of the radio (Kuyucu, 2013: 373). Radio, having been forced to change with the emergence of every mass media tool, has expanded its area of influence by adjusting its size and exploring new techniques in broadcasting with the aid of digital broadcasting technology and internet (Bay, 2007: 30). The changes in radio hardware and the understanding of broadcasting have also brought about a transformation in the concept of audience. The advancement in methods of listening to radio arising from the convergence of radio with the updated technologies has made radio available to access from all devices with internet. This easy accessibility has led to the transformation of listening habits in addition to broadcasting habits (Tufan, 2009: 88).

Although technological advances such as digitalization and internet were at first interpreted as threats to raise's popularity, radio has managed to benefit from these technological improvements and solve its chronical problems. The radio, which solves the problems of sound quality caused by analog audio transmission in digital transmission and voice transmission has increased the diversity of access and has become easily accessible everywhere. Resulting from the convergence between radio and the internet the audience of radio has become more active and established a permanent communication line with broadcasters and assumed a role of shaping the content that of broadcasts (Özel, 2014: 169). Although the audience was content with what was offered to them at the beginning, having the audience at an active position where they provided constant feedback became much more critical as time went on. Due to the changes brought by the technological improvements, radio broadcasts have now become appealing to not only masses but also to individuals as the experience of listening to the radio is far more customizable. Radio interfaces which could be accessed from almost any device presented the audience with multiple contents at once. Being able to access broadcaster content via websites, apps, new media tools, and similar platforms to acquire information about broadcasting schedules, get in to contact with other listeners, and such interactions are becoming more involved in radio broadcasts (Ataman: 2013: 97).

Moreover, one more reason why internet broadcasting is endorsed by more and more broadcasters each day is that user habits can be recorded and analyzed (Hendy, 2000). In addition to this, yet another benefit of internet broadcasting is the accessibility of every program whenever and wherever the audience wants thanks to "podcasts." The users, thanks to the convergence between radio and internet, are now available to access instant lines of communications and avoid problems caused by time restraints. Radio, after experiencing a transformation due to technological advancements has expanded into newer domains. Listeners of radio who utilize social

media platforms such as Facebook, Twitter, Instagram and Periscope have both the ability to create momentary lines of communications and video broadcast. Thus, they can communicate news about themselves in addition to adding visual components to their broadcasts (Ataman, 2013: 97 - 98).

Method

The research done in this work aims to define the changing radio listening habits. To this end, a series of comprehensive interviews have been conducted with 12 individuals from various socio-economic backgrounds on April 2018 in Anadolu University Faculty of Communication Sciences. These individuals were divided into three main groups depending on their socio-economic backgrounds. Thus, the research group of 12 individuals includes four individuals of higher socioeconomic status(Universtiy Professors), four individuals of average social-economic status (middle-class officers) and four individuals of lower socio-economic status(workers).

The distribution of the interview subjects according to their socio-economic status is as follows:

Lower socio-economic status: Ayşen Karababa, Zeki Toygar, Kadir Karnuş, Nesrin Yaren.

Middle socio-economic status: Tamer Olcay, Fidan Turan, Sejda Vatansever, Zeynep Kiracı.

Higher socio-economic status: Ozan Yıldırım, Haluk Birsen, Deniz Kılıç, Hakan Ayaz.

The interviewees were directed with the following questions:

Do you listen to the radio?

What is your purpose of listening to the radio?

To which radio station(s) do you listen to most?

Why do you prefer to listen to this station(s)?

Which types of programs interest you the most?

Can you name the three programs you listen to the most?

Which time of the day do you listen to the radio?

Can you name the radio program host you like to listen to the most?

Do you listen to the radio via a device that is not a radio (e.g., phone, computer)?

Do you listen to Podcasts?

If you were a radio broadcaster what type of programs would you like to do?

What do you think is the difference between radio and other mass communication devices?

Have you experienced any changes in your radio listening habits throughout the years?

What type of role did the radio play during your childhood years?

How do you remember radio broadcasting?

Have you ever taken part in a radio program? If yes, what type of program was it?

Do you think that participating in radio programs has a positive effect on democracy?

The data collected from the interviews have been evaluated and analyzed to achieve the aim of this investigation.

Radio listening habits

When they were asked whether they listened to the radio or not the participants Ayşen Karababa and Nesrin Yaren from the lower socio-economic status group had answered that they hardly listened to the radio apart from the times when they were running errands at home. Karababa has also gone on to explain the reason why she rarely listened to the radio: "I do not listen to the radio these days as much as I did in my youth. Seldomly I listen to it when I am at home, running errands like cleaning the house. The reason behind this is that I now have a mobile phone. I use it to listen to the songs I like from Youtube. Also now I am married with kids and cannot spare the time to listen to the radio as much as I did in my youth." However, male participants have stated that they actively listened to the radio. A participant from the middle socioeconomic status group, Sejda Vatansever has reported that she greatly enjoyed listening to the radio while Zeynep Kiracı from the same group said that she rarely listened to the radio. Tamer Olcay has given the answer that he mostly listened to the radio in his car, and Fidan Turan told that she only listened to the radio in her workplace. Turan also added that she had fond memories of listening to the radio as a child but she now hardly had the time for it due to work.

Haluk Birsen and Denix Kılıç who are from the higher socio-economic status group have stated that they frequently listened to the radio and that they had certain stations they followed. Ozan Yıldırm and Hakan Ayaz have said that they listened to the radio now and then.

Among all three groups, participants who were in their forties have been recorded to be frequent listeners of radio compared to the younger participants. In addition to this, participants with higher levels of education liked to listen to the radio more.

To continue with, the answers to the questions "What is your purpose of listening to the radio?" , "To which radio station(s) do you listen to most?" , "Can you name the radio program host you like to listen to the most?" and "Which time of the day do you listen to the radio?" were as follows:

Participants from the lower socio-economic status group Karababa and Yaren said that they listened to the radio only for music while Toygar and Karnuş said they listened to the radio for news in addition to the music. Yaren also added the follows: "I usually choose to receive the news from the TV, radio is something I solely use for listening to music as it helps me relax. I go back to the old days when I'm listening to the radio, it makes me think that I used to dance to this song and reminds me of good times." Kiracı from the middle socioeconomic status group said that radio for him was a means of spending fun time while Vatansever said he used the radio to get news and listen to music. Turan answered that he utilized the radio to get information regarding his interests.

Moreover, Turan went on to add the following: "I mostly listen to the radio to get informed about my areas of interest because I feel like I can use my imagination more when I am just listening. The absence of a visual component lets me use my imagination". The members of the higher socio-economic group all gave the answer that they saw radio as a source of news and entertainment. Birsen said that listening to the radio was an old habit for him and Yıldırım gave the information that he kept the radio on for background noise in the house. It has been observed that this group tends to utilize the radio to receive news, stay updated on culture and art developments and stay tuned on local developments. The participants who told that they used the radio for receiving news also added that radio was the option for them in environments where internet and TV were absent. So it can be concluded that generally, radio is mainly seen as a tool for listening to music apart from its side function of delivering the news.

The interviews ultimately led to the conclusion that there wasn't a significant relationship between radio listening habits and socio-economic status. Another result uncovered is that traditional radio listening habits have changed over the years. Considering that participants all came from the age range of 30-45, it can be said that they all adapted to the newer listening habits.

When they were asked which radio stations they listened to, the participants from the lower socio-economic status it was observed they did not have specific preferences. More specifically they described their habits as they listened to "whatever comes up that I like." However, stations such as Power FM, Metro FM, Radyo Fenomen and Number 1 are national stations chosen by the participants. The only local station mentioned by the participants of this group has been recorded as Radio A. From the participants of the middle socioeconomic group only Olcay has been able to provide station names saying that he listened to Power FM, Number 1 and Radio A.

It has also been observed that the higher the socio-economic status group was able to provide more specific answers regarding their station preferences. Yıldırım, from this group, has said that he followed Radio A and TRT news and he did not listen to local radios. Birsen stated that he listened to Power FM for music and NTV radio for news.

Kılıç gave the answer that he listened to Pal FM, Power FM, and Radio A and finally Ayaz said that he listened to Radio A, NTV radio and Power Turk.

The questions "Which types of programs interest you the most?", "Can you name the three programs you listen to the most?" and "Can you name the radio program host you like to listen to the most?" have all received negative answers regarding program names regardless of the socio-economic status. However, a member of the middle socioeconomic group, Olcay has given the names Kaidr Çöpdemir and Cem Ceminay. Member from the higher socio-economic group Birsen has given the names Nihat Sırdar, Zeki Kayhan Coşkun. This showed that participants were unable to name radio programs regardless of their socio-economic status.

The questions "Which time of the day do you listen to the radio?", "Do you listen to the radio via a device that is not a radio (e.g., phone, computer)?" and "Do you listen to Podcasts?" have received similar answers from all participants. The general response has been recorded as all participants listened to the radio when they are driving to work or home and during weekend hours. The participants revealed that they listened to the radio in their cars from which it can be deduced that radio was preferred when there was no access to TV and the internet. Female participants had emphasized that they listened to the radio during weekends when they were at home running errands. The participants who owned personal vehicles have been observed to listen to the radio inside their cars while the participants who did not own cars have been observed to listen to the radio in their homes, mostly during the weekends. Finally, the participants from the lower and middle socioeconomic status group have replied to the third question saying they did not know what a podcast was while the higher socio-economic status group responded that they di not listen to podcasts even though they knew what they were. The interviews have revealed that the participants were not familiar with the concept of podcast radio even though it is one of the key transformations of current radio broadcasting.

Expectations from the radio

The participants were asked “If you were a radio broadcaster what type of programs would you like to do?” The aim behind asking this question was to uncover the expectations the audience had regarding radio broadcasts. The asnwers given were indicative of the statement that the socioeconomic status created different expactations. For example a raido program is seen as a remedy to get away from the troubles of the daily life for the lower class, a tool for entertainment and information for the middle class and finally, a verbal tool that can produce content for various specialites for the higher socioeconomic status group. The interviews showed that the participants who belonged to the lower socioeconomic group saw radio solely as a tool for entertainment and music. Karababa from this status group describes his view of radio as follows while anwering the above mentioned question: “ We all need to laugh, that’s why I would like to host comedy program. I feel like those types of programs are more likely to grab the readers attention. Such programs let you forget

about the troubles of daily life.". In addition to this statement, Yaren, who is also from the same socioeconomic status group has stated that she would like to host a program about music and daily new. However the main focus of this program would be music.

The interviews with the middle socioeconomic status members show that expectations start to differ from the previous group. The members of this group state that they would want to make program that is directed towards woman, child development and self development which ivolves expert opinions and informs its audience. They also state that they would be interested in such programs. Vatansever from this group says the following about the program he would like to host: "I woul take great delight in listening to a program that has woman as its main audience, therefore I would take the most joy in hosting such a program. I would also include music in it but most importantly it hes to address issues regarding woman rights." Kiracı from the same group expresess her opinions as: "I would like to host a program about children. A program where topics such as pedagogy, nutrition and education were discussed by experts would be wonderful." Turan talked about her ideal program saying the following: "I would want to make program that is in touch with the daily life. I take great intert in topics of self development so a program that revolves around such topics would appeal to me. Such a program could also include talks about movies and books. Because literary works have so much to say about self development. I feel like a program about these would be extremely pleasurable to listen to when combined with some music."

The interviews have also showed that the participants form the higher socioeconomic status group had expectations that were centred around receiving news information. For them an ideal program should have fresh and rich content at all times. The teaching staff of Universities point out that they would want to create programs about technology, politics, history and culture that tap into local and national issues and thus, they liked to listen to such programs when they come across them. They have also mentioned the short comings of todays media when it comes to receiving local news adding that a program that gave quality local news would be much appreciated. Kılıç talks about his expectations with these word: "I would want my program to be an informative broadcat about the time period we live in. Such a program would examine in detail the times we live in with valuable insights from Turkey's recent history.I would also like to host a program that goes through local newpapers. It would be significantly valuable to be informed about the traffic situations and what preventive measurements are being implemented. A program like this would be particularly appealing if it involved the statements from the authorities in it.

It has been observed that the programs the participants would like to the create are mostly verbal programs. However, verbal programs do not hold a sizeable spot in Turkey's current radio programs. Most verbal programs are now replaced by podcasts except for thematic radio stations. It would be mistaken to say that today's audience is only interested in programs of music and entertainment as there is a

significant interest in news programs as well. Educated populations hold raido in a valuable spot when it comes to satisfying their need of receiving news. Listners of the radio from all socioeconomic backgrounds say that they interested in listening to raido programs that they could benefit from and that they are not familer with podcasts as they either do not know what it is or do not use it. This unfamiliarity is quite understandable when it considred that the interviewed individuals are digital immigrants.

Defining Radio (past_present)

The questions "do you think that there is a difference between radio and other mass communication devices?" and "Have you experienced any changes in your radio listening habits throughout the years?" were answered "yes" by all members of the lower socioeconomic status group. They also emphasized that radio appeals to the receiver's imagination as it does not have a visual component and that it has a different language. Karnuş' uses this statement to describe the relationship between radio and imagination: "I think that radio has a different feel, it lets you merge what you hear with your imagination. TV lets you see what is being described, but only the radio gives me the unique pleasure of imagining. It is definitely more effective on me as I enjoy using my imagination" The members of the lower socioeconomic group have also said that their radio listening habits have changed dramatically over the years and that they did not listen to the radio as often anymore due to the low quality of the newer contents and lack of time.

The middle socioeconomic group have also defined the radio a warm and sympathetic tool as it appeals to one's imagination. Vatansever describes the close relationship the radio establishes with its audience by saying "It's as if it is talking just to me." And when it came to answering the second question, the members of this group have stated that they did not have enough time anymore to listen to the radio. They also mentioned that the increasing amount of advertorials of the radio repelled them.

It can be stated that the higher the socioeconomic status group listens to the radio mare than the other groups. The participants say that they listen to the radio mainly for the purpose of receiving information as the primary interest for this group is being informed about the latest developments in areas such as culture and the arts. This group also said that they listened to the radio a lot less compared to the past, but their reasons were different. For the members of the higher socioeconomic status group, the main reason was that the content of the current radio programs was no longer satisfactory.

Participation and Democracy

To understand the relationship between radio and democratic involvement the interviewees were asked if they ever participated in a radio program. The members of the middle socioeconomic group said that they never took part in a radio program for reasons such as lack of courage. Kiracı described this as "stating my opinion in

front of a large crowd is something that I rarely dare to do." Vandever also talks about this by saying "I am a bit of a coward when it comes to facing the spotlight.". In addition to these answers, Turan also gives his opinions about democracy and participation with following word: "When I am expressing myself on the radio it is very much likely that I am also speaking for other people. Perhaps when a stranger hears that there are other people out there who agree with him or her, that person could get the courage to act.". However, Yıldırım from the higher socioeconomic group says "I don't think that mass communication tools, including radio, have a contribution to democracy." When his opinion about the relationship between democracy and participation is asked. Birsen, on the other hand, disagrees by saying the following: "As an ordinary citizen, if you were to be granted the ability speak out and get your message across to the masses, that would contribute to democracy." Kılıç also supports this by saying "Of course there is a contribution, the TV doesn't ask me my opinion, but radio does. If a radio program offers quality and informative content many individuals will want to participate and discuss their opinions. Writing doesn't have a soul, but the voice bears many emıtions in it. So, a radio program with good content is always a good opportunity for democratic improvement. Even the smallest local radio is a means of reaching the masses. So when the entire community says they don't want something, everyone can hear it". Ayaz makes another point by saying "the fact that you are invisible on a radio platform could encourage many people and therefore let more opinions be heard. So it would not be wrong to say that there is a contribution to democracy." From these answers, it can be said that more educated participants are aware of the relationship between participation and democracy.

Conclusion and Evaluation

All participants from various socioeconomic background find the content of the current radio programs to be lacking. With the impact of digitalization, today's radio allows everyone to produce and broadcast their own content. This opportunity radio offer makes the audience more powerful. However, the conditions Turkey is in at the moment do not foster an environment that is politically and culturally ripe for content production. Both in television and radio, the content is getting less and less productive each day. The technical opportunities provided by the internet are not enough on their own. The belief that radio is a tool solely for music is repelling audiences. Regardless of their level of education and socioeconomic background, all listeners are missing the old programs with richer content and are frustrated with the increasing amount of adds on the radio. It also cannot be denied that internet radios are yet the be embraced by all members of the society and podcasts are unknown to many individuals.

To continue with, radio is a democratic tool given that it is platform suitable for the participation of audiences. However, the audience is finding it hard to think that the radio has a critical power in a democracy and therefore choose not to participate.

In conclusion, radio is regaining its old value as it appeals to the imagination, provides a platform for democratic discussion and can easily be accessed.

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