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Management and regulation of mechatronic workstations industrial robot Mitsubishi RV-2AJ using inductive sensors for sorting of metal and non-metal parts

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Abstract

The use of sensors for robot's online programming is explained in this paper. Growing development of technical systems implies a continuous increase in their level of automation. By integrating sensors and other mechatronic components of the system, the application of appropriate control devices that are supported with modern software, improves the possibilities of using robots and significantly improves their utilization. In a practical example, which is designed to mechatronic workstation industrial robot Mitsubishi RV-2AJ, shows the importance of using sensors to manage and control the process of classification of metallic and non-metallic workpieces by using inductive sensors.

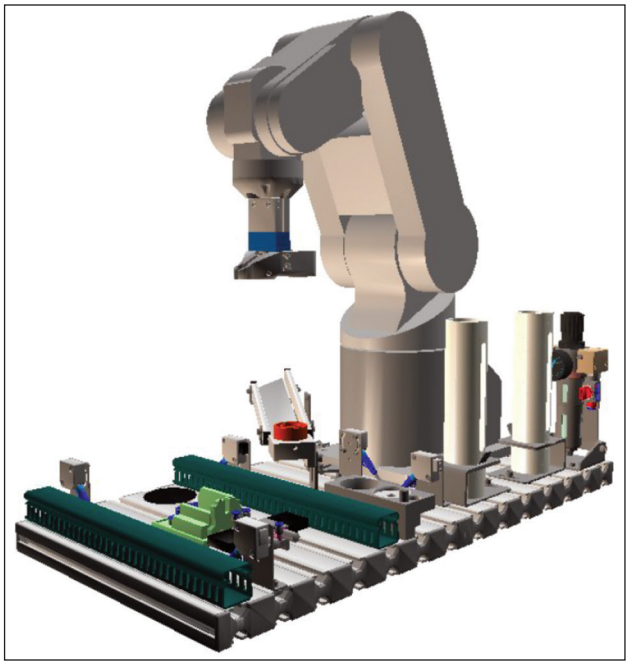
Key words: Mehatronics, Robot, Mitsubishi RV-2AJ, Sensors, Melfa Basic IV.

1. Introduction

For the purposes of the paper, modular production system (MPS) of industrial robot Mitsubishi RV-2AJ is used. Modular Production System (MPS) is divided into two parts. The first part of the station representing all of its components together with its sensors and actuators, which are set according to a specified schedule. The second part of the station consists of comparators, relays, control panel, input-output terminals and the control unit with which we achieved the management of the station, situated in its interior. These components could still join the electropneumatic converter which is located at the top of the station for easy connecting with pneumatic actuators. Picture 1 shows the modular production system (MPS) of industrial robot Mitsubitshi RV-2AJ. Robot station provides an appropriate system for practice and education. The real phases of work on MPS station may imply [1], [2], [3]:

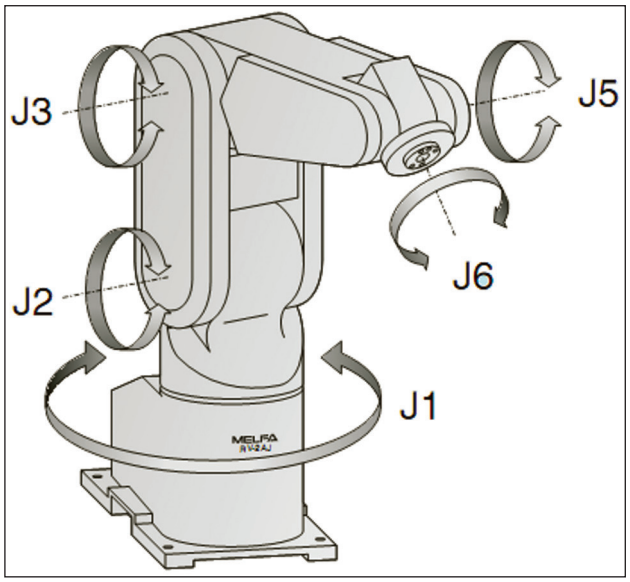
- planning,
- assembly,
- programming,
- commissioning,
- operation,
- maintenance and identification of errors.

Flexible manufacturing system Festo as a basic resource uses robotic arm model Mitsubishi RV-2AJ.



Picture 1. MPS of industrial robots Mitsubitshi RV-2AJ

Below we present a model of industrial robot RV-2AJ (Picture 2) and its geometrical parameters (Table 1).



Picture 2. Model robot RV-2AJ

Table 1. Geometric parameters of the robot RV-2AJ

Joint	Angle Range
J1	od -150°do +150°
J2	od - 60°do +120°
J3	od -110°do +120°
J5	od - 90°do + 90°
J6	od -200°do +200°

2. Products of MPS and its parts

The system manipulates the basic parts, with some having more performances. The first component has the shape of a hollow cylinder and has three versions: red, black and silver (Picture 3). Basic part is also the main part which travels through the entire system. The reason that there are several versions of cylinders is that certain cylinder when sorting based on the metal or non-metal, will be sorted in the section that belongs to him. Specifications of each cylinder are given in Table 2, [4], [2], [5].

Picture 3. Working parts (cylinder versions)

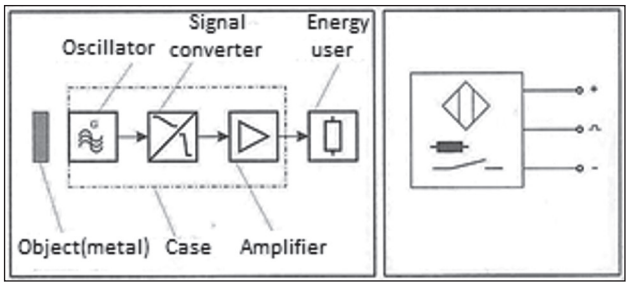
The following table lists the basic parameters of the working parts.

Table 2. Basic parameters from the working parts

Colour cylinder	Red	Black	Silver
Material	Plastic	Plastic	Metal
Height [mm]	25	25	25

2. 1. Inductive sensor

This type of sensor reacts only on the approaching of metal. The electric current creates a magnetic field through the oscillator. This is the area of operation of the sensor. With the arrival of a metal object in the zone of magnetic lines, changes arise in the field of eddying oscillators. The changes that are recorded in the signal converter are formed in an upsurge output. Amplifier has the role of bringing the signal to the level of usage in the control circuit [6].



Picture 4. The principle of inductive sensors and symbol

3. The selection and application of appropriate software for managing MPS

Ciros Automation is a software package that serves as a tool to create a virtual project for automation of technological processes and production. Its flexibility makes it suitable for use in various fields of automation and is suitable for use on a daily basis on the real-time simulations. The example is made in the software Ciros Studio within which integrated language Melfa Basic IV. Melfa Basic IV is a language which is used for managing and controling MPS station and consists of the following commands and data base, Commands used in this study are given in Table 3, [3].

Table 3. Commands of programming language Melfa Basic IV

Command	Description
MOV	Moves the robot to the desired position by the shortest route
MVS	Moves the robot to the desired position by the linear interpolation
HOPEN, HCLOSE	Opens and closes the gripper
DLY	Countdown timer-timer
IF THEN ELSE, WAIT	Unconditional branching, conditional branching, waiting
GOTO	Moves the current program in the indicated line of code
M_IN	Input signals
END	End of one cycle of the program
OVRD	determines the speed that is set for the entire program and is displayed as a percentage relative to the maximum speed.

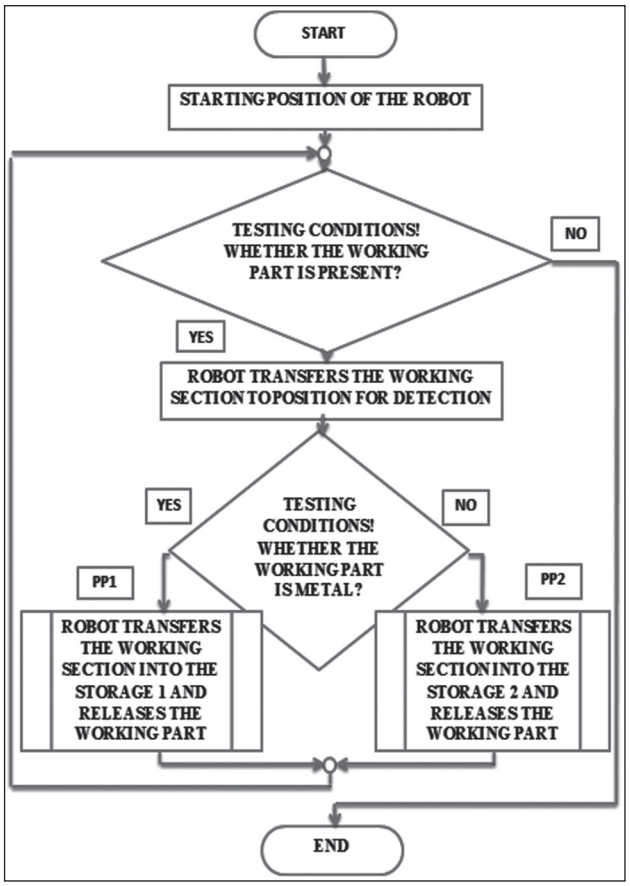
4. Distribution and sorting of working parts by type of material

In this section we will explain how to use the sensors in the robot station. We will use inductive sensor that will reveal metal parts and sort them in a warehouse (storage) while the other plastic parts will be sorted into another warehouse. Also we will use an optical sensor that will at the beginning of the program detect the presence of a part in the starting position and give the signal to start the robot. A flow diagram is shown in Picture 5.

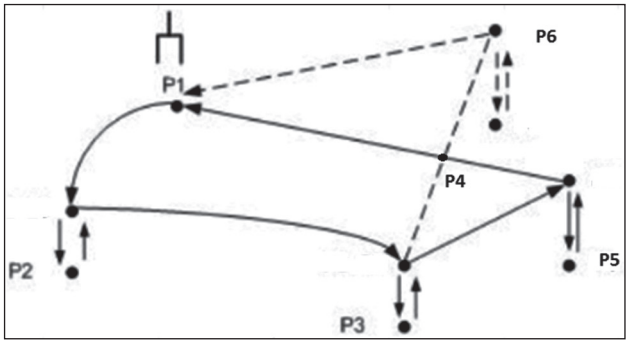
In order for the robot to execute certain tasks required by the flow diagram it is necessary to plan the movement of robot gripper and to determine the trajectories given in Picture 6.

Moving gripper of robot through the coordinates of the points P1-P6 given in Table 4. obtain trajectories shown in Picture 6.

The program performs the detection of the work piece by means of optical sensor. If workpiece is present robot takes the workpiece and distribute it to the place for the detection of material shown in Picture 7.



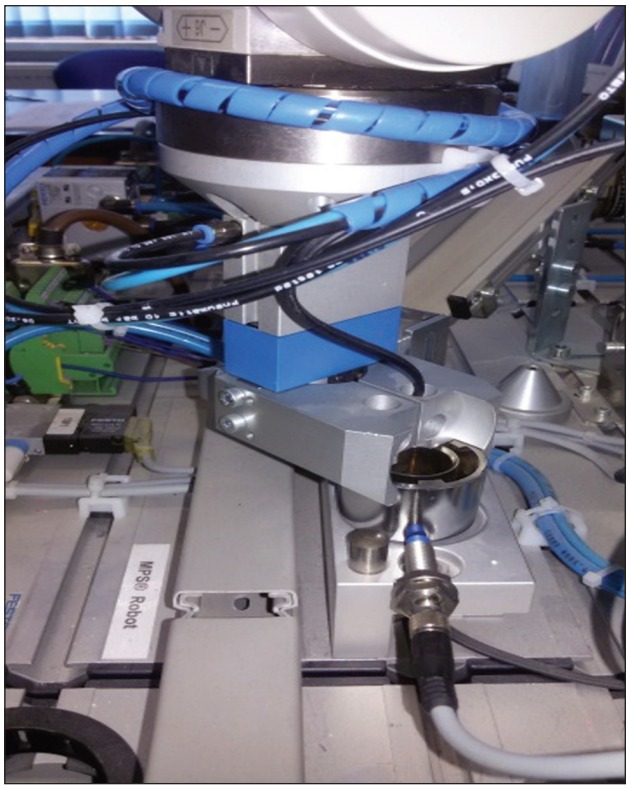
Picture 5. A flow diagram chart



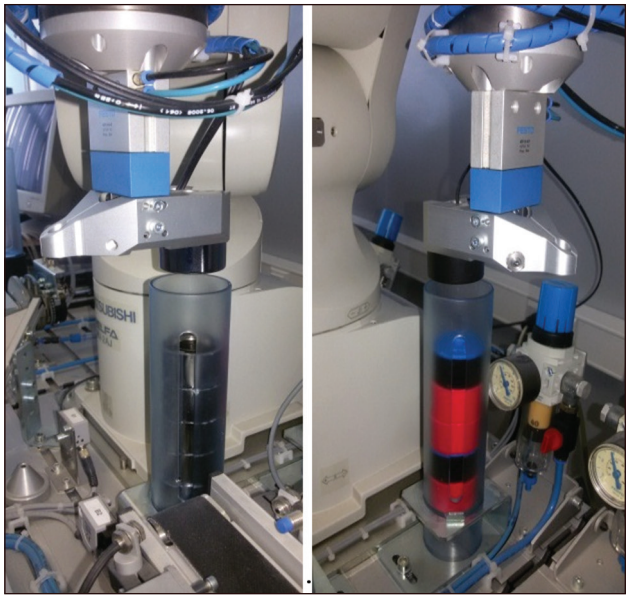
Picture 6. Movement trajectories of the robot gripper RV-2AJ

Table 4. Coordinates of the points

No	Position	Orientation
P1	216. 6, 54. 0, 345. 0	-44, 179, R, A
P2	255. 8, 45. 1, 184. 5	-44, 180, R, A
P3	214. 5, 167. 1, 177. 9	81, 178, R, A
P4	209. 3, 173. 7, 360. 0	81, 178, R, A
P5	71. 3, 190. 5, 360. 0	-93, 179, R, A
P6	-73. 4, 182. 9, 360. 0	-93, 179, R, A



Picture 7. Detection of the material by inductive sensors



Picture 8. Storage 1 and 2

The detected metal part is distributed to the storage number 1 while all other parts are distributed to the storage number 2 which is shown in Picture 8. Then the program repeats.

Below is a program of management and regulation written in Melfa Basic IV.

```
05 OVRD 70
10 HOPEN 1
20 MOV P1
30 WAIT M_IN(8)=1
40 MOV P2
50 MVS P2, 20
60 DLY 0. 1
70 HCLOSE 1
80 DLY 0. 1
90 MVS P2, -20
100 MOV P3, 16
110 DLY 0. 5
120 MVS P3
130 IF M_IN(10)=1 THEN *PP1 ELSE GOTO *PP2
140 *PP1
150 MOV P4
160 MVS P5
170 MOV P5, 15
180 DLY 0. 5
190 HOPEN 1
200 DLY 0. 1
210 MOV P1
220 GOTO 20
230 *PP2
240 MOV P4
250 MVS P6
260 MOV P6, 15
270 DLY 0. 5
280 HOPEN 1
290 DLY 0. 1
300 MOV P1
310 GOTO 20
```

Picture 9. Program management and regulation of mechatronic workstations industrial robot Mitsubishi RV-2AJ using inductive sensors for sorting of metal and non-metal parts

5. Conclusion

This paper has shown that even simple and scalable sensor combined with sophisticated programming languages allow the robots to work in a very complex task. The sensors allow the robot that has specific information and to act and adapt to the unregulated and unfamiliar environment. It can be concluded that without proper external sensors, robots have a limited range of action, and on the other hand with the correct choice of sensors and appropriate software, tremendously increases the

possibility of using robots. In this paper we used the inductive sensor that is meet the criteria of sorting of metal and non-metallic parts. In order to improve the system and lead to an intelligent mechatronic system is necessary to introduce the vision sensors. Artificial intelligence, which tends to be the highest level of robotic system is inseparably linked to the complex systems of sensors. All this leads to the conclusion that in the future with the increasing use of robots, it will be more emphasis placed on the different types of sensors, and therefore the sensors alone will progress and improve robotic systems.

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Helicopter Emergency Medical Service: the Case of Bosnia and Herzegovina

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Abstract

Bosnia and Herzegovina (BiH) as a partly mountainous country faces challenging geographical conditions that slow down response of ground emergency medical units and has significant presence of landmines as a result of the war in the 1990s, as well as faces a high number of injured in road accidents, etc. Often the hope of injured patients in incident site far from urban areas, or patients who need emergency transportation from one to another medical facility for further treatment is a Helicopter Emergency Medical Service (HEMS). Therefore, the primary objective of this article is to examine the current status and perspectives of HEMS in BiH with comparison to some other European countries.

Key words - Helicopter Emergency Medical Service, golden hour, BiH.

1. Introduction

In developed countries national emergency medical system provides road ambulances as well as aerial assets to quickly bring medical rescue experts to the scene of all types of emergency to provide first response and stabilization and then transport them to the adequate hospitals best suited for their treatment. These patients are dependent on first response time and time of stabilization. Short activation and tasking of available emergency assets increase patients chance to survive. Literature claims, if the injured person is transported to a medical facility within the first hour (“golden hour”), the chance of survival increases significantly.

In many EU countries, Helicopter Emergency Medical Service (HEMS) have become standard in the pre-hospital care of severely injured patients. According to EHAC (European HEMS & Air Ambulance Committee) statistics today there are over 360 HEMS helicopter bases in Europe and some 200.000 HEMS and air ambulance missions are flown annually. Additionally, EHAC states that the public perception of air rescue is satisfactory in the European Union, on a national level, but not so at the European level, where there remain considerable gaps [1].

Vesterbacka claims that HEMS in both rural and urban areas, add health benefits by shortening transport times and bringing medical expertise to the scene [2] while Pasquier says that HEMS advantages over ground transport including the ability to perform air searches for lost victims, rapidly shuttle rescue personnel and equipment to the scene, deliver timely on-site advanced medical care and reduce patient transport time to the hospital [3].

According to Vidovic, in about 65 percent of fatal accidents, death occurs in the first 25 minutes. If the first medical aid to casualty with heavy injuries is provided up to 14 minutes after the onset of the accident, further complications that can cause death affects only 20% of the treated victims. In prolonged first aid or medical care after 28 minutes from the onset of the accident, the consequences and complications, including death, occur in 80% of cases [4].

The time of providing first aid and stabilization of the patient and the challenging geographical conditions (of the total land area 5% is lowlands, 24 % hills, 42% mountains, and 29% karst regions) in Bosnia and Herzegovina (BiH) [5] as well as the climate (temperate continental climate type, the sub-mountainous and mountainous type and the Adriatic/Mediterranean and modified Adriatic climate type [5] significantly slow down response of ground emergency medical units. These factors inevitably confirm the very importance of raising the question of the extent to which HEMS has been developed in BiH? Accordingly

BiH's citizens who require emergency medical assistance when their medical status requires fast transport to adequate medical institution, should have adequate HEMS at their disposal.

2. Legislation and current state

BiH as the country located in the center of the Balkan Peninsula in the South Eastern Europe consists of the state government (a first tier of government) and two entities (Federation of Bosnia and Herzegovina (F BiH) and the Republic of Srpska (RS)) and one district – Brcko district, (a second tier of government).

Health care systems in BiH are mainly regulated by health institutions on the second tier of government. The entity laws (the Law on Health Protection in F BiH ("Official Gazette of the F BIH", no. 46/10, and Law on Health Insurance "Official Gazette of the F BIH" no 30/97, 7/02, 70/08 and 48/11 and Law on Health Protection in RS ("Official Gazette of the RS", no. 106/09 and Law on Health Insurance in RS, "Official Gazette of the RS", no. 18/99, 51/01, 70/01, 51/03, 17/08 and 1/09,) and Brcko district (BD) Law on Health Protection ("Official Gazette of BD BiH" no. 38/11) and Law on Health Insurance in BD BiH („Official Gazette of BD BiH", no. 1/02, 7/02, 19/07, 2/08, and 34/08) regulating the issue of health care and health insurance in BiH.

There is not existing Ministry of Health at state level (first tier of government). Only the Department of Health is established within Ministry of Civil Affairs of BiH and is "in charged for preparation and enforcement of regulations, harmonization of plans of entity authorities and defining a strategy at the international level in the field of health, and especially in terms of developing strategies for health care sector in BiH in cooperation with the entities and Brcko District of BiH" ... [6].

Above written laws define principles for the provision of medical health care and health activities that should be organized so the population is always secured and available to emergency medical services (EMS), including emergency transportation. But the laws do not exactly mention neither definition of HEMS (Helicopter Emergency Medical Service) nor the establishment of HEMS. HEMS is "a flight by a helicopter operating under a HEMS approval, which purpose is to facilitate emergency medical assistance, where immediate and rapid transportation is essential, by carrying: medical personnel or medical supplies (equipment, blood, organs, drugs); ill or injured persons and other persons directly involved" [7]. Three distinct HEMS operations can be distilled from the existing literature. Booz defined [8] it as: Primary (transport of medical personnel and equipment directly to the scene (or nearby) of an incident/accident), secondary (direct to a designated site to meet road ambulance(s) coming from either a hospital or an incident site to facilitate rapid on-carriage of patient(s) by helicopter to a hospital), and tertiary response (planned urgent and rapid transfers of critically ill patients requiring specialized care between hospitals (inter-hospital transfers – often referred to as air ambulance)).

BiH, its entities and the Brcko district haven't got a commercial HEMS service. Currently, Armed Forces of BiH (AF BiH) on behalf of Ministry of Defense of BiH (MoD) at state level and Helicopter service from BiH's entity Republic of Srpska (RS) are able to conduct helicopter Ambulance flights in BiH.

AF BiH on behalf of MoD is able to conduct HEMS operations from two military bases Rajlovac (Sarajevo) and Mahovljani (Banja Luka) by using helicopters such as Mi-8T, Mi-8MT, Mi-8 MTV, UH-1H and Gazelle. According to Article 4. of Law on Defense of BiH, "Official Gazete 88/05", AF of BiH are supporting civilian structures in case of natural and other disasters. That is reason why AF BiH is on general support for HEMS missions and do not have permanent 24/7 on-call HEMS duty.

Operating from current locations doesn't enable coverage of the entire operation area of BiH territory. Basically, one emergency medical helicopter can cover an area of about 50km radius (about 27 NM), which is a typical case in Germany [9]. As far as current HEMS rings and their coverage in BiH are concerned the HEMS rings are calculated with notice to move 15 minutes. The medical rings have been calculated with the speed of available helicopters for HEMS. Some of AF BiH's helicopters' cruising speed is 180 km/h (Mi-8 helicopters) but they can fly 220 km/h and more, so the rings might have a radius of 40 NM that is flight time of 20 min-

utes plus 5 minutes on the ground to pick up patient which all makes 60 minutes, or called "golden hour". Nevertheless, regardless of the sufficient speed of helicopters, it is practically impossible to cover whole territory of BiH from 2 locations (Sarajevo and Banja Luka) even with rings of 40NM (blue rings on Figure 1). The Gazelle helicopters will keep the same pattern as Mi-8 helicopters. Additionally, AF BiH's UH-1H helicopters operating from Rajlovac base have a cruising speed of 166 km/h, so the rings for those helicopters might have a radius of 30 NM which results to the smaller coverage of BiH territory than Mi-8/Gazelle helicopters (Figure 1 – purple ring).

When an emergency event or critical illness happens to someone who requires air ambulance transport, it can't directly activate HEMS by 'call out' activation system (e.g. 911 or 112). Referring to AF BiH support it can be initiated by sending request directly from hospitals to MoD's Emergency Operations Center (EOC) or during the natural and other disasters through EOCs of entities/Brcko district of BiH/Ministry of Security of BiH to the MoD. Operational Center for Command and Control in Defense Institutions of BiH (OCK2I-OBiH) is responsible for administration and coordination of AF BiH support to civilian structures in case of natural and other hazards/disasters or other accidents [10].

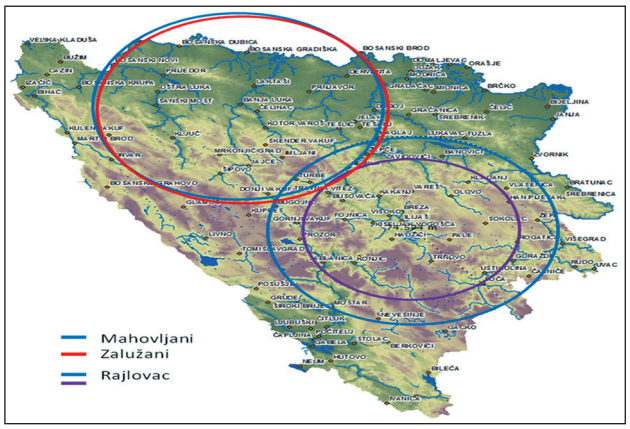

Figure 1. Current Air ambulance/HEMS rings

Also, it is important to note that flights by military helicopters outside the territory of the BiH require obtaining diplomatic clearance from the countries whose territories the military helicopter will fly over and where will land. Those flights are performed with the obligatory presence of medical personnel from the medical institution who treated patients/emergency services as well as military medical staff.

Beside the military helicopters BiH has one more governmental HEMS operator. Helicopter Service (HS) of BiH's entity RS was established in 2008 as a non-commercial operator for the provision of air transport. From 2014, HS of RS is expanded its operations to medical transport and special operations for the Ministry of Interior of the RS [11]. HS of RS is under direct authority of the President of the RS. For the purpose of HEMS missions it operates from Banja Luka (airfield Zaluzani-former AF BiH base) and primarily uses one Bell-206 helicopter as well as three Gazelle helicopters. The range of HS of RS in order to meet golden hour is shown on the Picture 1 (purple ring). The crews of HS of RS are on call 24/7, 365 days a year. The system of air medical transport involves cooperation and coordination between the HS of RS, the Ministry of Health and Social Welfare of RS, University Clinic Center of RS - Banja Luka and teams of health care institutions. Once the medical indication of patients requires HEMS flight the decision for air medical transport is made by team leaders in the health care institutions where the patient is hospitalized. There is also entity coordinator for HEMS (employee of University Clinical Center of RS). Team leaders are obligated to provide all necessary medical records of the patient on a special form with basic information, clinical status and ability to be transported by air in an unpressurized aircraft. The flights are performed with the obligatory presence of medical personnel and only in Visual Flight Rules (VFR) [12].

The Minister of Health and Social Welfare of RS, Bogdanic in his interview states that everyone who has been insured in RS has the right to use HEMS. Additionally, he stated that those who don't have insurance also have the right to use HEMS, because this service is primarily dictated by the patient's health condition [12].

Looking at statistics on the webpage of HS of RS it can be concluded that HS is primarily focused on secondary/tertiary transport of patients in BiH as well as cross-border flights (generally to the Republic of Serbia). Also, AF BiH generally is conducting secondary/tertiary missions.

Also, there were several cases where the primary response [10] been conducted. The costs of those helicopters are only connected to a financial burden from BiH MoD's budget and the budget of government of RS.

The F BiH has one operational Bell 206 helicopter but it is used only to support operations of the Ministry of Interior of the F BiH while another Bell-206 L1 Long Ranger is grounded (needs upgrade and maintenance). Brčko district doesn't have any helicopter. Above mentioned 5 helicopters (3 Gazelle – RS Government, 1 Bell 206B - RS Government, and 1 Bell 206B is property of Ministry of Interior of F BiH are only helicopters among 82 civilian aircrafts in BiH's Civil Aircraft Register as of 26 August 2016 [13].This statistics shows lack of civilian helicopters in BiH.

Beside HEMS missions, military helicopters conduct Search and Rescue (SAR) duty. This is the only mission for one helicopter of AF of BiH that is scheduled 24/7, 365 days of the year as a result of contract between MoD of BiH and Ministry of Transport and Communications BiH – Direction for Civil Aviation of BiH (BHDCA) [13]. The objective of this duty is conducting BiH`s obligation regarding SAR for commercial aircrafts in distress to meet Law on Agency for Air Navigation Services in BiH (BHANSA) as well as the internationally accepted SAR standard - the Annex 12 of International Civil Aviation Organization (ICAO). BHANSA is responsible for coordination of such missions from rescue coordination center (RCC) which is a part of BHANSA. According to current regulations the helicopter assigned as „SAR helicopter for commercial aircrafts in distress" can only be approved for other missions if the potential user has approval of Minister of Defense and consent of Rescue Coordination Centre of BiH.

3. Comparative view of HEMS in BiH and some European countries

Studies regarding HEMS have demonstrated variable results regarding patient outcomes. These differences are undoubtedly affected by the variability amongst HEMS systems around the world. Each HEMS group operates with different thresholds for activation, variable relationships with the local land EMS and there are a range of geographic and patient characteristics that will affect patient outcomes [14].

Some countries have smaller land area than BiH but use significant number of HEMS bases that can ensure fast response to incident site. For instance, Switzerland has land area about 41,000 km² and uses 13 HEMS bases [9], Slovakia has land area about 48,845 km² and uses 7 HEMS bases [15] while BiH has land area about 51,129 km² and uses 2 military and 1 entity governmental base.

Table 1. provides HEMS missions' statistics in some of the European countries compared to BiH in last 5 years. There is ostensibly big difference between missions flown in BiH [10], [11] and some European countries. Figures for the missions performed by BiH's HEMS helicopter fleets were slightly up on the previous years. Swiss operator Rega's (Rettungsflugwacht/Garde Aérienne) helicopters are performed on average about 30 missions per day [16] which is almost equals to all mission of AF of BiH for the previous years. Luxembourg has land area almost 20 times less than BiH and being conducted more than 3.000 missions every year [17]. Netherlands has constant growth of missions every year [18] while BiH neighbor Croatia is transporting about 511 patients as an average in last 5 years [19].

HEMS in some countries is being supported by National Automobile Clubs e.g. German ADAC (Allgemeiner Deutscher Automobile-Club) while some countries such as Slovenia [20] and Croatia [19] i [21], etc. conduct Air ambulance flights by civilian and military assets. In Slovenia, responsibility for HEMS operations is within police jurisdiction, using one A-109Power with Augusta installed EMS interior or alternatively, AB-212 or AB-412. These 3 helicopters are used for inter-hospital flights and for some mountain rescue service (which is organizationally independent from HEMS) while Armed Forces of Slovenia are provided primary mountain rescue missions with Bell 412 helicopters and serves as backup for HEMS operations [20]. According to internet based sources all HEMS operations in Slovenia are mainly funded by National health insurance and Ministry of health. Missions are conducted only during the day [20]. The Slovenian HEMS units conducted 3.000 interventions (3024 patients) between 16 July 2003 and 01 May 2016. Also, Slovenia in-

creased HEMS capabilities by establishing a base in Maribor on 18 Nov 2016 [20].

By annual report of Croatian Armed Forces [19] the HEMS costs for transportation of 558 patients in 2014 were about 3,3 million KM (Bosnia and Herzegovina Convertible Mark) while those costs for the transport of 510 patients in 2015 were about 2,85 millions of KM) [19]. The fuel consumption and other operating costs of those helicopters are equal or less of AF BiH helicopters. Therefore, it can be concluded that operating HEMS in BiH in order to transport about 500 patients per year requires about 3 million KM per year. It is important to emphasize that Croatia tasked Italian EliFriulia HEMS company with their partner Air Green to conduct HEMS missions between Aug 2015 and Jan 2016 as pilot project in Croatia. By the contract, for the tasking period of four months Croatia government paid about 10.7 million HRK to the EliFriulia company. After piloting this project Ministry of Health has not extended the contract with this Italian civilian helicopter service and now this task is performed by military helicopters.

In many western countries, the major HEMS operators have been commercial helicopter operators. But, it is noticed that Croatia like Slovenia decided that HEMS services will be conducted by military and police helicopters [20], [21]. Ministry of Health of Croatia, Ministry of Interior and the Dubrovnik-Neretva County were signed an agreement for establishment HEMS for an initial period of 15 June to 1 October 2016. The Ministry of the Interior tasked a helicopter for HEMS during the summer months. Ministry of Health provides medical team while the Ministry of Interior and the Croatian Institute for Emergency Medical Services provide medical and other equipment required to accompany and treat the patient during the flight [21].

Across Germany, clinics are increasingly specializing in treating specific types of illnesses. Since the distances between the patients and clinics are becoming larger, the use of helicopters has a crucial advantage. The ground ambulance is used in short distances. Apart from emergency rescue alerts, 24% of German-wide missions involved intensive care transports between clinics [22]. Also, in BiH we can recognize that some clinics are specializing in treating specific types of illnesses (e.g. "BH Heart Centre" is one of the most sophisticated health institutions specialized for treatment of cardio and vascular diseases in South Eastern Europe [23].

CEO of DRF Luftrettung – German air rescue claims that "every third emergency patient has to be transported in a hospital by a helicopter. For several years the German health system has been undergoing structural changes, for example a specialization of clinics. Their helicopters can cover wide distances fast and therefore have a crucial advantage to provide the patients with an optimal treatment, especially in rural areas." Also, he emphasized that every fifth mission was flown at night [24]. Joint Aviation Requirements (JAR) Airplane Operations (OPS) 3 standards [7] define helicopter characteristics, equipment, and composition of the crew and their training. At this moment it is not possible to fully train/equip BiH's crews/helicopters to meet required standards. The flight during the night have some constrains.

Table 1. HEMS flown missions in BiH and some EU countries for period 2011-2015

Country Land Area (km2)	2011		2012		2013		2014		2015	
	Flights	Patient	Flights	Patient	Flights	Patient	Flights	Patient	Flights	Patient
BiH 51,129	37	16	42	13	58	21	63	27	120	40
Croatia 87,661	1383	490	1330	470	N/A	529	506	558	464	510
Netherlands 42,000	4670	N/A	4935	N/A	5749	N/A	6859	N/A	7650	N/A
Slovenia 20,270	302	N/A	297	298	N/A	290	247	N/A	242	N/A
Slovakia 48,845	15 767 HEMS missions during the years 1994-2013						N/A			
Switzerland 41,000	10797	9278	10250	8802	13793	8587	14435	8739	15053	9208
Luxembourg 2,586	> 3.000 missions every year						3500 missions		>3.000 missions	

If we make comparison of methods of funding there are different approaches of European countries to address this issue. For instance, Swiss Emergency medical assistance by air – Rega is an autonomous, privately run, non-profit foundation. With over 2.5 million patrons, it is firmly rooted within the Swiss population and funded CHF 88, 1 million in 2015. These costs are not covered by a health or accident insurance [16]. Also, the Donator's Programs [17] are practice of EU countries. It is therefore foreseen that a combination of public and private financing will be required. This is common in other countries where HEMS helicopters are acquired and operated by private foundations, but financed partially through governments buying services from the foundations, and partially by membership fees from supporters. Membership fees are frequently required to finance HEMS for people who do not have health insurance, and to provide training and competence to personnel in the HEMS service.

This comparison must be red flag for BiH government, institutions at all levels and society as whole to develop strategies, prepare study to establish effective HEMS and to ensure funds. An end state is to create the system that will be functional and meet required EU standards regardless of whether it operated by state aircrafts or private companies.

4. Perspectives of HEMS in BiH

A weak links with hilly and inaccessible areas mainly due to bad road conditions, traffic jams in cities or no alternative roads from some parts of BiH which don't allow easily picking up injured/ill patient from the incident/accident site all result in critical loss of life-saving time for the patient. Also, transferring the patient from the health care center to the clinical centers between entities/Brčko district's medical facilities results in critical loss of life-saving time for the patient. In those cases rapid action by road ambulances don't meet requirements of the "golden hour". For instance, patients transported as secondary/tertiary response for medical treatment from Bihac city (northwestern part of the country) to Sarajevo capital can take about 5 hours by the road, even under the ideal weather conditions. Bad road conditions result that this transportation can be extended for 6-8 hours while the helicopter can take it a little bit more than 1 hour.

Due to the large number of traffic accidents in South East Europe (SEE), Regional Road Safety Strategy (RRSS) for South East Europe Transport Observatory (SEETO) countries (Albania, Bosnia and Herzegovina, Croatia, FRYM, Montenegro, Serbia and Kosovo) has been developed within the European Commission (EC) Project: "Support for Implementing Measures for South East Europe Core Regional Transport Network, Multi Annual Plan 2008-2012". The aim of the RRSS is to reduce the number of road fatalities by 50% from 2007 to 2019. In 2006, The Council of Ministers of BiH adopted the National Law on Road Safety treating all road safety aspects which has been applicable within the whole territory of the country [25]. Although the project is approved and Law is adopted, BiH is still facing a huge number of road accidents. BiH's Auto Moto Club (BIHAMK) published that BiH faced 38.658 traffic accidents in 2015 (7627 accidents with killed and injured persons and 31032 accidents with material damage). In comparison to 2014, there were 2434 more accidents in 2015. The number of killed people in traffic accidents is in constant growth in F BiH for the last 3 years while in RS is almost equal to average in last 4 years [26]. Adequate HEMS that will support faster transport of injured persons from incident site to hospitals in order to reduce number of fatalities can be used as a tool to reduce road fatalities by 50 % that is the aim of RRSS.

Also, one should not forget that BiH is the most mine contaminated country in SEE region (total suspect area currently covers around 1.145,00 km2 or 2,3% of total country size) [27]. BiH Mine Action Strategy (2009-2019) has an aim that BiH is clear from mines until 2019. The dynamics of the implementation of the objectives and activities of the Strategy does not ensure that BiH will meet international obligations and strategic objectives defined by 2019 Ottawa Convention. BiH Mine Action Center (BHMAC) did revision of the strategy in 2015 and found that BiH has implemented 50% of the implementation of the technical and financial part of the Strategy. The new proposal is that BiH would be clear from mines until 2024. To do so BiH will follow new demining model, so called Land Release, [27]. During demining activ-

ities responsible authorities have planned AF BiH helicopter for general support in order to establish HEMS for transport of possible injured to closest hospital for further treatment [10].

The number of people that enjoy winter sports and other recreational activities in BiH (at the mountains surrounding Olympic town Sarajevo or other mountains rises every year. Some incidents are connected to the tourists staying in mountains. Usually, incidents happen in the inaccessible terrain away from the road communication and approved ski terrain during the winter season. In order to improve EMS this is one more obligation for authorized institutions/agencies to ensure HEMS from those mountains to the closest appropriate hospital/s for further treatment.

Additionally, BiH needs to develop cross-border HEMS with neighboring countries. It's possible to use an aircraft of a neighboring country instead of own means considering distance of operations [28], [29], a speed of reaction and ease of crossing a borders.

Moreover, BiH is also subject to natural hazards/disasters [30] and have to have aerial assets to support society in case of such disasters. Possible airlift of injured/ill patients from all above mentioned situations gives the right to think seriously about introducing efficient HEMS which takes a shorter time to pick up the patient and return to the hospital. The risk of transporting a patient with severe injuries is greatly reduced.

Coming to the possible solutions it is worth noting that even if BiH were to set up HEMS services to the 4 international airports (Sarajevo, Banja Luka, Tuzla i Mostar) or to locations close to those airports BiH it would not be able to obtain full coverage of the whole territory within the "golden hour" requirements for primary missions even with HEMS rings of 40 NM (Figure 2 – blue color rings). There are certain gaps on sought-eastern/western boundary of BiH. Those gaps are even higher once the UH-1H helicopter is tasked for HEMS (Figure 2 – purple color rings). As an alternative option, if BiH were to establish 6 HEMS bases (4 bases at International airports (Figure 2 - blue rings) embedded with 2 additional bases established in Bihać and Livno (Figure 2 - green rings)), certain small gaps on eastern and southern parts of BiH would remain. However, those gaps might be manageable with the speed of helicopters to successfully conduct primary missions from/to home-bases of HEMS helicopters. However, due to the limited budget for HEMS there is possibility to introduce an interim solution by establishing HEMS helicopters at 4 international airports with the task to transport patient/s to the hospital other than home-base hospital (if the distance can't comply with "golden hour"). In this option, coordination is gaining importance as well as short notice to move.

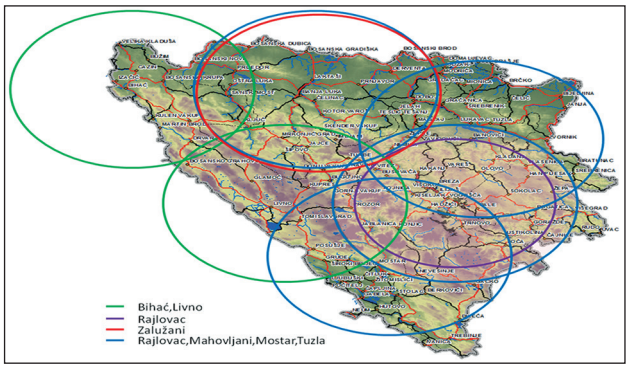

Figure 2. Possible HEMS in BiH

If the AF of BiH or other institutions decide to buy new helicopters that have fast cruising speed, the gaps visible on Figure 1. may be covered. The Council of Ministers of BiH has approved project „Ensuring and improving operational helicopters of the AF BiH with the implementation period 2016-2025" [31]. Accordingly, if AF BiH buys helicopters that have fast cruising speed about 250 km/h above presented gaps might be covered. Also, Government of BiH's entity RS adopted decision on the procurement of a multipurpose helicopter, in 2017, which will be fully equipped with the modern medical equipment. HS of RS is planning to re-locate this helicopter for certain period in southern parts of BiH that will additionally reduce existing gaps, mainly in entity RS [32]. The cities Trebinje/Foča are preferable options for relocation of newly procured helicopter.

Also, the Government of F BiH, recently adopted the conclusion that the funds for maintenance and equipment of helicopter Bell-206 L1 Long Ranger (six years in hangar because the fund for maintenance wasn't ensured) will be ensured from special fee for protection against natural and other disasters at the disposal of the Federal

Administration of Civil Protection. According to rough estimates 1.000.000, 00 KM is needed to bring this helicopter to operational status [33].

Beside governmental operators, in 2017, VDH aero company is going to begin HEMS services mainly for persons that have German ADAC membership. According to estimate of the one of executive directors of VHD aero, the company will start to conduct operations in the second quarter of 2017. Currently, VDH aero procured one Gazelle helicopter [34]. At this moment getting airworthiness certificates for this helicopter is in progress. Also, VDH aero has an intention to procure one helicopter AW-109.

Crews have to be certified in accordance with national/internationally accepted standards. In order to be effective, HEMS must be established 24 hours a day in all weather conditions.

When it comes to the resources and finances a combination of public and private financing will be required. Public financing might be by involvement of entities, ministries of health and increasing budget of Ministry of Defense for HEMS purposes. Entities are getting special fee for protection against natural and other disasters and those assets can also be used to support this project. Also, individuals have to be able to pay such service. Additionally, one option of the financing HEMS are EU funds.

5. Conclusion

Efficient helicopter emergency medical services play a significant part in modern Emergency Medical Systems in many countries and therefore HEMS should not be seen as an exception. It's a necessary service that must be established for saving lives, protects assets and generating direct and indirect value.

It requires an application of systematic and comprehensive concept of HEMS management including coordination and cooperation of numerous governmental agencies/organizations at all level of governance diverse civil society elements as well as different commercial companies. HEMS needs to be incorporated into the health care system with a clear way of managing and financing it.

In BiH, local health services focus on basic services while the major hospitals are regional and located in major cities. The helicopters will help the ground ambulances when it is necessary for their engagement according to selection criteria of patients and priority degrees. In this way, helicopters will allow quick and direct access to more specialized and sub-specialized medical centers despite the fact that cost of a helicopter mission is higher than with a ground ambulance.

It can't be argued that there is no progress on the development of helicopter emergency medical services in BiH but BiH is still far from desired HEMS standards. According to current state and estimates, it is unlikely to establish a commercial agency which will provide HEMS solely for BiH citizen in the next few years. These problems could be mitigated by adopting legislation and strategy by adequate authorities in BiH, signing necessary interstate and international agreements, ensuring interagency coordination, allocating appropriate budget for resources, an improvement of activation and response times, improving helicopter capabilities of all state/entity aircraft users in BiH in order to be fully ready for HEMS missions.

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Safety coefficient calculations of hoist ropes on excavator MARION - 7400

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Abstract

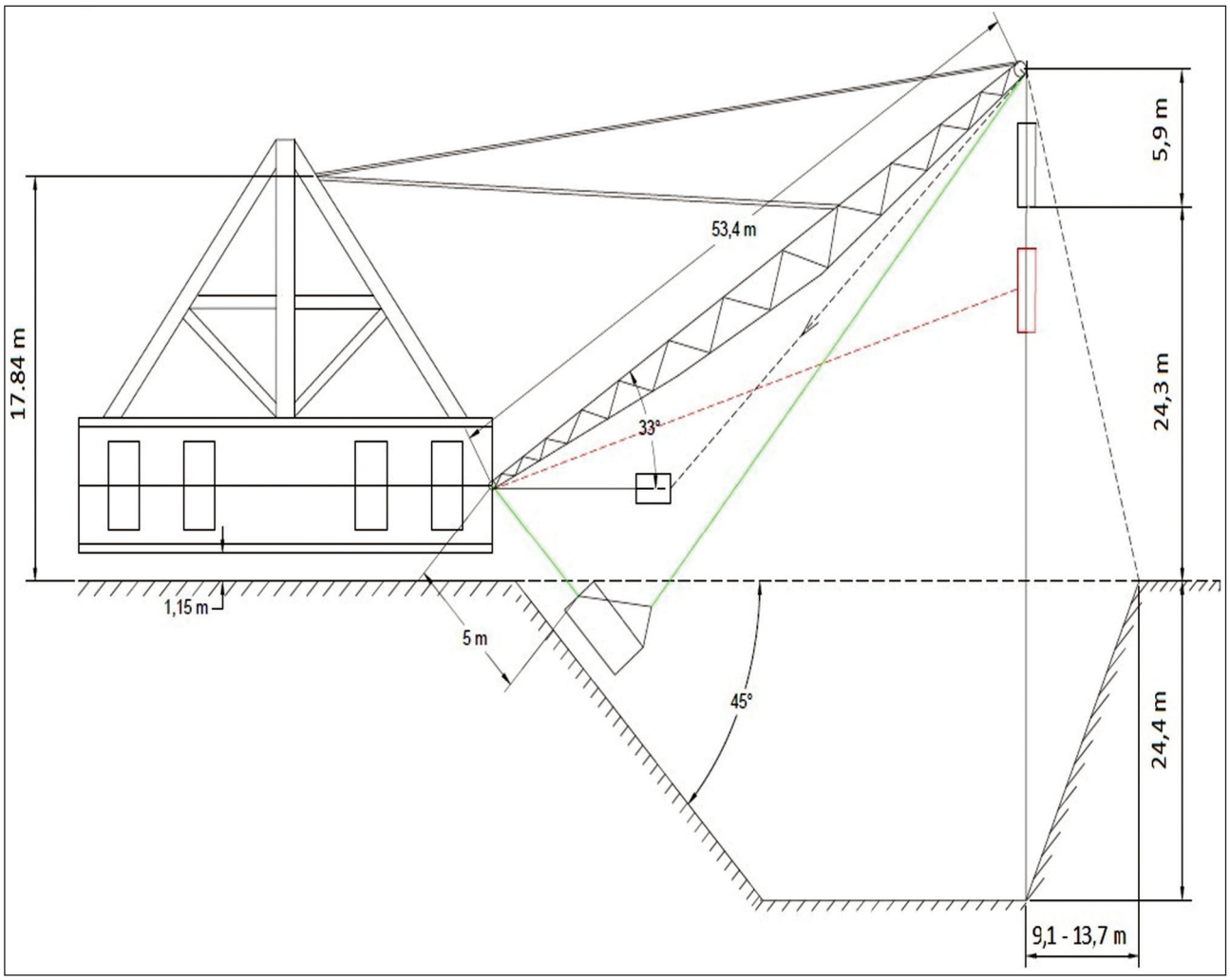
This paper provides overview and order of load calculations on ropes in excavators Marion 7400 aiming to determine safety coefficient in order to determine allowed loads in ropes during excavator operation.

Based on allowed load and safety of ropes structure and continuous observation of its safety, time of ropes usage can be suggested.

Operation process covers all ropes on excavators used for:

1. Digging of mineral raw materials
2. Elevation and unloading of full dipper
3. Holding of central foothold support of excavator (mast) in excavator operation process and execution of certain operations.

Key words: Excavator, rope, digging, elevation



Picture 1. Position of central foothold support of excavator (mast) with dipper 5 m away from excavator front

1. Introduction

This paper provides overview of calculations on all ropes that function in coal exploitation on surface mines based on safety coefficient calculations.

Several cases of load had been observed:

- When dipper is 5m meters from excavator front,
- In case without load,
- In case when dipper is under angle γ,
- Calculation of ropes load in elevating and digging process

Excavator Marion 7400 is big and complex machine for coal exploitation in coal mines. In this case, we are dealing with coal exploitation where several complex mining operations are being conducted by excavator: digging, elevation and transporting of coal and barren soil on mine landfills. It is imperative to mention that continuous excavator operation depends on functionality of hoist ropes, which are divided in three types: hoist ropes, elevation ropes (dipper with excavated material) and ropes for central foothold support of excavator (mast). [1]

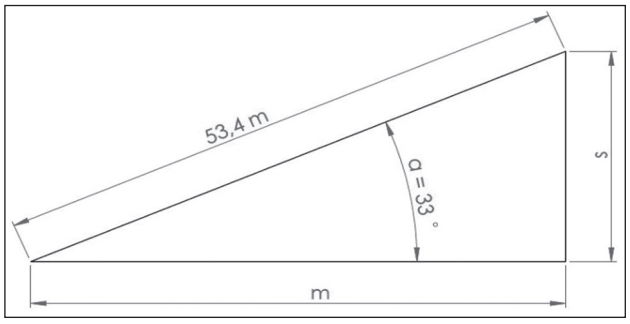
In this paper, we will observe three cases or three positions of dipper that are characteristic for time of machine – excavator exploitation.

A.) Determination of forces in ropes during position of dipper 5 m away from excavator front (1) [1]

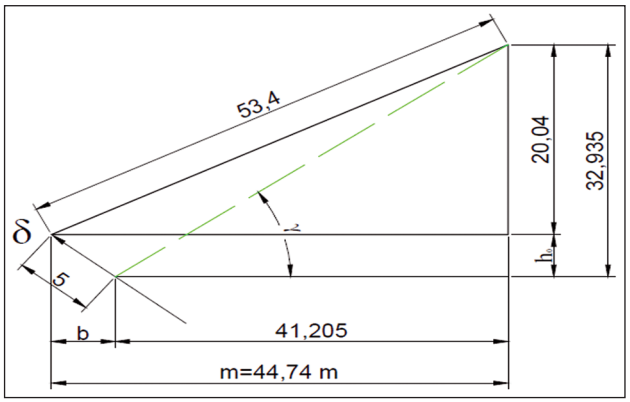
Analysis of forces in ropes during position „a“

sin α = 0,544; $s = 53{,}4 \cdot \sin 33° = 29{,}04\ m$

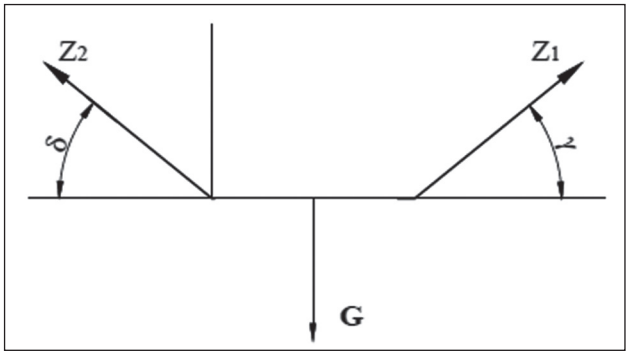
cos α=0,838; $m = 53{,}4 \cdot \cos 33° = 44{,}74\ m$



Picture 2. Position of central foothold support of excavator (mast) in comparing to horizontal axis



Picture 3. Dimension on central foothold support of excavator (mast)



Picture 4. Position of forces on excavator Marion M-7400 (in elevation and digging)

Z_1- force in elevation rope

Z_2- force in hoist rope

$h_0 = 5 \cdot \sin 45° = 3{,}535\ m$

$t_g\gamma = \frac{32{,}935}{41{,}205} = 0{,}799 \Rightarrow \gamma = 39°$

$l_0 = 5 \cdot \cos 45° = 3{,}535\ m$

$\Sigma X = 0 \Sigma X = 0 \Rightarrow z_1 \cdot \cos\gamma = z_2 \cdot \cos\delta \Rightarrow$

$Z_2 = Z_1 \cdot \frac{\cos 39°}{\cos 45°} = 1{,}09 \cdot Z_1$

$\Sigma Y = 0 \Sigma Y = 0 \Rightarrow z_1 \cdot \sin\gamma + z_2 \cdot \sin\delta = G$

$z_1(0{,}629 + 1{,}09 \cdot 0{,}707) = G$

$\Rightarrow z_1 = \frac{G}{1{,}399} = 0{,}714 * G$

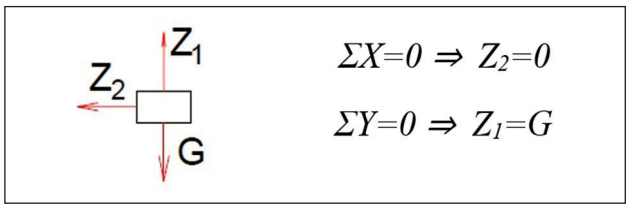
$Z_2 = 0{,}778 \cdot \cdot G$

In this position

$Z_1 = 0{,}714 \cdot G$

$Z_2 = 0{,}778 \cdot \cdot G$

B.) Analysis of forces in ropes for position of bucket in point „b“ when bucket is vertical and unloaded



Picture 5. Position of forces on bucket (dipper) at the end of excavator – Marion (M7400)

C.) Position of forces when bucket (dipper) elevator rope is in distance under angle γ

$\text{tg}\,\gamma = \frac{29{,}04}{39{,}74} = 0{,}7307 \Rightarrow \gamma = 35°$;

$\sin 35° = 0{,}573$;

$\cos 35° = 0{,}819 = Z_1x / Z_1$

$Z_1x = 0{,}810 \cdot Z_1$;

$Z_2 = Z_{1X} = 0{,}810 \cdot Z_1$

$\sin 35° = Z_1y / Z_1$

$Z_1 = Z_{1y} / 0{,}573$

$\Rightarrow \Sigma Y = 0 \Rightarrow Z_1 = \frac{G}{\sin 35°} = 1{,}745\ G$;

$\Sigma X = 0 \Rightarrow Z_2 = Z_1x$

$\Sigma X = 0 \Rightarrow$

$Z_2 = \frac{Z1}{0{,}819} = 1{,}221\ Z_1 = 1{,}221 \cdot 1{,}745\ G$

$Z_2 = 2{,}13\ G = 2{,}13 \cdot 24{,}5 = 52$ (t)

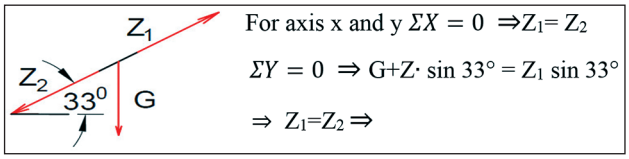
In position

„ C“ $\Rightarrow Z_1 = 1{,}745\ G = 1{,}745 \cdot 24{,}5 = 42{,}8$ (t)

$Z1 = 1{,}745\ G = 42$ (t)

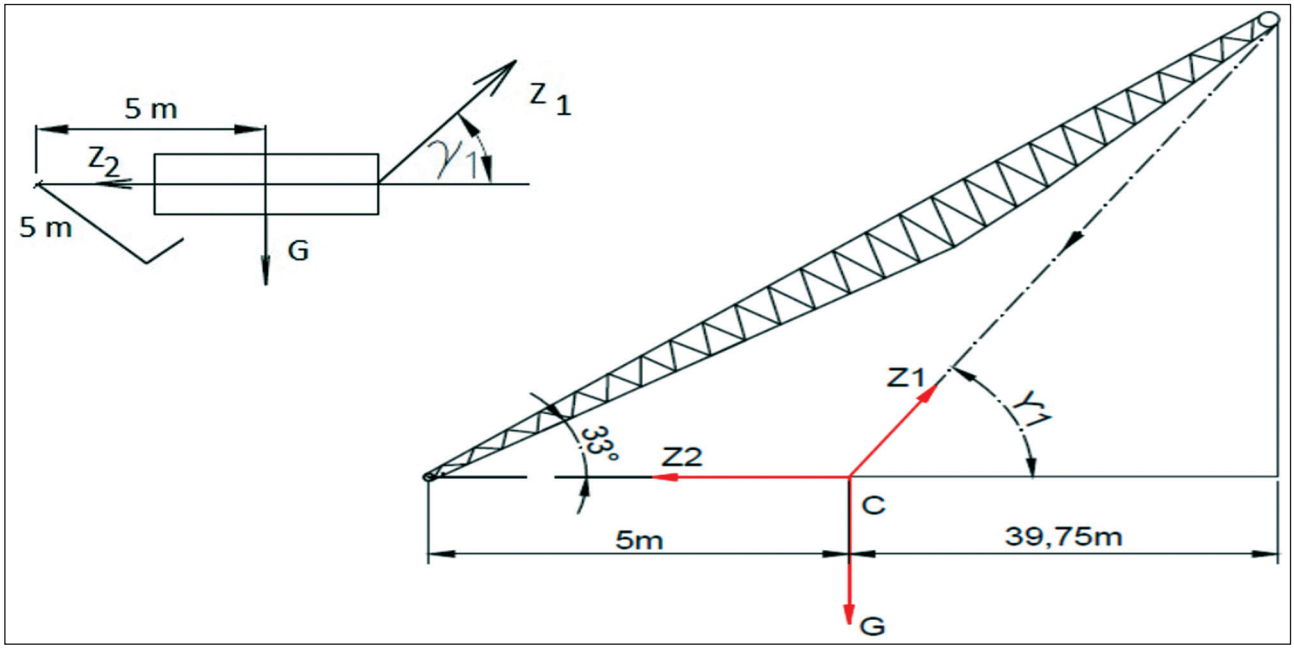
$Z_2 = 2{,}13\ G = 52$ (t)

D) Analysis of forces for the most inconvenient position (impossible position) – outstretched cables



Picture 7. Position of forces on dipper when ropes are in same direction – under the same angle on excavator Marion (M7400)

Forces larger than engine capacity which pulls cables will not be evident



Picture 6. Position of forces on bucket when rope is under angle γ on excavator Marion (M7400) (the mass of dipper + the mass of material + the mass of rope)

E.) Determination of masses during excavator operation

a.) The mass of dipper

G_k = 4,8 t or G=48 kN

The volume of dipper

V=9,15 m^3 ⇒ The mass of full dipper

With coal G_u=9,15 · 1,38 t/m^3 = 12,63 t = 126,3 kN

With agregate G_u= 9,15 · 2,1 t/m^3 = 19,215 t = 192 kN – Marl

b.) The mass is sufficient for calculation

The mass of rope – cable

$G_k = l \cdot g$ = 48,7 · 9,72= 473,364 kg= 4,73 kN (500 kg)

Therefore, total values are:

G_{min} = 48 kN+4,73= 52,73 kN (empty dipper)

G_{max} = 48+4,73+192= 245 kN or G = 24, 5 t

These are statistical values that are multiplied with dinamic coefficient depending on machine operation

$G_{Dmax} = \varphi G_{max}$;

$G_{Dmin} = \varphi G_{min}$

φ = Dinamic coefficient in mining machines operation: φ = 1

F.) Determination of elevation and digging forces

Rope – force of elevation

Z_{1min} = 0,714 G_{min} = 37,65 kN

Z_{1max} = 1,745 G_{max} = 427,50 kN

Forces on rope during digging – force of digging

Z_{2min} = 0,778 G_{min} = 41,55 kN

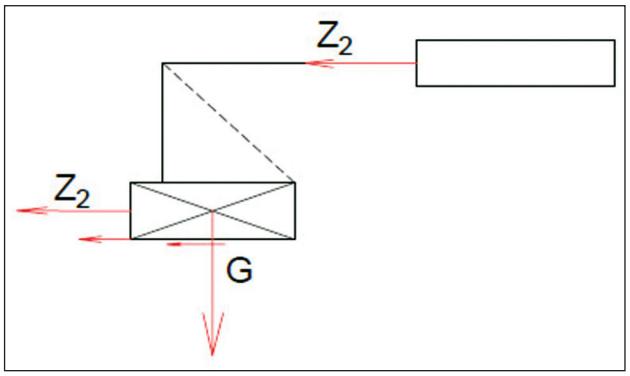
$Z_{2max} = (G_k + G_m) \cdot \mu + F$

Z_1 = 1,745 · 24,5= 43,6 t

Z_2 = 2,13 · G= 53 t

$G_{kaš} \approx$ 5 t

Z_1, Z_z - ($Z_{kop.}$) - force in elevation rope, force in hoist rope
Z_{1x}, Z_{1y}, Z_{2x}, Z_{2y} - force and components force in ropes
V – the volume of dipper
G – total the mass of dipper and material
$G_{kaš}$ – the mass dipper
G_k – the mass of rope cabel
G_m – the mass materials
F_{kop} – force on hoist rope
$F_{tr.}$ – friction force
$F_{zkop.}$ – cutting force of material
τ – average similar tensio
η – coefficients security



Picture 8. Position of forces in digging process – excavator Marion (M7400)

$G_{mat} \approx$ 19 t

$Gu._{maš} \approx$ 0,5 t

A= Cutting surface of dipper · δ_{tooth} = 220 · 17 = 3740 (cm^2)

$G_{uk.} \approx$ 24.5 t

5 teeth is on dipper . l_{dipper} = 220 (cm) ; δ_{tooth}= 17 (cm)

$Z_2 = (G_{kaš} + G_{mat}) \cdot \mu$

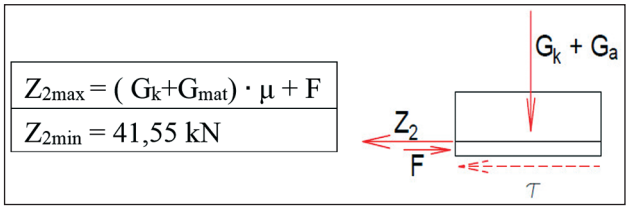
μ – friction coefficient

$Z_2 = (G_k + G_{mat}) \cdot \mu + F$

T (friction force) =($G_{uk.} \cdot \mu$) = (48 +195) · 0,35 =84,35 kN = 8,5 (t)

F-force (Shearing – soil resistance present in process of digging)*

depending on type of digging material - see prospects (μ i F)

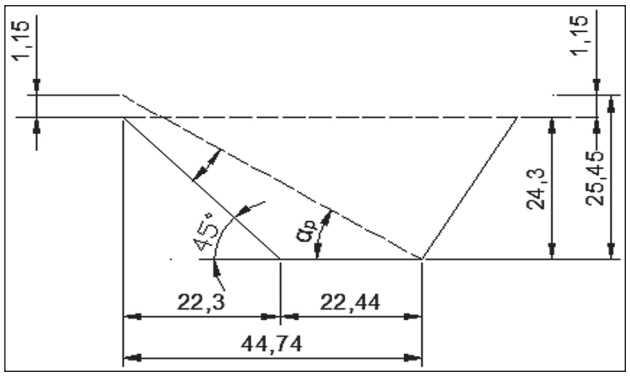


Picture 9. Position of forces on dipper when rope is in horisontal position during digging – excavator Marion (M 7400)

In digging process the force of digging is present that depends on friction force as well, and is in function of friction coefficient (μ_1). According to literature D. Ignjatović is calculated as follows: for marl and steel μ1 = 0,25-1 [2] . [2] However, in bad working conditions this coefficient can be less and it can be determined through relation:

μ_1 = 0,75 μ_2 = 0, 75 · 0,47 = 0,35.

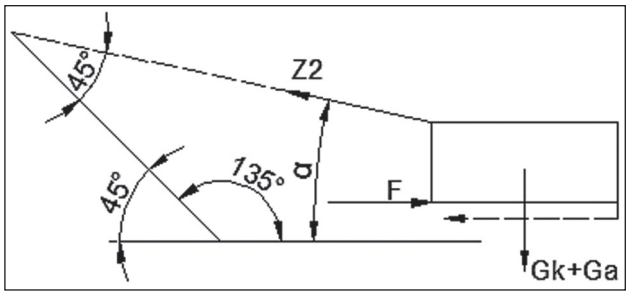
μ_2 = tg φ, μ_2 = tg 25°,



Picture 10. Position of ropes under the angle up to 45° in digging process and starts from undetermined angle α_p

And for solid materials φ = 25°, tg 25° = 0,47
This means friction coefficient is; $\mu_1 = 0{,}35$.
Ga = Gm

G.) Force on hoist rope under the angle



Picture 11. Position of force on dipper when rope is under the angle up to do 45° in digging process

$$\Sigma Y = 0 \quad Z_2 \cdot \sin\alpha = G_k + G_M$$

$$\Sigma X = 0 \quad Z_2 \cdot \cos\alpha = \Sigma F_{TR}$$

$$\Rightarrow Z_2 = \frac{(G_k + G_m)\cdot\mu + F}{\cos\alpha} =$$

F (cutting force) of material in depth of surface mine digs from 100 – 150 m, similar to present state in surface coal mine Turija, and according to prospect in project from mining institute Tuzla for analysis of marl material

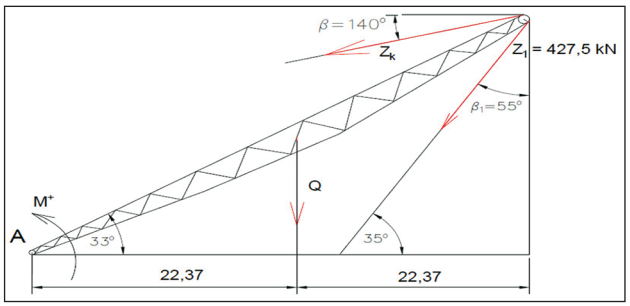
$\tau_{max} = 170$ N/cm², while
$\tau_{min.} = 5{,}6$ N/cm²
Average similar tensio
$\tau_{prosj.} = 62{,}8$ N/cm² = 0,0628 kN/ cm²
$F_{zkop.} = \tau_{max.} \cdot A = 0{,}062 \cdot 3740 = 231{,}88$ kN = =23,2 (t)

The surface of cross section in tooth blade on dipper for type Marion 7400

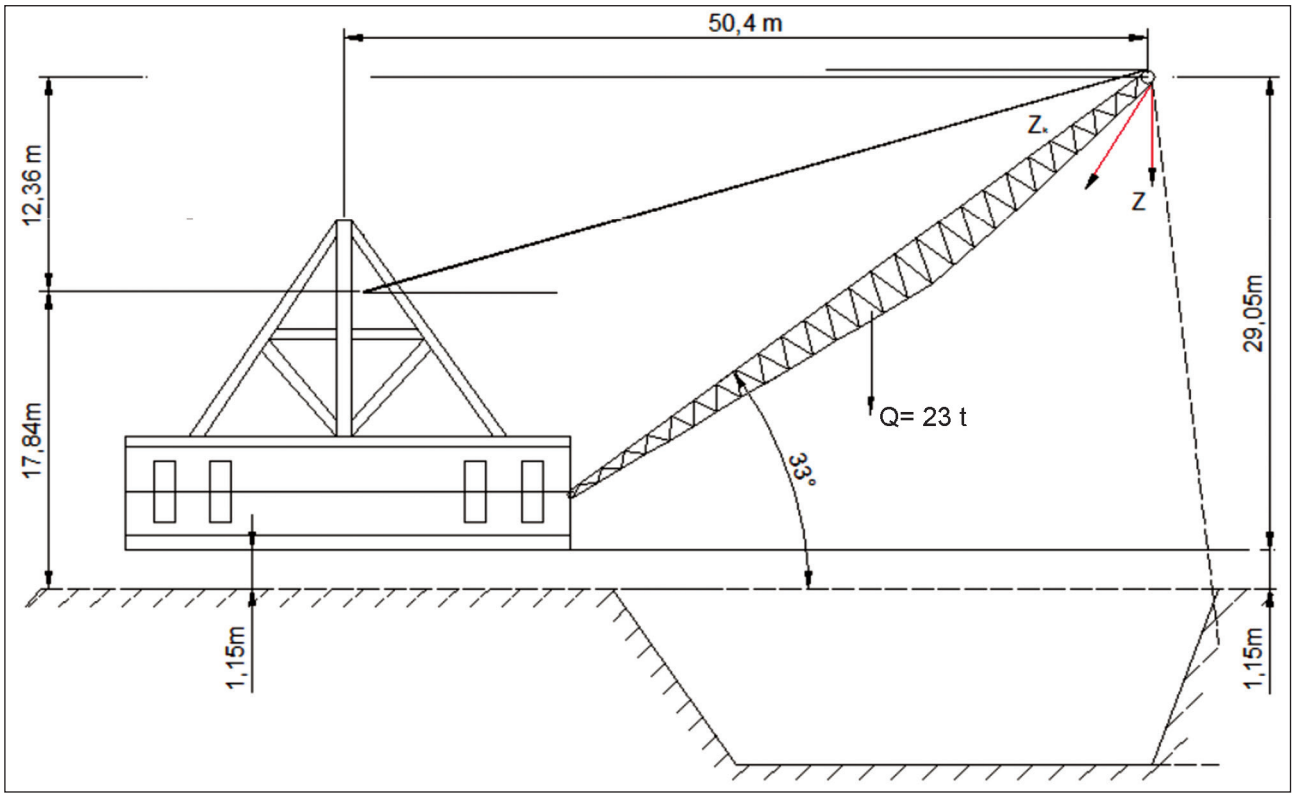
The thickness of the blade on excavator dipper δ=170mm, and the width of the blade is a;
s = 2200 mm = 230 cm ,
$A = 220 \cdot 17 = 3740$ cm² 45° < α_p < 30°
calculation of force in hoist rope is;
$Z_{2max} = (Gk + Gmat.) \cdot \mu + F_{Zkop.} =$
$Z_{2max} = (45{,}0 + 190{,}00) \cdot 0{,}35 + 231{,}2 = 82{,}25 + 231{,}2 = 313$ (kN); $Z_{2max.} = 313$ kN ,
For position, for angle αp = 30°;
sin αp = 0,5; cos αp = 0,86
$\Sigma y = 0 \quad \rightarrow G - Fu \cdot \sin\alpha = 0$
$\Sigma x = 0 \quad \rightarrow Fu \cdot \cos\alpha - F_{tr} - F_{z\,kop.} = 0 \quad \rightarrow$
$F_u = (F_{tr} + F_{z\,kop.}) / \cos\alpha = (84{,}35 + 231{,}2) / 0{,}86 = 315{,}55 / 0{,}86 = 367$ (kN)
This is for α = 30° and for 45°;
Fu = (Ftr + Fz kop.) / cos α = (84,35 + 231,2) / 0,75 = 315,55 / 0,75 = 421 (kN).
For digging angle; α = 45°; $F_{uk.} = 373$ (kN)
$F_{uk.} = 373 / 0{,}75 = 527$(kN)
Fu = 527 (kN). Competent for calculation of safety coefficient (η), and for digging is rope
Ø = 56 (mm); A = 1844 mm²
$Zkop = Z\,kop._1 = A \cdot \sigma \cdot 10^{-3} = 1844 \cdot 1{,}77 =$ = 3263 kN
Safety coefficient;
$\eta = Z_{kop.} / F_{uk} = 3263 / 527 = 6{,}19$

This rope gives absolute safety during operation regarding the fact that it fits in standard values allowed (η = 5-12)

H.) Determination of forces in on central foothold support of excavator (mast) ropes in load elevation and holding of on central foothold support of excavator (mast) in M 7400



Picture 12. Position of forces in M7400, when elevation rope is under the angle up to 35°, a on central foothold support of excavator (mast) under the angle up to 33°



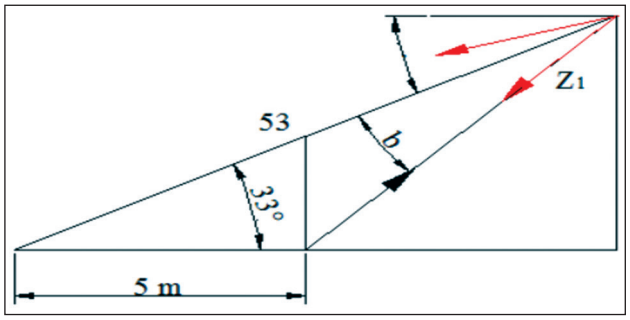
Picture 13. Position of forces on M7400

$$\text{tg } \beta_1 = \frac{12,36}{50,4} = 0,245$$

$\Rightarrow \beta 1 = 14°$

$\Rightarrow \sin \alpha = 0,241$

$\Rightarrow \cos \alpha = 0,970$



Picture 14. Position of forces in elevation rope in most inconvenient position and rope on on central foothold support of excavator (mast)

$Z_1 = 245,5$ kN

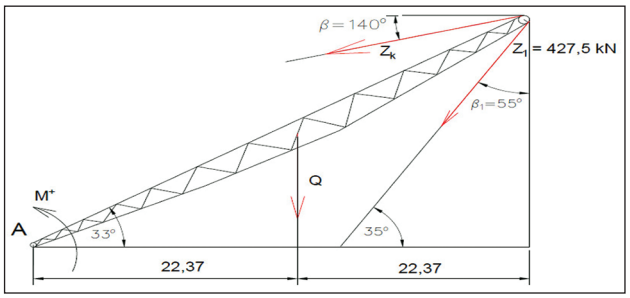
The mass central foothold support of excavator Q=23 t

Q=230 kN

$\beta_1 = 55°$

$\cos \beta_1 = 0,819$

$\sin \beta_1 = 0,573$



Picture 15. Position of forces in on central foothold support of excavator (mast) in most inconvenient position of elevation rope

$G = G_k + G_{materijala} + G_{uže}$

$G_k = 4,8$ t $= 48$ kN$= 4,8$ t,

$G_m = V \cdot \gamma = 9,15 \cdot 2,1 = 19,215$ t $= 192,15$ kN

$G_{už} = 19,1 \cdot l_{už} = 4,73$ kN $= 0,5$ t

$G_k = 4,8$ t $= 48$ kN$= 4,8$ t,

$G_m = V \cdot \gamma = 9,15 \cdot 2,1 = 19,215$ t $= 192,15$ kN

$G_{už} = 19,1 \cdot l_{už} = 4,73$ kN $= 0,5$ t

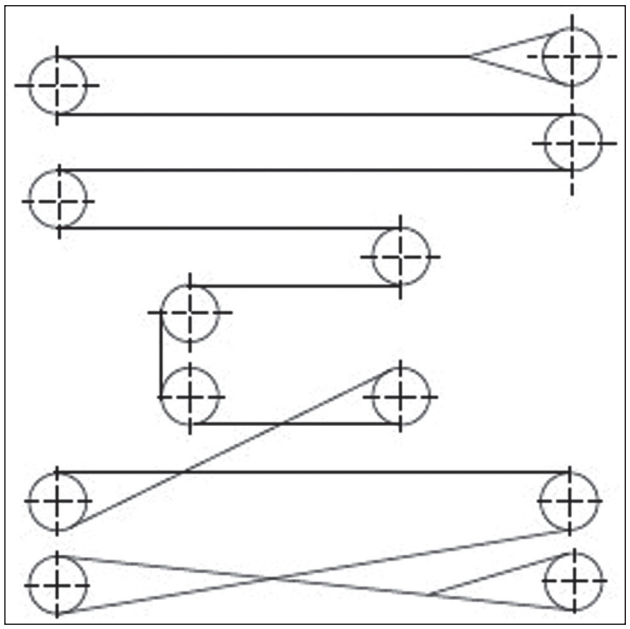
Statistical values:

$G_{min} = 48 + 4,73 = 52,73$ k;

$G_{max} = 48 + 4,73 + 192,5 = 245,23$ kN

$G_{dinamical} = \varphi G$; $\varphi = 1$

φ – depending on working regime



Picture 16. Position of elevation rope in a most inconvenient position on on central foothold support of excavator (mast)

Rope on entral foothold support of excavator (mast)

Q= 24 (t) = 240 (kN)

G= Gk + Gm + Gu = 245 (kN)

Zuk. = total force of dipper rope Zk

$\Sigma M_A = 0 \Rightarrow$ Zuk. (0, 97 · 29,05 - 0,241 · 44,74) + $+Z_1 \cdot 29 \cdot 0,5 - Z_1 \cdot 44,74 \cdot 0,8 - Q \cdot 22,37 = 0$

Z uk. = (427·45·0,82–427·29·0,573+230·22,4)/18= = (15756 - 7095, 2+5152) / 18 = 766 (kN)

Zuk = 766 (kN)

In one rope is Zuž. $= \frac{zu_k}{6} = \frac{766}{6} =$ 127 (kN)

For rope on central foothold support of excavator (mast)

($Z_{už. k.}$) M7400 je Ø 32, A = 603 mm2 → table values

So is; $Z_{už. k.} = A \cdot \sigma \cdot 10^{-3} = 603 \cdot 1,77 =$

$Z_{už.}$ = 766/ 6 ropes = 127 kN

$Z_{už. k.}$ = 1067 (kN) force for rope Ø 32

$\eta = Z_{už. k.} / Z_{už.} = 1067 /127 =$ 8, 4.

η = 8, 4. standard coefficient is 5- 12 , what fits in standard limitations.

Safety coefficient of tope on central foothold support of excavator (mast) is η = 8,4.

Elevation rope on excavator M 7400

Table value of load elevation in elevation rope (Z už. d.) in excavator: M7400 Ø 44,

A = 1144 mm2 → table values;

Z už. d. = $A \cdot \sigma \cdot 10^{-3} = 1144 \cdot 1, 77 = 2024$ (kN)

Z už. d. = 2024 (kN);

If the force on rope Z_1= 427 (kN) is most inconvenient position, rope burden consists of only component $Z_{1y.}$ However, for the biggest rope burden the total mass of material, dipper and rope is taken into consideration.

Statistical values:

Gmin = 48+4,73 = 52,73 kN

Gmax = 48+4,73+192,5= 245,23 kN

$\eta = Z_{už. d} /$ Gmax = 2024 /245,23 = 8,25

η = 8,25 which also fits in standard values allowed

4. Conclusion

All ropes on Marion 7400 have satisfactory safety coefficients which, according to rules, have safety coefficients η within the limits 5-12.

Professional services should make manuals on usage and replacement of ropes.

Inspections and ways of inspection can be suggested and after one year of intensive usage expand the usage in two more times by 6 months. After certain intervals defectoscopy of ropes can be done.

After 2 years of usage, it is necessary to conduct defectoscopy and perform analysis of load capacity for valid ropes, on samples of ropes in institutes. In case positive outcomes of performed analyses ropes can be used for additional 6 months.

Constant proper maintenance of ropes is precondition for good condition of ropes.

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Correlation between traffic congestion on seasonal variation of vehicles and RSPM levels at the traffic junctions of Mumbai

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Abstract

Traffic congestion is a major transportation problem in urban areas. Traffic congestion is high during peak hours. Survey is conducted at hotspot traffic junctions in Mumbai throughout the day during all the seasons. Traffic congestion is measured and correlated with the number and different types of vehicles. Public survey is conducted to check the prevalence of asthama using ciplas spirometer. Traffic congestion was measured at all the hotspots but selected significant junctions were used for formation of equation. Accuracy cheque is done for the Dadar junction which is 93% accurate than the algorithm prediction.1582 number of people were surveyed for various respiratory tract infections which includes sinusitis, tonsilitis, bronchitis, pneumonia etc. Results obtained from the survey are represented. Correlation between the traffic congestion and the traffic police for respiratory tract infection is tried to relate through this paper.

Key words: Traffic, Junctions, Vehicles, Congestion, Season, Correlation, RSPM

1. Introduction

The people in modern cities viz. Mumbai are mostly dependent on automobiles. Dependence on automobiles creates traffic congestion. The causes of traffic congestion are various and common among major cities, like more people drive further and far, limited transport choice, high density of vehicles per unit of road availability, limited transit service, scattered and unplanned development of cities. Due to traffic congestion pollutant matter like PM2.5 exposed from automobiles which creates respiratory disorders. Every year number of vehicles are rising considerably.

Traffic congestion is a condition on transport networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road issues.The traffic junctions are preferred site where congestion traffic is more as compared to other junctions. Sites selected for monitoring are KhadaParsi junction, Nana chowk junction, Haji Ali junction, Nagpada junction, Kemps corner, Andheri West, Bhandup Station junction, Dadar T T junction, Dharavi junction, Elphistone Road Junction, Ghatkopar link road, JVPD, Indian Oil junction, Kalanagar junction, Khetwadi junction, Kotwal Garden, Panjarapol Junction, Santacruz airport road, Parel T T junction, Sion Station junction. Twenty junctions are selected as hotspots of traffic congestions by the traffic control department.

The growing number of asthma rise is a serious problem associated as occupational hazard towards the traffic police. Efforts must be made to reduce the exposure levels at the source itself. Traffic junctions are identified as the most polluted spots where maximum concentration will occur as the vehicles should idle for signals at the junctions. [1]

For the longer time, signalized junction, the time display panel can be fixed, so one can shut down the engine for a while, which may reduce the pollution near junction. During study, it has

been found that, the small change in traffic volume keeps the same concentration of pollutant. So, the model needs to improve in this regards to get the accurate results for every small change in traffic volume.The particles emitted from the vehicular exhaust of more than 10-micron size are held in upper respiratory tract and particles less than 10-micron size (PM10) accumulates in the lung and produces respiratory abnormalities. Hence, PM10 are of great concern in air pollution studies [2]. This study provides the clear idea about, how the development of good infrastructure will help in building of good environmental conditions"

2. Materials and Methods

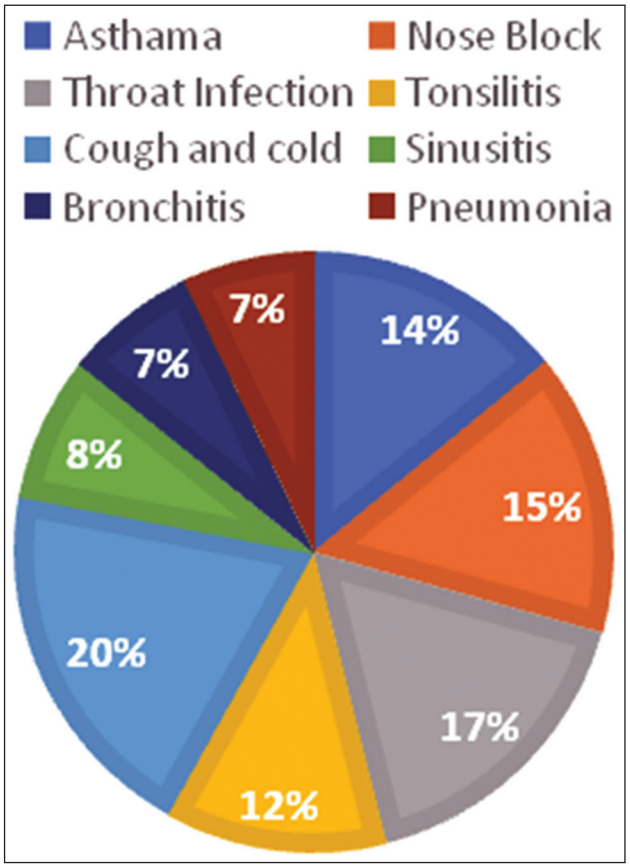
2.1 Descriptions and details of experimental site and analysis

Traffic junctions are considered as hot spot of air pollution, as vehicles have to wait in idling mode of operation for signals and so the amount of pollution increases. Several times it is observed that the signal lane is so long that the vehicles should wait for second turn of signal. Bhandup Station, Dadar TT Junction, Haji Ali, Indian Oil, JVPD, Khadaparsi, kherwadi, Panjarpol Junction were selected for ambient air monitoring and traffic congestions. Data from other junctions is rejected due to non-significance and only above mentioned eight junctions. Traffic density and congestion period was recorded. Traffic Police (Police constables, police naik, police head constables having outdoor duties and administrative work along with street vendors were diagnosed for asthama and other respiratory disorders. Spirometric analysis was done for finding asthama in the traffic police. [3]

2.2 Survey

Survey was conducted along the traffic junctions and congestion spots. Street Vendors, shopkeepers, traffic police were considered for survey through questionnaire. [3] It was observed from the data that these people were exposed to traffic pollution and heavy traffic during peak hours of the day for short durations. Most the people surveyed, were found to be suffering from breathing/ respiratory problems. A lot of them have been diagnosed with asthma at some time or the other.

Acute and chronic symptoms were observed among the exposed people. 1582 no of people were surveyed for various respiratory tract infections which includes sinusitis, tonsillitis, bronchitis, pneumonia etc. Results obtained from the survey are represented in Graph.1 pilot survey [3]



Graph 1. Pilot survey

Comparison of Number of Traffic with respect to the Junctions, Type of Vehicles, Season, and Congestion:

The Following table has the significant factors for predicting the number of vehicles in the city. Each factor is marked by a coefficient of the equation (Estimate) along with its standard error, value by t-test and its p-value with comparison with Number of Vehicles.

Significant parameters which affect the number of vehicles (Table 1).

Factors taken for developing the algorithm:

- Multicollinearity to be less than 4.0
- P-value to be taken at 95% confidence level
- The overall accuracy of this equation is 90.8%

Table 1. Parameters and standard values

Parameters	Estimate	Std. Error	T Value	P-Value
(Intercept)	-1211.42	591.73	-2.047	0.042951
Congestion	311.34	62.47	4.984	2.27e-06
Bhandup Station	-1199.95	338.24	-3.548	0.000567
Dadar TT Junction	1026.63	319.67	3.212	0.001720
Haji Ali	2052.65	307.28	6.680	9.39e-10
Indian Oil	-1319.38	305.73	-4.316	3.43e-05
JVPD	-1497.60	317.97	-4.710	7.10e-06
Khadaparsi	1560.98	307.03	5.084	1.48e-06
Kherwadi	-1328.79	302.28	-4.396	2.51e-05
Panjarpol Junction	-277.76	334.51	-3.820	0.000219
4-Wheeler Vehicles	1823.60	159.38	11.442	< 2e-16
Buses and Trucks	-1293.48	164.73	-7.852	2.57e-12

Final Equation for Predicting Number of Vehicles = = 311.34 * Congestion (kmph) - 1199.95 * *(Bhandup) + 1026.63*(Dadar) + 2052.65 * (Haji Ali)) - 319.38 * (Indian Oil) - 1497.60 * (JVPD) + 1560.98 * (Khadaparsi) - 1328.79 * (Kherwadi) - 277.76 * (Panjarpol) + 1823.60 * (4-wheeler-car)- - 1293.48 * (if it is a Bus or Truck) - 1211.42

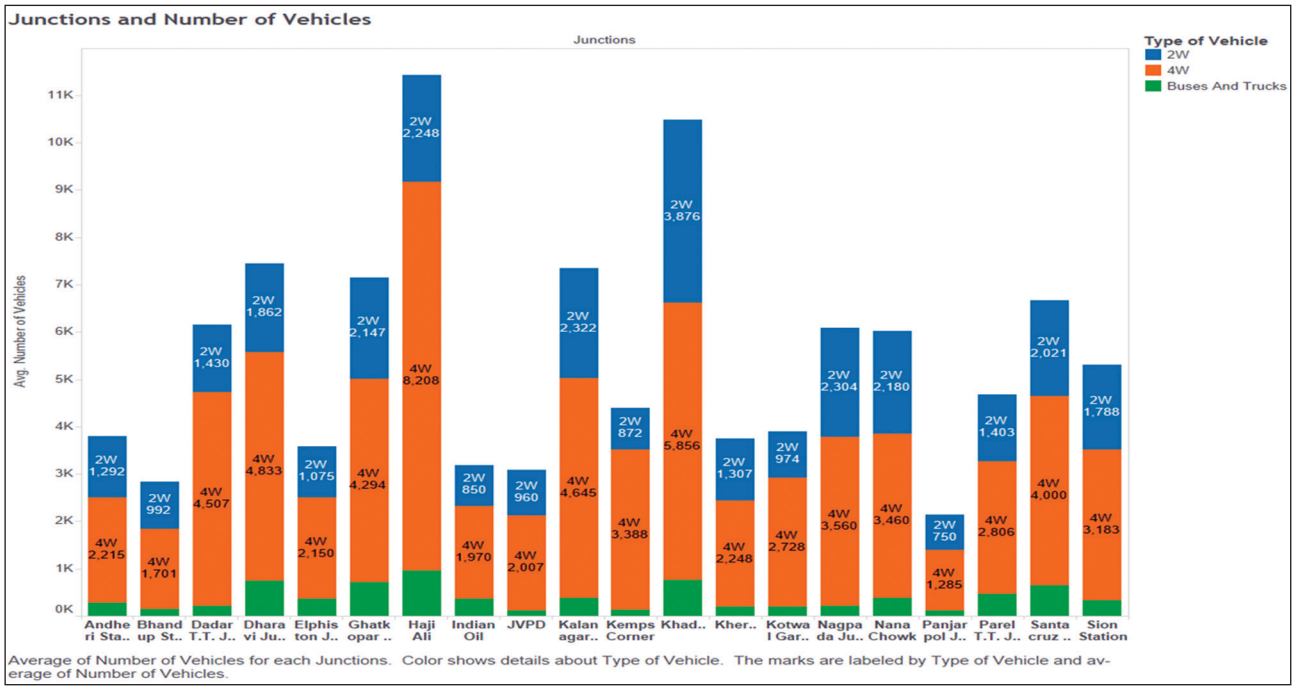
For the above equation to hold true,

Eg- If one is at Dadar Junction with Congestion = 9kmph, the equation would come as 311.34*9 + 1026.63 - 1211.42 ~= 2617 Vehicles. Wherein the data is compare with the manual counting which varied to be 2433 in actual. So, the accuracy percentage is 93% which is higher than the accuracy predicted by the algorithm.

- Congestion should be in kmph as per the data provided
- All other factors of the equation to be filled with either 0 or 1 on the basis of True or False

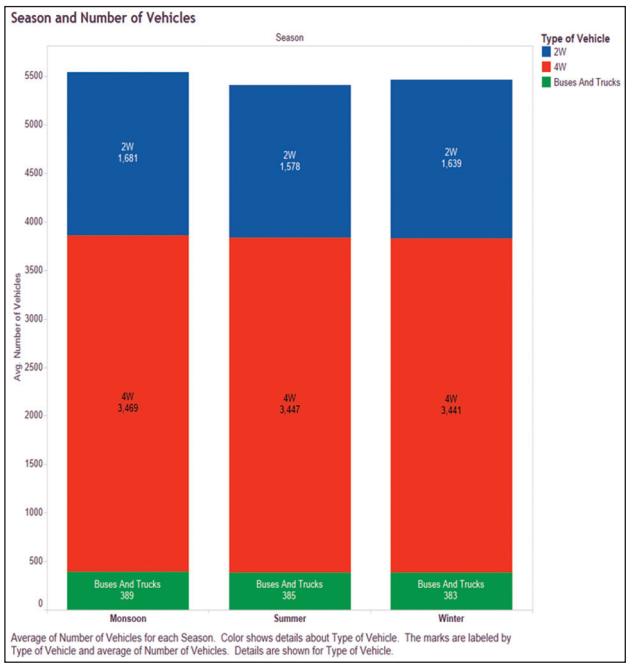
Insights-

- Seasons do not play a role in increasing or decreasing Number of Vehicles
- 2 wheelers do not constitute in adding up or decreasing Number of Vehicles
- The Highest Traffic Volume can be found in Haji Ali followed by Khadaparsi and Dadar TT.



Graph 2. Graph showing Junctions with Average Number of Vehicles

The Junctions which are not a part of this equation are not significant factors affecting the Number of vehicles.



Graph 3. Graph showing Average Number of Vehicles per season Graph

3. Conclusion

With the help of equation at any junction the number of vehicles can be estimated with the congestion known. With the survey it is very clear that many people suffer due to particulate matter emissions from the vehicles at the traffic congestions. There is need to check for the evidence of asthama in the traffic police as occupational hazard. Seasons do not play a role in increasing or decreasing Number of Vehicles

2 wheelers do not constitute in adding up or decreasing Number of Vehicles.

Traffic police is observed to be the most exposed person towards traffic congestions.

Acknowledgements

Traffic Department Worli for providing data related to most congested junctions. Mr. Ashank Srinivasan for kind help in data analysis. Dr. Nilima Kandagatla, Dr. Asif Bhojani and Dr Sandip-Tilve for survey questionnaire and health aspects.

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Application of Intelligent Agents and Case Based Reasoning Techniques for Green Software Development

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Abstract

Green Software development is a new paradigm adopted by software practitioners in implementing sustainable software products and services. Presently Green software development has not been fully adopted due to inadequate availability of information needed to support decision making of software practitioners. Therefore this research aims to develop an intelligent Green software development model that presents the combined application of intelligent agents and case based reasoning (CBR) techniques for supporting decision making of software developers in achieving Green software development. Hence to support Green software development, intelligent agents and CBR assimilates Green process into traditional software development life cycle. CBR utilizes past software expert knowledge derived from the extraction of similar software development cases thereby providing suggestions to software developers. Intelligent agent brings flexible for CBR by enhancing the capability of adopting Green software development there by overcoming the shortcomings of inadequate information experienced in traditional software development lifecycle. Findings from this study show how CBR aids decision making of software developers by retrieving Green initiatives form the case base library and how intelligent agents execute autonomous support to software developers' towards Green process adoption.

Key words: intelligent agents; case based reasoning; sustainability; green process; green software development; software life cycle; decision support.

1. Introduction

Software development life cycle process has been adopted in implementing software capable of meeting functional requirements of end users. Since the year 1970 software engineers recommended development practices that supported software to be implemented in an intended scheduled and organized manner. From the 1980's software engineers started to consider cost involved in developing software systems. Cost and effort estimation models and validation methods were introduced to address this problem. In 1990's software developers began considering the quality of software services and systems developed. Since the year 2000 there has been a lot of changes due to the utilization of the Word Wide Web (WWW) in software development process [1].

Ever since the year 1990 software engineers has been implementing web based distributed software service or systems [1]. Thus since the last decades, energy consumption of data centers, servers and other Information Technology (IT) infrastructures utilized during software development has become a major issue. In order to address software development issues that results in high energy usage, increased CO2 emission, high cost incurred and environmental pollution caused by waste derived from software process. A new concept refers to the "Green Practice" was introduced [2].

Case Based Reasoning (CBR) is an Artificial Intelligence (AI) technique proposed by Professor Roger from USA in the year 1982. CBR utilizes a set of cases stored in a case base which is the main source of knowledge. CBR is based on the idea of making use of previous experience and selecting the most similar previous case to resolve present problem, since similar issues would definitely have similar answers [3]. CBR is a quantitative and qualitative (mixed) technique of knowledge retention and retrieval similar to problem solving that matches new cases with past indexed cases.

CBR maps existing case base library in providing a list of Green software development suggestions to software developers. The retrieve case information is usually simple so that it can be applied, but also complex by containing problem solving parameters. Using cases is an imperative approach for disseminating knowledge [4].

CBR is a problem-solving technique that deploys reasoning rules which utilizes similarity search in retrieving past experiences and previously successful cases for addressing present problems. Where all cases are indexed with real data using a database structure for quick and accurate information retrieval in order to vigorously provide Green software development initiatives [4]. CBR makes reasoning through knowledge and experience, which are utilized as solutions to similar case problems. CBR is a suitable technique to be applied in achieving Green software development because it overcomes the limitations of ordinary reasoning rule based techniques that finds it challenging to collect knowledge from domain expert and also carryout reasoning of existing knowledge. As such CBR has previously been applied to several research areas in resolving organizational problems as used by researchers such as Zhao et al. [4].

Agent technology is an area of autonomous computing in AI. Research on agent technology started in the mid 1980's and since then it has been applied to several areas for practical purposes. An agent is a computer program capable of interacting autonomously and effectively with its surrounding through its own effectors and sensors in order to undertake assigned goals or self-defined tasks [5]. Intelligent agents are computerized entities which are executed under a definite environment. Intelligent agents can be developed to tackle issues which are impossible or difficult for an individual system to resolve [6]. These intelligent agents interact with their environment through knowledge exchange in order to accomplish the tasks assigned to them by being reactive since they accept commands from end users (software practitioners) in the external environment giving increasing possibilities to end user [5]. Intelligent agent aims to control and co-ordinate large complex system (comprising of hardware and software system) into a lesser complex system. Intelligent agent acts as a communication bridge between software developers and the case base library to support decision making hence enhancing case access and retrieval of relevant information.

Therefore this research study integrates intelligent agent and CBR to support Green software development due to the autonomous nature of agents and learning capability of CBR. The application of CBR and intelligent agent can support software enterprise reduce CO2 emission, lessen energy consumption and also decrease cost incurred in software development. The structure of this paper is organized as follows: Section 2 presents the literature review. Section 3 is the methodology; Section 4 is the discussion. The final Section is the conclusion, limitation and future works.

2. Literature Review

2.1 Background of Intelligent Agents

Since 1980 agent technology has turn out to be one of the most applied AI techniques. Intelligent agents comprises individual software agents that work together to provide task cooperation and coordination. Intelligent agents comprise individual abstract or physical entities that can acts on their own and can converse with other agents to improve decision making [4]. Integrating these autonomous intelligent agents into software development facilitates problem solving by supporting improved collaboration of individual agent with different capabilities and goals working together to accomplish their assigned tasks [7].

Intelligent agents possess reasoning, learning and self-organized capability. Intelligent agent was applied in this study because they are highly reliability, robust and also competence in solving problems. Intelligent agents practically provide a medium of deploying several experts in a particular application to address complex tasks through the assistance, communication, administration and regulation among individual agents [4]. Intelligent agent aids Green software development by monitoring and suggesting recommendation opinions to software developers through a set of static actuators and sensors as seen in Figure 1.

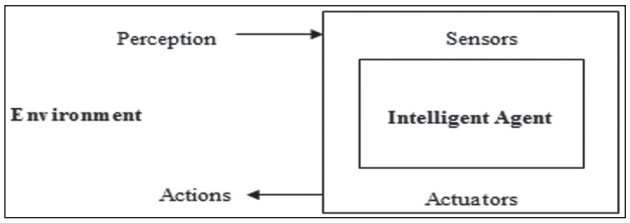

Figure 1. Shows a structure of an intelligent agent [8]

Figure 1 shows the component of an intelligent agent, the agent reaction is based on its perception and function (task to be executed) programed by the developer. Intelligent agent perceives and acts on the environment deployed. The agents' perception is responsible for transforming the actions executed by the end user (such as software developers). Intelligent agent control and implements predefined functions such as Green software development by perceiving its deployed environment through its sensors. After executing the predefined action, the agent perceives feedback from the environment about the failure or achievement of the deployed action through its actuators [8].

2.2 Overview of CBR

As stated previously CBR is an AI technique incorporated with database technology that comprise of past knowledge as cases. CBR uses reasoning procedures to memorize previous cases analogous to existing case problem, and then utilizes these cases to address current problem [6]. CBR aids storage of cases in the case base library through case indexing. In CBR cases are retrieved through searching of previously indexed cases by comparing the case parameters/attributes similarities of cases problem and case solution residing in the case base library. In case indexing, cases are structured as components having parameter used to develop the case base library. Thus since all Green cases are stored as components cases, the case retrieval procedures (new case) uses indexed cases parameter values to assess the degree of similarity between stored case. The case query search is executed using matching similarity search such as Nearness to Neighborhood (NN) algorithm [6].

CBR also allow learning from past and present experiences. Once any problem has been successfully solved by the domain expert, the case is subdivides into a series of tasks and then saved in a case based library to form a new case. Once a case is searched by a user such as the software developer the available cases in the case base are then matched with searched cases parameters to determine if the past solution case and present problem cases are similar [9]. CBR cycle comprises the retrieval of the most related case(s), reusing the retrieved case data, revising the selected solution and lastly retaining the revised case solution for future usage [10]. Case reusing of retrieved case leads to an enhanced efficiency towards solving novel problems, which is better than attempting to solve the problem from beginning. Furthermore CBR technique supports incremental and continuous learning due to case revision and retaining. Although learning in CBR occurs after case adaptation. Hence, as a case is successfully applied, its feedback will be retained for future use [11].

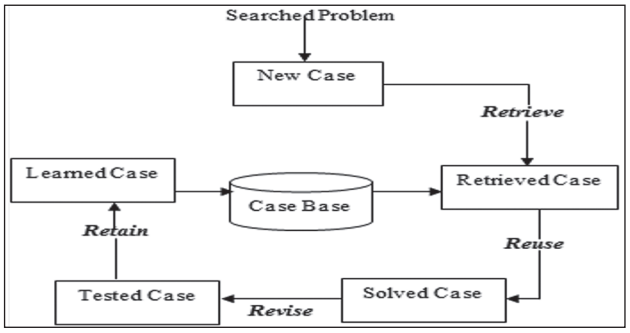

Figure 2. Traditional Case Based Reasoning Cycle [9]

Figure 2 shows the traditional case based reasoning technique deployed to retrieved previous similar case from the case base in solving new problems, after which the problem is retained and saved in the case base as learned case.

2.3 Green Software Development

Over the years a few research has been carried out to support software developers adopt Green software development, however only a 13 studies are selected to be briefly explored. Each study selected is aimed at achieving Green software development as shown in Table 1.

Table 1 summaries a few studies that has contributed towards supporting software developers attain Green software development. Each of the

Table 1. A related works on Green software development

Authors	Contributions	Problem Addressed
Mahmoud and Ahmad [12]	Proposed a Green model for achieving sustainable software engineering.	Constructed a two level Green software model that comprises of Green software engineering process that promotes Green practice. The model entails sustainable life cycle of software product and software tools that encourages eco-friendly software.
Thiry et al. [13]	Developed a Green RM reference model for sustainable software development.	Carried out a case study of 3 Brazilian firms to investigate the integration of Green IT into software development with ISO/IEC 14001 environmental requirements, based on requirement of organizations.
Dick et al. [14]	Designed a model for Green and sustainable software.	The model presents the lifecycle process for providing guidelines and checklists for developers, administrators and user for reducing consumption energy and improving energy savings overbalance.
Kern et al. [15]	Presented a calculation based approach for carbon footprint of software product life cycle.	Investigated CO2 emissions of software by measuring energy and carbon footprint of software in Green software engineering.
Shenoy and Eeratta [16]	Suggested a Green software development life cycle model.	Addressed changes in current software development process and recommended suitable procedures to reduce CO2 emission, decrease energy usage and lessen paper usage, thus assisting enterprise attain Greener software development.
Abdullah et al. [17]	Implemented a web based knowledge management model for sharing and managing Green knowledge for software development.	Applied web technology to disseminate Green software development knowledge among software practice community in software development domain.
Steigerwald and Agrawal [18]	Explored the features of Green software design concerns and methodologies to enhance energy efficiency of software.	Resolved energy saving of software by presenting a technique to be applied by software developer.
Kocak [19]	Implemented a Green software development design for achieving eco- sustainability.	Addressed energy consumption reduction based on software database analysis and utilized qualitative analysis to provide opportunities for saving energy.
Scanniello et al. [1]	Designed software system Greening method using Graphics Processing Unit (GPU) based architecture.	Using experimentation grounded on robot based simulations; the authors resolved existing software migration procedure hence assisting refurbishing existing software system to be more eco-friendly thereby decreasing energy waste.
Kern et al. [20]	Defined a reference model to assess the energy effectiveness of software.	Presented the metrics to be considered for efficient energy and adequate resource consumption when developing Green sustainable software.
Penzenstadler [21]	Offered a checklist and guide word based approach for attaining eco-sustainability.	Utilized case study based on a car sharing system and provided a clear understanding on how eco-sustainability can be analytically achieved in software requirements engineering.
Dick et al. [22]	Developed a model that infuses Green IT features into software engineering procedures with agile approach.	Investigated software engineering and Green IT and produce an approach to support software developers implement "Greener" software from scratch.
Naumann et al. [23]	Proposed the conceptual GREENSOFT reference model.	Provided a cradle to grave approach that presents sustainability metrics and criteria for Green sound software development and also provides suitable guidance.

review authors aimed to support software enterprise in going Green thus attaining sustainability. Although none of the reviewed studies integrated any intelligent techniques to facilitate Green software development which is very important because these techniques such as CBR and intelligent agents support decision making of software practitioners and as such enhance Green practice adoption.

2.4 Inception of Intelligent Agents and CBR Technique Application

The application of agent technology and CBR is not a new research subject but has been deployed in several research domains such as in medical informatics where Ying et al. [24] presented the combined operational application of CBR and multi agent system to describe knowledge presentation utilization for decision support. The agent CBR application aids decision making in clinical areas such as in diagnosis, treatment, healing monitoring etc. Yang [25] developed a CBR information agent based web service for achieving cloud energy saving. The author designed cloud collaborating diagrams to deploy web service thereby attaining energy saving over the internet.

Linghu and Chen [6] proposed a new intelligent multi agent approach for flood disaster predicting based on CBR. Their approach comprises of a number of agents, infused to execute assigned functions. The agents and CBR are deployed based on a prediction algorithm. Kuo and Lin [9] implemented a collaborative Robocop agents integrated with Genetic CBR to provide better tactic for robots and aids the saving of robots knowledge for future reusing. The robots learn by retaining experience and as such avoid making similar mistakes. Zhao et al. [4] suggested agent technology and CBR for diesel fault diagnosis. CBR and multi agent supports knowledge processing, fault examination and monitoring. The integrated agents brings flexible for CBR by improving the ability of addressing complicated issues thus resolving the limitations experienced in traditional based systems.

Gonzalez et al. [10] utilized CBR technique for developing intelligent tutoring platform by using agents' technology to resolve reusability and modularity problem. CBR was used to save students' information in order to preserve past knowledge experiences which is later used for teaching. Vargas et al. [5] applied agents and CBR to monitor software process approach. The authors aimed to support and guide software organizations based in deploying the implemented tool (MoProSoft) to enhance the assistance provided to end users. Based on the review studies, the first six authors applied CBR and agents in other domains.

The last reviewed study implemented by Vargas et al. [5] is similar to this research study because the authors applied CBR and agents in software process area; however the authors only considered the software process activities related to analysis and design phases in providing existing solution instead of totally creating new solution.

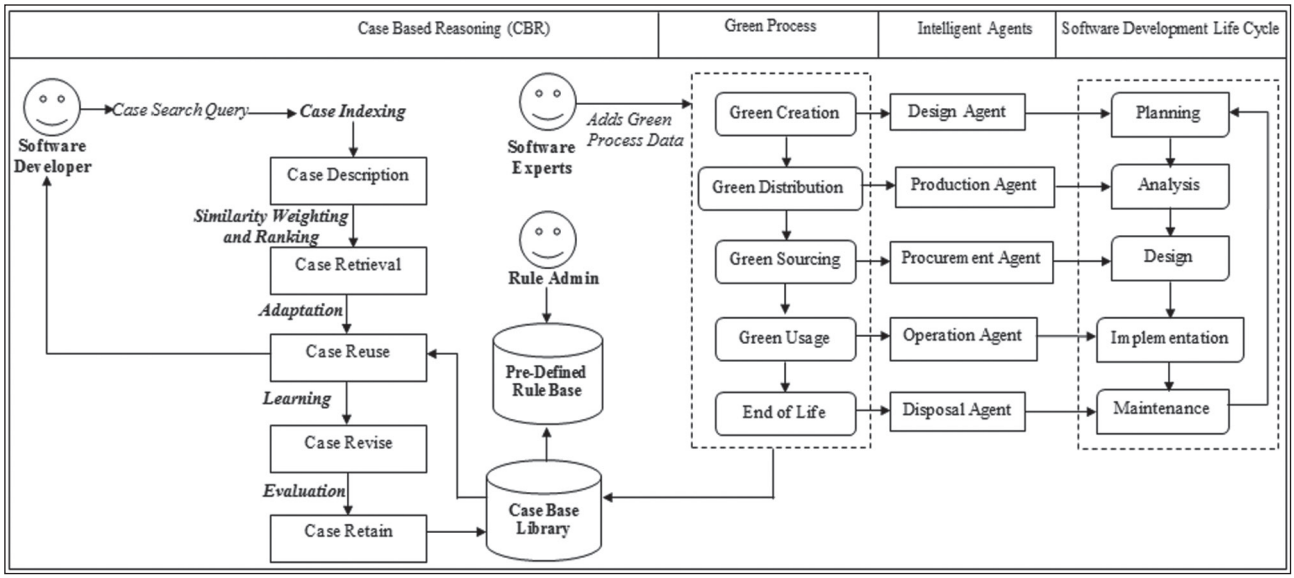

Figure 3. Intelligent Green software development model

Table 2. Green process adopted in software development

Green Process	Description
Green Creation	Is implemented when software developers utilizes Information Systems (IS) such as telecommuting, IP telephony, thin client, web based business services, videoconferencing and virtual collaborative tools in software development process.
Green Distribution	Invloves deploying information systems and other auxiliary subsystems with limited impact on the environment by using sterile delivery systems to encourage minimal unwanted pollution to the environment and lowering resource consumption.
Green Sourcing	Implies the practice of purchasing IT infrastructure that posses Green labels of certifications in software development process.
Green usage	Aims to bring about energy consumption reduction and and reducing IT induced CO2 emissions by optimizing of energy utilization without reducing the installed power base, structural avoidance results in reduction installed power capacity.
End of Life	Refers to practices of refurbishing, recycling reusing and disposing IT hardware in an ethical eco-friendly manner during software development process.

Table 3. Intelligent agents for supporting Green software development

Intelligent Agents	Description
Design Agent	This agent suggests various medium in which IS can be applied to facilitate Green implementation. This agent aims to ensure that CO2 emission is lessen when IT infrastructures are utilized when carrying out software development activities.
Production Agent	This agent recommends eco-friendly strategies and initiatives to be integrated by software developers. Such strategies and initiatives recommender by this agent includes how to deploy IT systems and facilities to consume less energy in software development process.
Procurement Agent	This agent provides software developers with computer hardware merchants or vendors that sell eco-friendly hardware that are less safe to the environmental. This agent also ensures that software developers purchase IT infrastructure with Green or eco-label. Such certification are gotten from recognized non-governmental industrial standards such as Energy Star, Environmental Protection Agency (EPA), Waste Electrical and Electronic Equipment Directive (WEEED), ISO certification etc.
Operations Agent	This agent ensures software developers use IT infrastructure in an ethical and responsible manner. This agent checks if IT systems and technology are used in mediums that saves electricity usage, reduce cost incurred, lessen CO2 emission, reduce water wastage and if software organizations utilizes renewable energy sources as solar, wind etc.
Disposal Agent	This agent supports software developers in recycling, refurbishing, reuse and disposing of electronic waste generated form obsolete and old hardware. This agent also ensures that these e-wastes are dispose-off properly without causing harm to the environment. Since most computer related hardware contains lead (Pb) and this element can percolate into the soil and water and cause environmental pollution.

3. Methodology

This Section shows the application of CBR and intelligent agent for Green software development. CBR support software developers to retrieve and utilized Green software development initiatives previously added by software experts. Intelligent agents help to achieve Green process adoption in software development as seen in Figure 3 each of the agents acts as an intermediary between each Green process and each software development process.

3.1 Model Description

Table 2 illustrates the Green process to be considered by software development team in achieving Green software development.

Table 3 outlines the intelligent agents that support the software developers in making decision on how to achieve Green software development.

Over the years software practitioners have adopted the System Development Life Cycle (SDLC) as a guide in developing software which possesses quality, on time and with less cost incurred. Al-

Table 4. Traditional software development life cycle

Development Life Cycle	Description
Planning	Planning also known as the investigation stage focuses on identifying the problem to be solved, this phase also involves defining the project scope by considering the managerial feasibility, economic consideration and technical skill.
Analysis	The project analysis or proposed system requirement gathering is the second step carried out by software development team once the project problem to be solved has been well defined and it is mostly based on feasible tasks. The analysis phase relates the problems to possible solutions, evaluates the project activities to be carried out and defines the functional requirement of the end users & non-functional requirements of the proposed software system.
Design	System design is the next phase which transforms findings from the analysis phase into physical and logical blueprints and modelling for system implementation. The logical blueprints consist of graphical user interface modelling, software operational models, database table design. The physical blueprint mostly consists of the physical networks layout, the modelling and possible connection diagrams of facilities and the planned connection model of peripheral devices.
Implementation	The implementation phase mainly codes or programs the designed system. The system implementation comprises the necessary hardware and software needed to translate the design models blueprints into operational state and usually includes installation, deployment, testing (system verification and validation), bug and error fixing and lastly end user training.
Maintenance	System maintenance which is the last phase is usually a continuous progression carried out to enhance the implemented software system aimed at ensuring that the software is working accurately without errors. As such repetitive activities such as software update, anti-virus updating, patching, performance monitoring is carried out by a few assigned software developers. Other maintenance strategies include security enforcing, system troubleshooting, database refinement, data backup and obsolete system hardware change. Furthermore, feedbacks are collected form end users who actually use the implemented software to enhance and the software operational performance.

though SDLC is faced with several limitations such as longer time consumption, less communication between stack holders and development team, etc. despite these weaknesses of SDLC, the life cycle processes is still generally adopted by a few software developer and experts.

The SDLC process as seen in Figure 3 comprises of planning, analysis, design, implementation and lastly maintenance. Each of these processes is adopted by software practitioners when they develop software products and services. Table 4 briefly describes each of the stated software development process.

3.2 CBR Cycle Description

Case Indexing

Once the case is added to the case base library each case is indexed individually as shown in Table 5 in the case identification column. Although in reality, Green activities to be deployed are stored based on category as shown in Table 1 in the third column for example, low, medium, high based on the preference or priority assigned by software experts. Essentially, the case index is based on the importance of the case content in achieving Green practice adoption in software development process. The case are indexed and divided into few categories to facilitate the quick retrieval of similar individual cases.

$$Ci = P(a) / S(a) \quad (1)$$

Where *Ci* is the indexed case in the case base library, *P (a)* is the problem case attributes or parameters and *S (a)* indicates the solution case attributes in the case base library.

Case Representation

The CBR cycle starts with the description of a new case query which corresponds to previously saved case. It is imperative for the new case to be

Table 5. Case structure

Case Parameter	Data Type	Parameter Description
Case id	Integer	This is the primary key of the case stored in the case base library.
Case identification	Varchar	This is a unique alphanumeric identification used to index each case base library.
Case name	Text	This is the name of the case. The name assigned to the case is very important because it is used as the keyword used by software developers to execute search query from the case base library.
Case category	Text	This is the group the case belongs to, since some case will be added by the software experts as public or private case.
Case source	File	This are attached Green practice documents that were utilized doing past adoption of Green software development initiatives.
Case duration	Date/Time	This parameter or cases attribute documents the date and time taken for the particular case to be resolved.
Case problem	Text	This parameter states the case problem that was solved.
Applied solution	Text	This attribute stores the solution applied in resolving the case problem. This attribute also contains data on all the Green strategies and initiatives deployed in successfully addressing the problem.

sufficiently described so that the retrieval of suitable past cases from the case base will be possible. An example of a case structure is shown in Table 5.

Based on Table 5 each case solution in the case base library is represented as shown in equation

$$S(a) = \sum p1, p2, p3, p4, p5, p6, p7, p8 \quad \text{..... (2)}$$

Where *S(a)* is the solution case attribute, *P1* is the case id, *P2* is the case identification, *P3* is the case name, *P4* is the case category, *P5* is the case source, *P6* is the case duration and *P7* is the case problem and *P8* is the proposed solution that can be applied.

Similarity, Weighting and Ranking

Similarity of cases in CBR cycle is carried out by checking the weight of each case parameter in the case base library. The best similar case in the case base library similar to the searched problem are retrieved and displayed to the software developer based on ranking of the case. Thus the cases do not have a defined order before ranking. The case ranking procedure displays the retrieved cases solutions according to collaborative filtering and semantic similarity. This causes the likely case solutions to have a better exposure degree and thereby supports software developers selects the most suitable answers to their problems in a short period of time. The similarity between a new case problem and an existing case solution in the case base library is computed as shown in equation 3:

$$\text{Similarity (sq, c)} = \sum i=1 \ldots n \; wi*sim(sqi, csi) \quad \text{..... (3)}$$

Where *sq* indicates searched query, *cs* represents the case solution, *n* is the ranked number of cases retrieved and *w* symbolizes case parameter weight.

Case Retrieval

The retrieve phase recovers and displays analogous cases. Case retrieval mainly finds the most related case from the case base library according to the parameters of the case problem that is being searched. The CBR cycle mainly depends on this phase to derive the right solution. Case retrieval is executed in CBR using the Nearest Neighbor (NN) algorithm, which is one of the algorithms generally integrated in detecting similarity checking between two or more cases. The retrieval of the case is deployed in equation 4.

$$P(a)\,[S(a)]*Q = (1- ai)*\,P(a)\,[S(a)]\,*Q + ai* \; *(x+y*\,P(a)\,[1]*Q) \quad \text{..... (4)}$$

Where *P(a)* signify the nearest neighbors of the case problem being search as a query *Q* to find case solution *S(a),* with parameters *ai,* and *x+y* are the parameter values.

Adaptation

Once the case has been retrieved from the case base library using Nearest Neighbor (NN) algorithm, the case solution is usually adopted or modified by the software developer to suits the current software development process which may differ from the past situation added by the software experts. Thus software developer adapts the case to suits his/her development process and once a case solution has been adapted the adapted case become a new case and is stored in the case base library to enhance the knowledge in the case base library and also improve case retrieving performance. This phase (case adaptation) is deployed by software developer (human), who are more consistent than machine reasoning as shown in equation 5.

$$[S(a)]\ [ai]^* x+y = [S(a)new]\ [bi]^*(x+y+1) \quad \text{..... (5)}$$

As before *S(a)* is the retrieved case, *ai* is the case parameters, *x+y* are the parameters value. *S(a)new* is the adapted case solution, *bi* is the adapted case parameter and *x+y +1* is the adopted parameter value.

Case Reuse

The reuse phase involves the application of retrieved data from previous cases to address searched problem. The software developer utilized all retrieved cases from past knowledge and adapted case solutions from the case base library to address the impending problem solutions. The reusing of the adapted case parameters is outlined in equation 6.

$$[S(a)new]\ [bi] = 1 / 1+ [S(a)new]\ [bi]^*(x+y) \quad \text{.. (6)}$$

Learning

The CBR cycle possess the capabilities to learn from past and present experiences, thus CBR is a suitable technique appropriate for dealing with the complex decision making. The learning procedure is executed when the CBR cycle gains new experiences based on the case solutions that are usually selected by software developers. Learning is also stimulated by feedback provided by software developers after applying a selected case solution. At times, retrieved cases are not exactly similar to problem to be solves and are adapted to be reused. The adaptation of the case caused a change to the case parameter values.

So if *P(a)* is the searched case problem which comprises of case parameters ∑*P1, P2, P3, P4, P5, P6, P7, P8* as shown in equation 2 and *S(a)* is the retrieved case solution includes parameters *ai,* and *x+y* as the parameter values as presented in equation 4. The learning process is shown as follows:

$$L = \text{Change } (\sum p1, p2, p3, p4, p5, p6, p7, p8, ai^* *(x+y)) \quad \text{..... (7)}$$

Where *L* is the CBR learning and *Change ()* means learning derived from the *P(a)* and *S(a)* applied by software developer.

Revise

The revise phase is process where the selected case is revised to be in line with past experiences. Case revision offers the most appropriate, updated solution and returns the adapted and previous solution to evaluated and retained as the final reference case solution which is the last case parameter as seen in Table 1. The case solution is revised based on equation 8.

$$\text{Sim } (S(a)old, S(a)new) = N(S(a)old \ \&\ S(a)new) / N(S(a)old \mid S(a)new) \quad \text{..... (8)}$$

Where *(S(a)old*, *S(a)new)* is the similarities between the old case and the adapted new case, *N* is the number of cases to be revised.

Evaluation

The phase examines and compares the preceding case solution (previous solution and adapted solution) to gain insights on each case parameter to find out which parameter data is to be updated. The evaluation phase often affects and even changes the Green initiatives decisions to be retained in the case base library.

$$\text{If<S(a)1>\&< S(a)2>…< S(a)n>Then evaluate each < Case Solution > based on <Weight (w)> similarity} \quad \text{..... (9)}$$

Equation 9 shows the procedures deployed by CBR in leaning, which is based on the concept

that each case parameter has a weight that is used by NN algorithm to check the degree of similarity between the case problem and case solution. Thus as applied by Kuo and Lin [9] a similarity range between "0" and "1" is utilized for checking and evaluating to calculate and evaluate the degrees of similarity between the cases. Practically equation 9 is used alongside case retrieval in equation 4 to find the most similar solution to the searched problem case that is to be retained.

Retains

The phase involves the retaining of the case after being applied. In this phase past and present case data are retained for future use. Thus the selected case parameters values are stored in the case base library. Then based on software developers application and feedback on the old case solution or adapted case solution is retained. Hence the retaining of the old case solution or adapted case solution is represented by equation 10.

$$P(a) = \sum i=1 \text{ Sim } (S(a)old, S(a)new) * * P(S(a)newi, PFi) \quad (10)$$

Where *Sim (S(a)old*, *S(a)new* computes the similarity check on the case parameters in relation to the case problem parameter *P(a)* and *PFi* is the performance feedback index data provided by the software developer which is based on which of the solution is more applicable in solving the problem. The more application solution *S(a)old* or *S(a)new* is retained.

Case Base Library

Contains added best practices of how software developers can adopt Green software development. Thus software developer can retrieve such Green cases and also apply these knowledge and experience in developing quality software with lower cost and on time by considering the environment. The case base library thus provides case data which later becomes Green software development initiatives and strategies. The case base library usually mines data from the pre-defined case base when no case data is available in the case base library. Cases are saved into the case base based on equation 11.

$$CB= (C, a) \quad (11)$$

Where *CB* is the case bas library, *C* and *a* represent the case and the case parameter value of each case solution saved respectively in the case base library.

Table 6 summarized the best practices that can be adopted by software developers in implemented Green software development. These best practices are retained in the case base library and reuse by software developers and comprises of the software development process and Green process to be adopted.

Pre-Defined Rule Base

These are rules base added to support attainment of Green software development. However these rules are only called when the case base does not have any available Green case and are only added by the rule admin. An example of a rule added by the rule admin can be represented as;

Rule 1 and Rule 2 can be said to be the rules to be added in the pre-defined rule base, thus two rules are added into the pre-defined rule base

For Rule 1 and Rule 2

Rule 1: For Case Solution A and Case Solution B

Assign case parameter weight of 1.9

Rule 2: For Case Solution B and Case Solution C

Assign case parameter weight of 1.5

Now the relationship of all rule based cases in the pre-defined case base is shown as:

Sim (Case Solution A, Now Case Solution) = 1.7

Sim (Case Solution B, Now Case Solution) = 1.8

Sim (Case Solution C, Now Case Solution) = 1.2

For Rule 1: assign {value [1.7 * 1.8] * 1.9} = 5.8

For Rule 2: assign {value [1.8 * 1.2] * 1.5} = 3.2

Since Rule 1 has higher similarity value (Sim), the case based library will retrieve and utilized the suggested solution from Rule 1 for resolving the searched problem.

Software Developer

Carries out the case search query to retrieve possible solution in adopting Green software development. In a software organization the software developer is usually a team of software developers that comprises of software analyst, software designer, programmer and software tester.

Table 6. Green Software Development Matrixes

Green Process * Software Life Cycle	Green Creation	Green Distribution	Green Sourcing	Green Operation	End of Life
Planning	Suggest software functions that do not case harm and care for the natural environment.	Approve substitutes that possess nominal effect on the natural environment.	Carryout environmental impact assessment of hardware to be purchased for developing software products and services.	Initiate eco-friendly policies and strategies for software development team members. Document functional and non-functional requirement using electronic mediums.	Get feedback and approval from top management and end users.
Analysis	Increase the significance of sustainability dimensions (economic, environmental and society) when drafting functional requirements.	Reduce energy consumption and decrease utilization of inks and papers in software documentation (use e-documentation).	Increase consumption of recycled materials and shift to renewable power from sources such as solar, wind etc.	Reduce transportation of software team members instead use virtual collaborative platforms. During software development process decrease working space to help diminish energy utilization.	The proposed software system should be flexible and durable for long term usage.
Design	Deploy only energy proficient hardware for modelling software systems.	Install energy management application when designing the proposed software blueprint.	Procure energy competent infrastructure in developing the software systems.	Deploy network and database server virtualization throughout the development process.	Reuse development facilities to lessen wastes generated.
Implementation	Energy proficient programming and always reuse code or adopt Object Oriented Programming (OOP).	Use energy efficiency computers when programming and testing Since this phase requires the hardware to be running for longer time.	Purchase and deploy energy management application during software system programming	Decommission old and outdated systems which are offline and are not in used during software development.	Carryout end users training on the need for sustainable practices from time to time.
Maintenance	The implemented software system should be reusable and transferable.	Proper maintenance to extend system life. Perform at the most energy efficient state	Instead of buying new hardware find and reconnect underdeployed system	Install energy tracking and monitoring system with existing software development systems.	Always recycling and refurbish software systems. Always re-document via electronic mediums.

Software Expert

Adds new Green process information on how software developers can adopt Green software development. Since the software developer is only familiar with the software development life cycle but not familiar with Green process.

Rule Admin

This user adds pre-defined rules to suggest Green solution to software developers when no Green case is available in the case base library or the case base library is empty.

Discussion

Sustainability refers to natural resource use for accomplishing present needs of humans while considering the societal, economic and ecological impacts for the future generation to be able to meet their own need [26]. Due to current environmental concern, economical awareness and societal initiatives all over the world, software firms aspire to attain sustainability. Several studies on Green practice adoption and implementation mainly focus on carbon foot print lessening, saving energy consumed reduction by deploying virtualization on physical machines and enterprise data centers. Green practice in software process aims to facilitate software enterprise utilize lower amount of energy in accomplishing sustainable software development [17]. With the increasing request of software based applications, IT has contributed negatively on the environment due to cumulative natural resource and energy consumption [12]. The effect of IT on sustainable software development is termed Green software development.

This study uses passive approach that entails explicit interaction from software developers to define the case problem (e.g., Green software design, Green software implementation, etc.) which is enquired by agent based CBR model in facilitating Green practice adoption during software development. According to Falconer et al. [11] applying intelligent agent and CBR technique facilitates experiences gaining when evaluating problems and system learning attained from the interactions of users (software practitioners) with the agent based CBR model. The agent based CBR model aims to provide Green software development advice (e.g. Green software planning via usage of similar cases, etc.) to software developers. Furthermore, all mentioned processes are monitored and formalized by the CBR to query the search problem and retrieve similar case solutions [25]. CBR and intelligent agent facilitate the acquisition of accessible knowledge for software development processes and decreases inappropriate cases retrieved from the case base which usually require monotonous sorting procedures.

To increase the robustness of intelligent agents CBR technique was incorporated with these agents [27]. CBR technique is similar to how humans make decisions to solve actual problems based on their experiences. CBR was thus applied because this AI technology provides solution for problems by comparing present problem with analogous problems referred to as case for discovering solutions. However the knowledge in the case base is derived from several domain experts thus enabling the agent based CBR approach is easy to adapt to changes in software development process [5]. The application of a hybrid intelligent agent and CBR technique is expected to deliver improved performance in attaining Green software development solution other than using each of these techniques in separation [11]. According to Gonzalez et al. [10] intelligent agents is similar to human reasoning capabilities and also provides feedback as an expert program.

The intelligent agent and CBR application provides integration that supports decision making of software developers through the execution of agents and CBR. Simultaneously both techniques offer a medium that assures communication among the individual agents, and the end users such as the rule admin, software experts and software developer. Although each Green process agent behaves as an autonomous entity and facilitates the deployment of each software development life cycle process to be adopted by software developers with the Green practice recommendations presented by the CBR cycle.

4. Conclusion, Limitation and Future works

Although over the years IT has been deployed to provide solution by delivering efficient solutions for the environment known as “Green IT”, aimed at supporting energy and natural resource savings. But at the moment research studies on Green IT has basically focused on environmental sustainability in terms of efficient computer infrastructures to reduce CO2 emission, lessens energy usage and lastly decrease waste generated during software enterprise process. But ignored the economic and society dimension of sustainability, this thus gave birth to the discipline referred to as Green Information Systems (IS), which utilizes information systems to not only care for the natural environment but also considers the economic and societal dimensions of sustainability.

Based on the drive towards Green IT and Green IS, it is obvious that Green software development can be of great use in supporting software enterprise attain sustainability. Although hardware components utilized during software development process also contributes to CO2 emissions. Software development can also have a positive effect on the natural environment by adopting Green initiatives in operating IT infrastructures and related hardware. Environmental friendly software applications can be installed to monitor and consume natural resources competently.

CBR is an AI technology that can be used to develop intelligent systems. CBR is a technique suited for intelligent automated problem solving. CBR comprises of case indexing which leads to retrieving best previous case from case base to software developer who adapts the retrieved case solution to resolve present problem. Once the case has been adapted for reuse, it is evaluated to check if the applied case solution was successful and this leads to CBR learning and case retention [7]. An agent can be said to be a computer program deployed in a particular environment, which possesses the ability of executing autonomous and flexible actions in order to attain its pre-design goal such as achieving Green software development. This research develop an intelligent Green software development model that shows the combined application of intelligent agents and case based reasoning (CBR) techniques for supporting the decision making of software developers in achieving Green software development.

The model is poised with a few limitations which include the manual retrieval procedures deployed by CBR in checking the case parameter weighting. Since each parameter weight has to be pre-set by the system programmer when developing the CBR cycle or the weight has to be selected by the software developer who uses a backend trial and error function in retrieving similar case. There is need for an automated case parameter weighting method.

Therefore future works will involves the application of Analytic Hierarchy Process (AHP) technique to autonomously aid case parameter weighting when retrieving analogous case from the case base library. AHP technique is suggested as a suitable technique to address the limitation of the model since it uses pair wise comparison which is suitable for making decision and judgement based on case parameter weighting. Lastly an agent based CBR AHP tool will be implemented as web based system to support software developers adopt and implement Green software development through the web.

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Selected plant species with sedative effects and their medicinal use

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Abstract

The use of herbs in treatment of a variety of diseases is known for a long time in history of mankind and it is known to be the oldest form of treatment. Following regulatory and manufacturing developments, world-wide use of herbal medicines is increasing. Herbs are attractive alternative medications to many patients with sleep disorders, who may be averse to using conventional drugs. This paper deals with systematization and detailed analysis of selected plants (*Valeriana officinalis* L.*, Melissa officinalis* L.*, Humulus lupulus* L.*, Passiflora incarnata* L.). In this paper the attention is focused on the treatment of tension, irritability, anxiety, depression and insomnia by using these plant species. The paper consists of a theoretical and research part of the work. The theoretical part reviews the listed plant species and evaluates the level of evidence regarding their safety and efficacy in therapy, and in the practical part of the paper the use of sedatives in our region is examined on a sample of 120 respondents. The aim is to highlight the importance of the use of those plant species and explain their mechanism of action in the central nervous system of man. It also examines which preparations of the above-mentioned plants are present in pharmacies across Bosnia and Herzegovina and which drug forms are preferred by patients.

Key words: *Valeriana officinalis* L., *Melissa officinalis* L., *Humulus lupulus* L., *Passiflora incarnata* L., phytotherapy, insomnia, anxiety, tension

1. Introduction

Treatment with medicinal herbs and their preparations is one of the oldest methods of treatment in history of mankind. Centuries of use for treatment of various diseases justified the introduction of herbal medicine in scientific medicine, because our ancestors not only eased the symptoms of illnesses with the help of some plant species, but completely cured them.

At the present time, the treatment with plants is the basis of preserving the health and possibility of prevention and treatment of mild forms of diseases. Various forms of herbal medicines can be found in the pharmaceutical industry, such as: water extracts of herbal drugs, ethanol extracts, oil macerates, aromatic water, medical spiritus, syrups, ointments, capsules and tablets.

In this paper, attention is focused on the characteristics and the mechanism of action of selected plant species: valerian, lemon balm, hops and passionflower in the central nervous system of humans. The aim is to stress the importance of their use in the treatment of tension, irritability, anxiety, depression and insomnia. Also, the research of use of sedatives in Bosnia and Herzegovina was carried out and plant based sedatives which can be found in pharmacies across Bosnia and Herzegovina are reviewed.

2. The mechanism of action in the central nervous system

The mechanisms of a drugs action in the central nervous system are not always well understood. However, during the last 30 years we have seen a huge improvement in the methodology of pharmacological studies of the central nervous system. First, it turned out that almost all drugs that affect the central nervous system caused their effects by acting on specific receptors that modulate synaptic transmission. Secondly, it has been shown that the drugs are the most important tool for studying various problems of the central nervous systems physiology. Third, the effects of drugs with known

clinical efficacy on diseases of the central nervous system gave us the option to set fertile hypotheses about mechanisms of a disease [1].

The neurohumoral processes taking place in the central nervous system involve: neurotransmitters, neuro-hormones, neuromodulators and neuro-mediators. In this case, the neurotransmitter is any substance which transfers stimuli across the synapse (e.g., acetylcholine, norepinephrine).

The question is why do we need so many neurotransmitters in the central nervous system? It is safe to say that some of these substances perform a role of classical neurotransmitters in the transmission of stimuli from one neuron to another. Also, a number of these substances plays an important role in the "chemical encryption" during the transfer of information between neurons. It should be noted that a larger number of substances allows for a greater number of codes. Axon synapses regulate the quantity of the release of neurotransmitters at the terminals of presynaptic fibers.

Amino acids as neurotransmitters

The amino acids that act as neurotransmitters in the central nervous system are: gamma-aminobutyric acid (GABA), glycine and glutamic acid. These amino acids are used to maintain a rapid link between certain points in the central nervous system. Glutamic acid represents an excitatory neurotransmitter, whereas glycine and GABA are inhibitory neurotransmitters in the central nervous system.

Neurons that use GABA as a neurotransmitter are among the most abundant in the central nervous system. GABA is equally distributed in almost all regions of the brain and spinal cord, especially in local inhibitory interneurons. However, the known GABA-ergic pathways with long fibers (e.g., striatonigral path connecting the caudate nucleus and substantia nigra). GABA quickly inhibits almost all the neurons in the central nervous system in a way that increases the permeability of neuronal membranes to chlorine ions.

The effects of gamma-aminobutyric acid are exhibited through specific GABA receptors (GABA-A and GABA-B receptors).

GABA type A receptor consists of alfa and beta subunits and possibly gamma and/or delta subunits, with four or five total subunits constituting a functional receptor assembly. The types and number of subunits in a receptor assembly may vary with the species and possibly with the anatomical location. Binding of GABA results in opening of a chloride ion channel [2].

Metabotropic GABA type B receptors are transmembrane receptors for gamma-amino-butyric acid (GABA), which are attached to potassium channels via G proteins. Changing the concentration of potassium hyperpolarizes the cell at the end of the action potential. GABA receptors are present in the central and peripheral autonomic nervous system. They can stimulate the opening of K + channels by which the neuron is approaching equilibrium potential of K + ions. GABAB receptors are inhibitory receptors are considered. GABAB receptors may also reduce the activity of adenylyl cyclase and reduce cell conductance of Ca2 +.

The drug with sedative (anxiolytic) effect reduces anxiety and causes sedation, and by doing so does not change the mental and motor functions of the central nervous system. Sedatives (anxiolytics) cause a lesser degree of depression of the central nervous system than hypnotics [1].

It is known that some plants exhibit their sedative effects through the GABA receptor system, but all of the mechanisms of action are yet to be explained. *Valeriana officinalis* L. acts on GABA neurotransmitters in the central nervous system, increases their concentration in the cleft between the two nerve cells, increases their secretion and reduces the re-entry of the substance into the cell. *Humulus lupulus* L. also increases the concentration of GABA by GABAA receptor modulation. *Passiflora incarnata* L. can be classified as a GABAB receptor antagonist, and *Melissa officinalis* L. contains oleanolic acid, which is a GABA transaminase inhibitor. It is an agonist of all GABA receptors.

3. Traditional medicine

Phytotherapy makes a large part of the traditional - folk healing methods. Human diseases exist as long as the human race and therefore this method is as old as man. In the beginning of his creation man has taught, imitated or carried in himself the need to act as well as other animal species by looking for medicines in his environment. The large number of seeds of medicinal plants have been found around the caves and houses on stilts.

Simultaneously with the development of human society and civilization, phytotherapy developed as the main way of medical treatment in almost all world regions: China, Egypt, India, Greece, Rome, and Arabia. All those areas that have had their periods of power, abound in various studies and findings in the field of science and medicine alone.

In the last 200 years people who mostly engaged in phytotherapy are folk healers, therapists and herbalists who instinctively felt that the plants carry great power and healing properties, and that the delicate petals, leaves, trees and roots have unfathomable wisdom of nature and the precious gifts of healing, that man with all his medical machinery will never succeed to cancel out, or to overcome. On the other hand, this is the reason that the ancient phytotherapy remains without decent literature and systematization and thus is still pretty much a puzzle [3].

Valerian (*Valeriana officinalis* L.) is a medicinal plant that is used to treat many diseases and relieve their symptoms for thousands of years. The plant is used in ancient Rome (Dioskurides) and ancient Greece (Galen) due to its medicinal properties. In the 18th and 19th century it was one of the most frequently used drugs.

Dioscorides has healed abdominal pains, urinary and gynecological problems with valerian. Valerian was a highly requested and important drug in World War II, for both soldiers and residents of conflict zones [4].

In traditional medicine the juice of freshly picked leaves and shoots of hops is commonly used, which considerably improves the digestion, the secretion of urine, drains excess bile and relieves the pain of the uterus. Salad prepared from young shoots of hops is used for the regulation of liver function. Tincture of hops, which is prepared by covering fresh hop cones in alcohol, is recommended for gout and jaundice. The shoots of hops prevent scurvy. In folk medicine, tea made from hops leaves is successfully used against scurvy, enlarged spleen, blood diseases and long-term fever. Freshly harvested and ground leaves are recommended as compresses to relieve the pain of rheumatism, gout, tissue contusions and sprains [5].

Lemon balm is traditionally used to regulate digestion and calm nervous tension. It is the main ingredient in Carmelite water, which is still produced in Germany by the traditional recipe.

In the case of lemon balm scientific medicine has copied almost everything from folk medicine. Our folk healer Sadik Sadikovic says: "When the uterus drops or when a woman is weak and cannot get pregnant, make a bath with lemon balm and drink the tea daily, for a long period of time."

Spanish doctor Alfonso Monardes brought passionflower to Europe in year 1569 together with the documentation on its medicinal use. The Aztecs used passionflower as a sedative and a spasmolytic. In the long history of use, the most frequently mentioned beneficial effects are the treatment of insomnia, diarrhea, dysentery, epilepsy, skin eruptions, neuralgia, neurosis, hemorrhoids, headaches, pain, cramps [4].

4. Material and methods

We conducted a research on the use of sedatives on the territory of Bosnia and Herzegovina, a country in Southeastern Europe with Mediterranean climate, and a population of 3.829 million. The country is mostly mountainous, and close to 50% of Bosnia and Herzegovina is forested.

Our research was carried out on a cohort of 120 individuals, 70 were female and 50 were male. The respondents were of different age groups and different levels of education, as well as different economic status. The aim was to find out how many people use plant-based sedatives and how many of them use other drugs, as well as which plant species with a sedative effect and which drug forms are preferred by patients. Respondents answered questions from the following questionnaire:

QUESTIONNAIRE ON THE PLANT BASED SEDATIVE USE ON THE BiH TERRITORY
1. Sex: a) Male b) Female
2. Age structure: a) under 25 years b) 25-34 years c) 35-44 years d) 45-54 years e) 55-64 years f) over 65 years
3. Occupation a) employed b) unemployed c) pensioner d) college student e) high school student f) other_____
4. Are you using sedatives? a) Yes b) No
The following questions were provided to respondents who use sedatives
5. How often do you use sedatives? a) several times a day b) once a day c) every 2-3 days d) 3-5 days e) weekly f) on demand
6. Do you prefer plant based sedatives? a) Yes b) No
7. In what form do you use plant based sedatives? a) In form of a tea b) In form of a pill or a capsule c) In form of essential oil or drops d) Other_____
THANK YOU!!!

5. Results and discussion

Answers to the questions in the questionnaire were statistically analyzed and presented in tables. Of 120 respondents, 70 were female and 50 were male. Age structure is shown in the following table.

Table 1. Age structure

Age category	Number of respondents
Below 25 years	7
From 25 to 34	19
From 35 to 44	24
From 45 to 54	32
From 55 to 65	29
Over 65 years	9

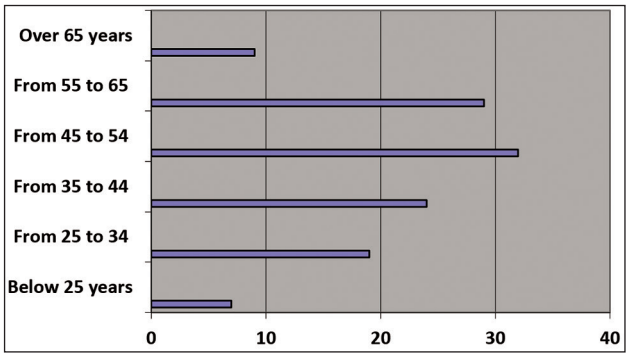

Figure 1. Graphic representation of the age structure of the respondents

In the third question of the questionnaire, the types of occupations of respondents are examined considering that the material instability may well affect the health and be a major source of stress. The data are presented in the following table:

Table 2. Occupation

Occupation	Number of respondents
Employed	31
Unemployed	62
Pensioner	8
College student	5
High school student	1
Other	13

25.83% of respondents were employed, and as many as 51.67% responded that they are unemployed. Of the total number of respondents there were 6.67% of pensioners, 4.17% college students, 0.83 high school students. 10.83% answered with "other".

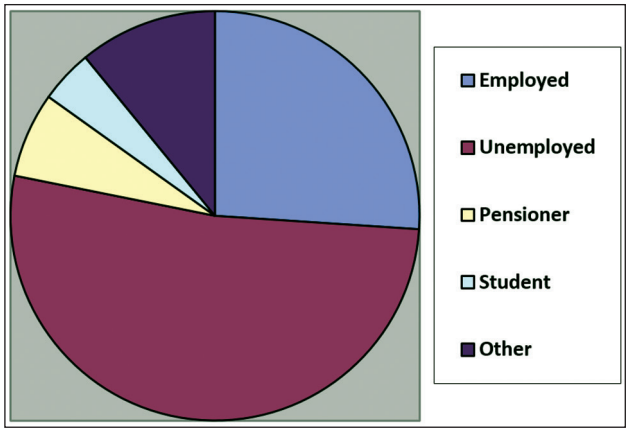

Figure 2. Occupation of respondents, graphical representation

Fourth question was aimed at determining the number of respondents who use some form of sedatives and who will be subject to further research in the following questions. The results are shown in Table 3:

Table 3. Number of respondents who used sedatives

Are you using any sedatives?	Number of respondents	Percentage
Yes	76	63,33%
No	44	36,67%

The results show that 63.33% of respondents use sedatives. This is quite worrying so it is necessary to consider alternative methods that will have no side effects and will not create any form of addiction among users.

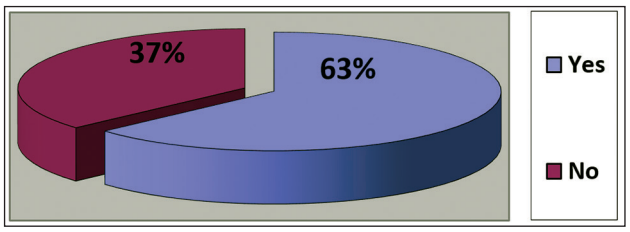

Figure 3. Graph showing the number of respondents who used sedatives

Fifth question was aimed at determining the frequency of use of such substances by the respondents. The data is presented in the following table:

Table 4. Frequency of sedative use

How frequently do you use sedatives?	Number of respondents
Several times a day	24
Once a day	19
Every 2-3 days	17
3-5 days	5
Weekly	5
On demand	6
Total	**76**

The results clearly show that the largest number of respondents who answered to the fourth question positively, use sedatives very often. 31.6% of respondents used sedatives several times a day, 25% of them used a sedative once a day while 22.37% used them every two or three days. Only 13.13% of users rarely used sedatives while 7.9% of them take a sedative if necessary.

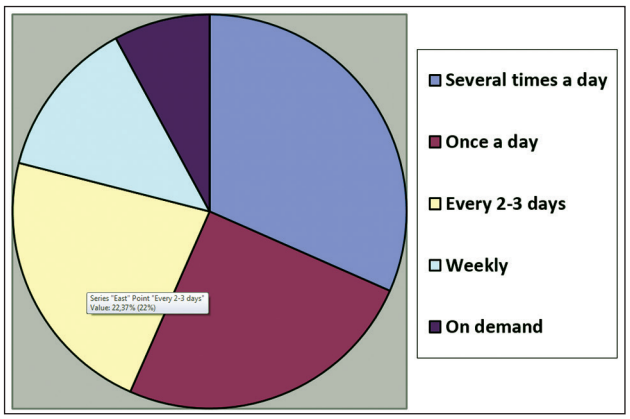

Figure 4. The overview of the frequency of sedative use

The sixth question was asked to find out what percentage of respondents prefers plant-based sedatives. The data is presented in further work:

Table 5. The number of respondents who use plant-based sedatives

Do you prefer plant-based sedatives?	Number of respondents	Percentage
Yes	36	47,37%
No	40	52,63%

The results of the questionnaire in this matter were pretty equal in both answers but there is still 5.26%, or four more of those users who do not prefer taking plant-based sedatives.

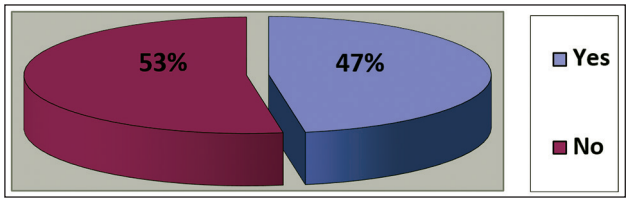

Figure 5. Graph showing the number of respondents who use plant-based sedatives

The seventh question was made to examine what kind of sedatives respondents most often choose.

Table 6. The pharmaceutical form of plant-based sedatives that respondents use

Pharmaceutical form	Number of respondents
Tea	20
Pills or capsules	10
Essential oil	5
Other	1
Total	**36**

The results showed that the highest percentage of respondents use tea, 55.55% of them, and 27.77% of them used plant-based capsules or tablets. 13.88% of respondents from a total of 36 use essential oils or drops tranquilizers, 2.8% use some other form of plant-based sedatives.

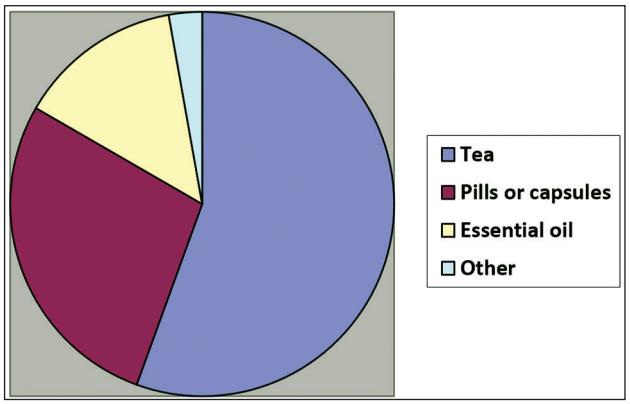

Figure 6. The pharmaceutical form of sedatives respondents use, graphical display

5.1 Sedatives based on selected plant species in Bosnia and Herzegovina

Medication with anxiolytic (sedative) action reduces anxiety and causes sedation, and in respect of its action does not change the mental and motor functions of the central nervous system. Unlike drugs with anxiolytic effect, the drug with hypnotic effect causes drowsiness, and then state of sleep and its maintenance. This should resemble natural sleep as much as possible. It should be noted that sedatives (anxiolytics) cause a lesser degree of depression of the central nervous system, while with hypnotics this depression strengthens. In our country, the following drugs that comprised of plants that are the subject of research are often used:

- Persen and Persen forte
- Lexoval
- Vamex
- Alora (pills and syrup)
- Valeral capsules
- Pronerv (Maxmedica)
- Belmirandan
- Belmiran san
- Bonisan
- Erbe de la notte (Esi)
- Dormirin
- Dormirin forte

One capsule of Persen forte contains 125 mg of valerian root extract, lemon balm leaf extract 25 mg 25 mg of peppermint extract. It relieves signs of nervousness and insomnia, it makes it easier to fall asleep. The recommended dosage for adults is 1-2 capsules, 2-3 times a day.

Lexoval forte is a product that is used 1-2 times a day and consists of valerian, hops, mint and lemon balm. The effect of the preparation is the following: reduces anxiety and tension, relieves irritation, reduces stress and contributes to better sleep [6].

Each capsule of Vamex contains 90 mg of valerian, 25 mg of lemon balm and 15 mg of hops. It works by balancing the neurotransmitters that play an important role in the regulation of mood [7].

Alora is a preparation intended to treat problems caused by stress and anxiety. It contains 100 mg of extract of the plant *Passiflora incarnata* L.

One capsule of Valeral contains 100 mg of dry extract of valerian with 0.8% valeric acid, 50 mg of dry extract of hops with 0.1% flavonoids and 20 mg of dry extract of lemon balm with 2% of rosmarinic acid. It is used to treat and prevent restlessness, tension, irritability, stress and insomnia [6].

A single Pronerv capsule contains 40 mg of valerian, 50 mg of lemon balm and 40 mg of hawthorn. It has a soothing effect and reduces blood pressure [8].

One Belmiran Dan pill contains 100 mg of dry passionflower extract and it is used for relaxation and stress reduction [9].

Each tablet of Belmiran San contains 150 mg of dry valerian root extract, 30 mg of dried hops and 80 mg of dry passionflower extract. It is soothing and relaxing and provides the patient with quality sleep [6].

A capsule of Bonisan contains 150 mg of dry valerian root extract with at least 0.15% valeric acid, 50 mg dry extract of hop cones and 5 mg of essential lemon balm oil. It is used in insomnia and for relaxation [9].

One capsule of Erbe de la notte contains 55 mg of magnesium, 70 mg of passionflower with a minimum of 3-4% of flavonoids, 22 mg of white hawthorn, 20 mg extract of chamomile flowers, 20 mg of valerian root extract, 10 mg of linden flowers and 1 mg of vitamin B6 [10].

Each Dormirin capsule contains 15 mg dry lemon balm extract, 10 mg of valerian root dry extract and 1 mg of melatonin [11].

One Dormirin Forte capsule contains 50 mg of dry lemon balm extract, 50 mg of dry extract of valerian root, 10 mg of zinc as zinc gluconate and 1 mg of melatonin [11].

***Valeriana officinalis* L.**

Figure 7. Valeriana officinalis L.

Valeriana officinalis L. is a long and herbaceous plant with odd plumose leaves (5-11 pairs). It is 0.5 to 2 meters high. At the top of the stem and branches is a white or pink big inflorescence which is made up of a large number of tiny flowers. It blooms in late spring and throughout the summer. The ground leaves have a handle and the ones at the top are seated. The fruit is up to 5 mm large and has plumes at the top.

Its rhizome is 2-3 cm long and 2-3 cm thick. There are the remains of stems and leaves at the top, and branches often emerge from it. It is annular on the outside and dark gray in color, so that the rhizome is not visible. Its odor is very strong and unpleasant. Fresh roots are almost odorless and a stabilized drug has a very bad smell.

This plant grows everywhere, but mainly at humid places, next to rivers and streams, meadows, rarely on the hilly and mountainous woods and dry places in Europe and Asia. Most valerian is grown and exported from Belgium and Netherlands. It is grown in our country, but also in many other countries of Europe and the United States.

Valeriana officinalis L. contains more than 150 chemical compounds, most of which are physio-

logically active. Rhizome and root of *Valeriana officinalis* L. contain on average 0.5-1% of essential oil. According to pharmaceutical standards, drugs should contain at least 0.5% of essential oil, and not less than 0.17% of valeric acid and its derivatives. The essential oil of valerian contains a mixture of monoterpene and sesquiterpene derivatives. The most important monoterpene derivatives are:

- v camphene,
- v pinene,
- v borneol and its esters.

In addition to the terpene constituents of the essential oil, the drug contains non-volatile monoterpene compounds, iridoids (valtrate, isovaltrate, acevaltrate). Underground organs contain a high amount of valepotriates, while smaller amounts are present in the aerial parts of the plant. Due to their ester structure valepotriates are very unstable in the presence of moisture, at an elevated temperature and in the presence of acids and bases. Decomposition products, aldehyde structures: baldrinal and izopropilbaldrinal are products of valepotriate hydrolysis. As for the non-volatile, sesquiterpene compounds, Valerianae radix et rhizoma contain mainly oxidized derivatives, such as [12]:

- v acids (valeric acids, hydroxy acid)
- v ketones (valeranon)
- v alcohols (valerianol) and
- v aldehydes (valerianal).

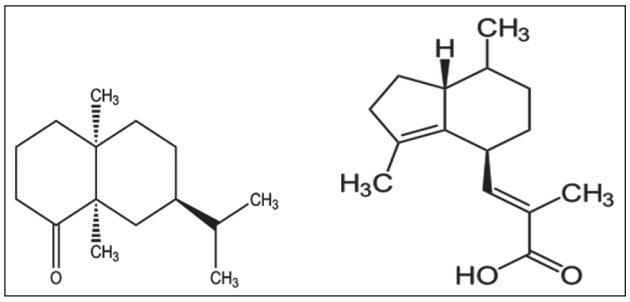

Figure 8. Valeranonand valeric acid (valeranon left, valeric acid right)

Alkaloids of valerian are present in small amounts (valerian and actinidine). They exhibit cholinesterase activity in vitro that has not been proved in humans or animals [13].

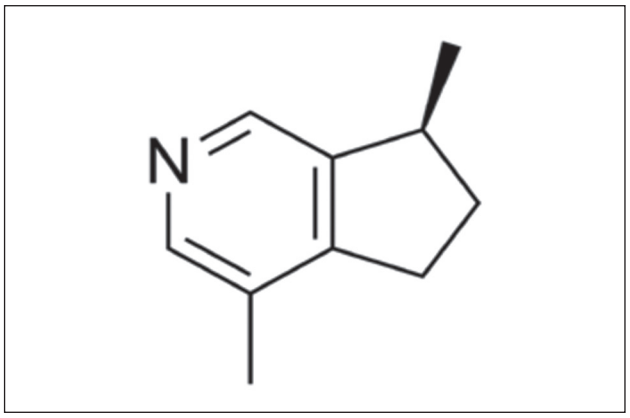

Figure 9. Actinidine

Hydroxypinoresinol is a lignan that is present in valerian. Its mechanism of action is based on the binding to benzodiazepine receptors in the amygdala and its considered to act synergistically with the bornyl acetate, valeric acid and valepotriates in achieving sedation [14].

Effects of Valeriana officinalis L.

Many researchers conclude that the combination of ingredients in *Valeriana officinalis* L. are responsible for its actions. The dried root and rhizome *Valerianae officinalis* L. in the form of various pharmaceutical formulations achieve [15]:

- v antioxidant,
- v cytoprotective and
- v neuroprotective activity.

The antioxidant activity

In folk medicine *Valeriana officinalis* L. can be used as an alternative treatment for the use of benzodiazepines in the treatment of insomnia. Research shows that the use of valerian does not cause any oxidative disorders in the brain after chronic use. It is important to note that valerian prevents brain damage induced by various pro-oxidants.

The alcohol extract of valerian root shows significant antioxidant activity and thus reduces lipid peroxidation (the antioxidant activity was analyzed in relation to the lipid peroxidation induced by Fe (II) ions). Since it is well known that insomnia can be associated with oxidative stress, valerian can be used as a tool for sleep improvement.

Cytoprotective activity

Root of *Valeriana officinalis* L. is rich in flavonoids. This effect is associated with antioxidant

properties of valerian. Due to the presence of flavonoids in the extract of valerian this plant is very interesting for further study in terms of development of neuroprotective agents for human use.

Neuroprotective activity

Reducing the overall excitability of brain neurons leads to prevention of excitotoxic neuronal death, increases the function of inhibitory neurotransmitter system, and as a result, develops the neuroprotective effect [15].

Therapeutic application of Valeriana officinalis L.

Pharmaceutical preparations from valerian rhizomes and roots have a multiple role in the treatment of disorders of the cardiovascular, gastrointestinal and central nervous system.

Numerous studies justify the traditional use of valerian products in order to achieve a sedative, hypnotic, anxiolytic effect, as well as the treatment of attention deficit in hyperactive children.

The effect of valerian on the modulatory activity of GABA

γ-aminobutyric acid (GABA) is an inhibitory transmitter of the central nervous system and achieves its effect by binding to GABA-ergic receptors. GABA A channels are modulated by numerous structural substances including clinically important drugs such as benzodiazepines, barbiturates and some general anesthetics, but also several herbal components, of which the most important are: flavonoids and monoterpenes (borneol and timolol) [16]. Borneol is a bicyclic monoterpene present in the essential oils of many plants, including valerian, chamomile and lavender. Extracts of these herbs are traditionally used to release tension, restlessness and insomnia.

A study conducted by Granger and colleagues demonstrated that borneol leads to a significant increase in activity of GABA binding to $\alpha_1\beta_2\gamma_2$L GABA A receptors, by direct modification of these receptors activity. Previous in vitro studies on rat brain preparations reveal that the most likely effect of valeric acid is achieved by binding to GABA A receptors [17].

Khom and associates came to the conclusion that a significant activity of valeric acid is achieved by α1β2γ2s stimulation, while the low level of activity is achieved by stimulating γ1, α1β2 or α2β2 receptor. Application of valeric acid in high concentrations causes direct activation of GABA A receptor channels. This research shows that valeric acid is an agonist with much lower efficiency than GABA [18].

Toxicity

There are indications that long-term use of preparations based on valerian may lead to the development of chronic toxicity, which manifests itself with [19]:

- v headache,
- v drowsiness,
- v heightened sense of unrest,
- v vague cardiac complications

The chronic use of high doses of valerian (5 mg per day) may result in the development of withdrawal syndrome if the use suddenly stops. The cytotoxic effect is observed in vitro, but the components responsible for this effect (valepotriates) decompose rapidly after oral administration [19].

Contraindications

A study by Donovan and associates shows that you should be careful during the simultaneous application of preparations on the basis of valerian and other drugs because of the potential impact of valerian extract on the activity of cytochrome P450 (CYP2D6 and CYP3A4). After the use of therapeutic doses of valerian extract there have been no reported adverse events [20].

***Melissa officinalis* L.**

Lemon balm is a perennial, herbaceous, branched plant with a short rhizome. The stem is straight, rectangular, branched and up to 1 meter high. It has a well-developed root. The leaves are oval, thin, brittle, serrated around the perimeter, slightly hairy. The whole plant is covered with fine small hairs. The flowers are white to bright red, located in groups of 6-10 [21].

Lemon balm blooms from June to September. The seeds of this plant are egg-shaped, small and shiny brown. When the leaves are rubbed, they smell like lemon, but the taste is bitter and slightly pungent. Also, lemon balm is resistant to low temperatures.

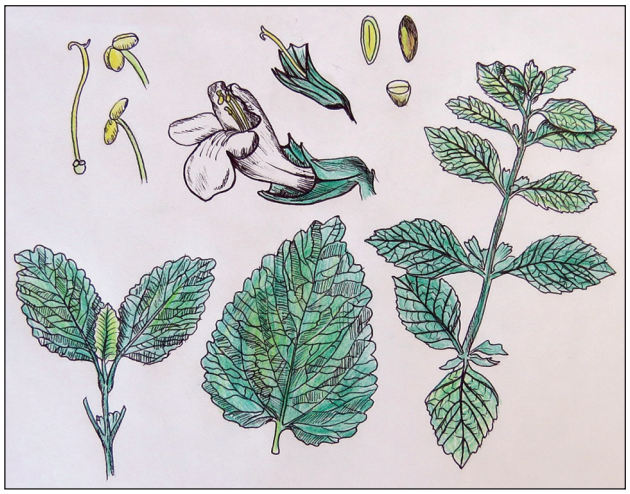

Figure 10. Melissa officinalis L.

The chemical composition of lemon balm

The leaf contains very small amount of essential oil, from 0.06 to 0.375%. Therefore, the essential oil is not a healing ingredient. The dry leaf contains very large amounts of rosmarinic acid (about 4%). It also contains flavonoids, such as luteolin, quercetin, apigenin and kaempferol, and smaller amounts of triterpenes such as ursolic acid [21].

The essential oil is obtained by steam distillation of lemon balm leaves. Since the content of essential oil is extremely low, the oil is very expensive. It is necessary to distill 5 -16 tons of fresh plants for one kilogram of essential oil. Therefore, the essential oil of lemon balm is listed as an expensive oil, so most people and a considerable number of aromatherapists never had the chance to even smell the essential oil.

Aldehydes stand out in its composition (geranial, neral, citronellal) and have a very pleasant, distinctive lemony scent [21]. They are highly requested, but drugstores mainly have bad forgeries, types of citronella mixed with lavender, lemon grass, distilled lemon oil and a mixture of essential oil of lemon balm with these oils. In worst cases, it is forged with synthetic compounds. We should be very careful when purchasing this essential oil because labels such as "100% natural and pure" are not a guarantee of quality, and neither is a place of sales because many pharmacies, and even schools for aromatherapy, sell forgeries of lemon balm essential oil.

Indications

In traditional phytotherapy lemon balm is used for insomnia, although it is less effective than species of valerian (*Valeriana officinalis* L.) and passionflower (*Passiflora incarnata* L.). It is sometimes used with fresh ginger juice as an addition to treatment of nausea in early pregnancy. It is also traditionally used with nettle leaves to treat anemia caused by iron deficiency [22].

Regulatory agencies did not approve the essential oil, probably because of its rarity, cost, and lack of data on clinical and traditional use. Leading aromatherapists - Daniel foam Pierre Frachomme, Dominique Baudoux and Kurt Schnaubelt - agree that indications resemble those of lemon balm leaves, therefore it is used for nervousness, insomnia, hysteria attacks and phobias, and is also used as additional help with tachycardia (increased heart rate) caused by stress [21].

Dermal use is suggested the most, and because of the amount of aldehydes, it should be taken orally only in capsules. Essential oil of lemon balm is not effective against the herpes virus, but aqueous extracts of lemon balm are. Oil of lemon balm is rarely used because of the price, but there are effective substitutes, such as essential oils of marjoram and mandarin. Therefore, we will mention only the dermal way of use.

Contraindications and side effects

Lemon balm is an extremely safe, non-toxic plant. There are no restrictions and warnings for its use. When used in treatment of mental illnesses patients do not develop tolerance nor dependence. The prescribed amount of essential oil is completely safe to use. The pure essential oil causes skin irritation and redness. Forged oils can often cause adverse reactions such as allergy, irritation, and even nausea. This is especially true for synthetic forgeries.

Humulus lupulus L.

Hops is one of the climbing plants and grows to about 6-7 meters in height. The fruits of this plant are in the form of a cone, the egg-shaped, lightweight, loose blossom is 3-4 cm long, and about 2 cm wide. Also, the fruit has a bitter flavor and pleasant aroma. The most important ingredient of hops is lupulin, and it also contains potassium salts, tannins, pectins.

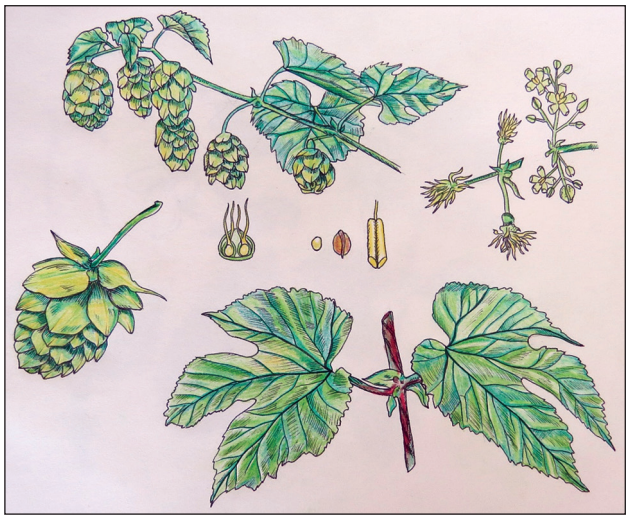

Figure 11. Humulus lupulus L.

Brewing countries are major producers of hops. Czechoslovakia is a major hop growing country. The old folk did not use hops as a cure. It is unknown whether the major brewing countries, Czech Republic, England, Germany, the Soviet Union and France, used hops in the middle and at the beginning of the new century. In the fifteenth and sixteenth centuries in England the hops was banned for beer production because it was, allegedly, damaging. The use of hops in brewing is more recent, and it found its use in medicine at the beginning of the nineteenth century [23].

When we talk about the chemical composition and the active ingredients of the plant, it should be noted that the female flowers contain essential oils, monoterpenes and sesquiterpenes. The most important ingredients are myrcene, humulene, caryophyllene and 2-undecanone. Humulone and lupulon are bitter hops ingredients. It also contains chalcone, flavanones, flavonols, catechins, proanthocyanidins, condensed tannins and methylbutenol [24].

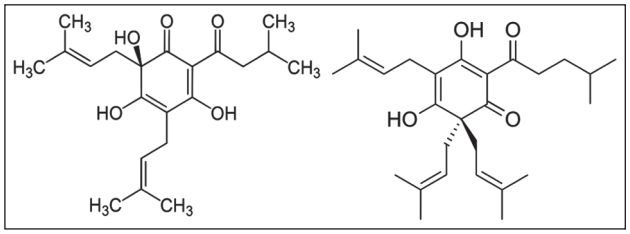

Figure 12. Humulone and lupulone (humulone left, lupulon right)

Hops has a calming and sedative effect and relieves or releases spasms [24]. When taken in large quantities it causes poisoning, which manifests itself in nausea, vomiting, headache and slow circulation.

***Passiflora incarnata* L.**

Figure 13. Passiflora incarnata L.

Homeland of passion flower (*Passiflora incarnata* L.) is Brazil (Amazon) and Peru. There they wer appreciated due to very tasty fruits. Passionflower grows in the eastern and southern parts of North America, and it is planted worldwide as an ornamental plant.

The passionflower stems can be smooth or pubescent; they are long and trailing, possessing many tendrils. Leaves are alternate and palmately 3-lobed and occasionally 5-lobed, measuring 6–15 centimetres (2.4–5.9 in). They have two characteristic glands at the base of the blade on the petiole. Flowers have five bluish-white petals. They exhibit a white and purple *corona*, a structure of fine appendages between the petals and stamens. The large flower is typically arranged in a ring above the petals and sepals.

The chemical composition of passionflower

Passionflower is composed of [25]:

v Flavonoids (2.5% of the dry weight of the plant): C-glycosides of luteolin and apigenin: iso-viteksin-2 “- glucoside, iso-orientin-2”-β-D-glucoside, vicenin-2;

- v Sugars: sucrose, fructose, glucose;
- v Polysaccharides: arabinoglucan;
- v Essential oil (in traces): limonene, α-pinene, zizaen, cumene;
- v Cyanogen heterozoids- (in traces);
- v The alkaloids (in traces): harmine, harmol, harmalol.

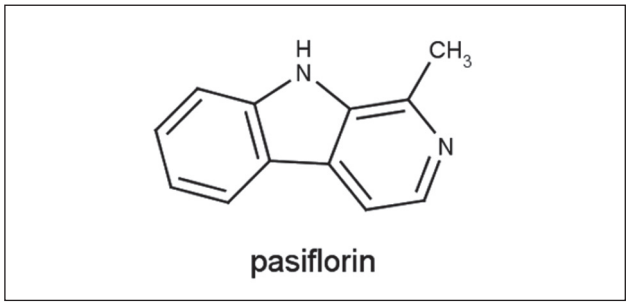

Figure 14. Pasiflorin

Passiflora incarnata L. is used in a state of nervousness and it has a significantly soothing effect on tension, restlessness, irritability, insomnia, but also on other health problems such as anxiety, preoperative anxiety, depression (minor to moderate), ADHD, addiction therapy (cannabis / cannabinoids, cocaine, nicotine, alcohol), erectile dysfunction, tinnitus.

Addiction, habituation and contraindications have not been reported. Drug interactions have been reported in addition to the suspected one with benzodiazepines (Carrasco et al.). Parallel application is possible under control. Side effects are very rare, as well as hypersensitivity to passionflower. It is not found to influence the ability to manage transport and machinery, but in case of drowsiness managing transport and machinery is not recommended.

Mechanism of action

Studies testing anxiolytic effect of passionflower

Soulimani et al. conducted a scientific study in which they examined hydroethanolic and water extracts of passionflower in mice. Hydroethanolic extract reduced the anxiety in mice in an unknown environment, while the water extract had a sedative effect. The aqueous extract had also a hypnotic effect. This study is one of the first to confirm the mechanism of action of different compounds depending on the polarity, and confirmed the importance of extracts containing all important groups of passionflowers compounds [25].

Zanoli et al. examined purified compounds, apigenin and chrysin which is a part of German chamomile and passionflower. They measured the effect on locomotor activity in rats and its anxiolytic effect. Both compounds at the lowest dose of 25 mg / kg showed a reduction of locomotor activity, but only chrysin showed anxiolytic effects. Chrysin activity, unlike apigenin activity, was mediated by the benzodiazepine receptor. From this study, we realized the diversity of the mechanism of action of flavonoids, but since the whole extract has not been tested, we cannot explain the full mechanism of action of passionflower or German chamomile out of it [25].

Brown et al. demonstrated the anxiolytic effect of chrysin in rats, which was comparable with midazolam, but the authors did not examine the native extract only the purified compound. The ethanol extract of passionflower blossom also demonstrated anxiolytic effect in the model of anxiety in mice [25].

Dhawan et al. tried to work out what exact compounds are responsible for the anxiolytic effect. They used a methanol extract of passionflower and determined that benzoflavones are the group of compounds that are having the best anxiolytic effect in the model of anxiety in mice. This is consistent with published data. However, the study itself is already designed with methanol extract and it is possible that other compounds which are not extracted in methanol also have biological activity. Benzoflavones from the methanol extract have a positive effect on decreased libido and azoospermia in rats caused by nicotine and alcohol. Observed effects are probably the consequence of the action of aromatase, a key enzyme in the synthesis of female sex hormones. A similar effect was demonstrated by the same group of authors in rats with reduced sperm count and reduced libido caused by cannabinoids. Dhawan et al. have proven that passionflower extract increases libido in mice as well [25].

A few years later Holbík et al. oppose the opinion of this group of scientists from India because they did not find the presence of benzoflavone in three passionflower-extracts from India, France and Italy. They proved the existence of phytol

isomer as one of the molecules from the benzoflavone group. Sampath et al. found that chloroform extract shows the best anxiolytic effect, and a very lipophilic extract in petroleum ether shows no anxiolytic effect. Unfortunately, the authors did not do a detailed analysis of the components in individual extracts.

Studies of passionflower are mainly aimed at the flavonoid fraction so that there are almost no data on the importance of alkaloids from passionflower and whether or not they also affect performance except in the study Soulimani et al. There are plenty of papers written about the activities of the alkaloids harmine, harmol, and hamalol. These alkaloids are probably not the dominant compounds - they are MAO inhibitors, and side effects related to the application of MAO are not found in the application of passionflower [25].

Other effects

Dhawan et al. found that, in a cough model induced by sulfur dioxide in mice, passionflower extract shows antitussive effects. Passionflower extract decreases acetylcholine induced bronchospasm in the guinea pig.

As the passionflower was traditionally used with gastritis, Mahady et al. proved a modest antibacterial effect on Helicobacter pylori, but it is not clear whether this result has relevance for clinical use. Masteika et al. have shown passionflower extract action against free radicals in vitro, which is not unusual for the extract rich in flavonoids.

Gupta et al. have proven the anti-diabetic effect in mice in which the diabetes was streptozotocin-induced, but for now no other studies were carried out on the basis of this work and its relevance is yet to be confirmed or disproved.

6. Conclusion

Based on all of the above mentioned, we concluded that hypotheses that were set at the beginning of the study have been proven. It was found that *Valeriana officinalis* L. (valerian), *Melissa officinalis* L. (lemon balm) *Humulus lupulus* L. (hops) and *Passiflora incarnata* L. (passionflower) are plant species which have a sedative effect and their use is soothing, reduces anxiety and causes sedation, and that when doing so its activities do not change the mental and motor functions of the central nervous system.

The use of those plants for the treatment of tension, insomnia, anxiety and irritability does not cause addiction in patients and side effects can occur only in situations when a higher dose than recommended is taken.

On the basis of the research it can be concluded that the citizens of Bosnia and Herzegovina use sedatives, but there is still not enough awareness of the importance of the therapeutic use of preparations which are composed of plant species that are the subject of this research. Respondents gave the priority to the use of sedatives that are not based on plants (52.63% of them), and respondents who prefer a different treatment are fewer (47.37%), these plant species are most commonly used in form of teas (55.55% of subjects).

We examined which preparations, composed of the above-mentioned plant species, can be found in pharmacies in our region. The results are following: Persen, Persen forte, Lexoval, Vamex, Alora (pills and syrup), Valeral capsules, Pronerv (Maxmedica) Belmirandan, Belmiran san, Bonisan, Erbe de la notte (Esi), Dormirin, Dormirinforte.

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Using YouTube videos to promote universities: a content analysis

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Abstract

In today's global higher education environment, international students represent not only an important source of external income for universities: the degree of cross-border student mobility also reflects the internationalization of higher education sector. Universities have engaged in efforts to sell themselves to prospective students and promotional videos are among the most widely used marketing tools for this purpose. This article reports the results of a study analyzing the content of 140 higher education promotional videos from 14 countries available on YouTube. The results reveal that while the pattern of use of YouTube for two-way communication with viewers, information contents and appeal messages among sampled universities is fairly homogenous, some marked differences emerge when cultural background and global position ranking of the university are taken into account. The implications of these findings are that, although transnational higher education has been profoundly globalized, culture still plays a significant role in marketing practice for the recruitment of mobile students. In addition, different universities have various student-targeted segments. These findings provide the basis of a series of recommendations for universities looking to optimize their use of YouTube and promotional video design to market to international students.

Key words: international student, education management, YouTube, content analysis, cross-cultural management.

J.E.L. Classification: A29; I21; P46; Z13

Introduction

The last five decades have seen an increasing flow of students across the world. During the 1960s, the annual growth rate of mobilized students was around 9 percent [1] and stayed stable at 5-6 percent over the following thirty years.

Over the last decade, as the knowledge economy has discoursed enhanced the value of education, accompanied by a global labor market constantly looking for knowledge workers and by the increasing demands from emerging middle-income class from South countries, it has resulted in a more highly liberalized industry than ever before [2].

As a consequence, we have observed an unprecedented jump in the number of transnational students. In 2010, the global population of mobile students was 4.1 million – twice the figure in 2000 [3].

On the map of competition for the transnational student market, the United States, United Kingdom, Australia, Canada and New Zealand – collectively known as the Major English Speaking Destination Countries (MESDCs) - are acknowledged leaders. There are two major motivations for universities in MESDCs to enter the international student market. First, historically, MESDCs - most particularly the US and UK - have used scholarships for the children of political elites from developing countries as a method of maintaining off-shore political sway [4,5] or to lure brain power for future research and development [6].

Second, as universities in MESDCs have fallen victim to decreasing levels of government funding since the early 1990s, higher education institutions in MESDCs have had to shift their strategies to aggressive campaigns for the recruitment of international students, increasingly relying on them as a source of income [4].

With the growth of the higher education industry in countries not traditionally associated with the mobilized student market, especially those from Asia, the interface of student recruitment has changed dramatically. While MESDCs are still leaders in the transnational higher education market in terms of international student's volume, they are declining as nation destinations in terms of international student's proportion [7]. According to the Organization for Economic Cooperation and Development [3], MESDCs lost 2.3% of their market share between 2006 and 2010. The figures show a fall from 45 to 42.7 out of every 100 internationally mobile student making MESDCs their study destination of choice. In other words, while the number of international students attending MESDCs continues to increase, the rate of increase is greater for non-MESDCs, particularly from Asia. With strongly performing economies, some of the more developed countries in Asia such as Korea, Taiwan R.O.C, Singapore or Malaysia have turned their attention to developing their national knowledge base through increasing investment in higher education. Attracting both international students and talented faculty has been among their top priorities [7,8].

Add these economic and social developments to the inclusion of international student numbers as one of the indicators in institutional rankings, such as the Times Higher Education World University Rankings or QS World University Rankings, and the result is a highly competitive and dynamic market of international student mobility.

The use of YouTube in higher education marketing

Video is one of the most common means of product promotion employed by managerial marketers - in any industry. According toStern & Resnik [9] , magazine advertisements have traditionally been considered a better option for advertisers in terms of involvibility of large volumes of viewers: where a television advertisement typically runs for 30 seconds, has limited scope for the inclusion of detailed information and an emphasis on being entertaining rather than informative, a magazine ad is able to provide more information and does not have the same time limits imposed. This trend, however, appears to be reversing due to the rapid growth YouTube, which was established in 2005. As a type of social media, YouTube has proven its advantages and efficiencies not only in attracting viewers [10] but also in the potential for uploader-viewer and viewer-viewer interaction. At the current time, practitioners in every sector across the world consider YouTube as 'an efficient platform for advertising and marketing' [10, 11]and higher education makes no exception. Creating a YouTube channel and uploading videos to promote institutional identity and the university's up-to-date achievements and activities has become increasingly popular in higher education management practice.

While the use of social media in general - and YouTube in particular - as a marketing vehicle is already ubiquitous in management and business practice, the body of scholarly research on social media is also growing [12]. Within the higher education sector, however, little is known about how universities are exploiting social media for management and promotional purposes. The purpose of this paper is to fill this gap in understanding by conducting a content analysis of 140 university promotional videos from 14 countries from 2007 to the present. This research provides an understanding of how universities from different cultures and global rankings are currently using YouTube to advertise to international students, as well as suggestions as to how marketers in higher education institutions can effectively harness YouTube to promote their university to the international student market.

Literature review

YouTube as a toolkit for university promotion

Founded in 2005 by three young entrepreneurs in California, YouTube is an open social-network for sharing videos and, along with Google and Facebook, is currently one of the most popular websites in the world [13]. Predominantly used for sharing non-professional videos for entertainment purposes [12], YouTube has rapidly attracted the attention of managerial marketers as an essential vehicle of promotion in both the for-profit [11] and not-for-profit sectors [10]. Organizations involved in advertising on YouTube range from small-scale, newly established beauty salons to

well-known philanthropic foundations. There are several reasons why organizations prefer advertising on YouTube to traditional means of communication like television or print media. On the one hand, thanks to YouTube's low costs and two-way communication [10], managerial marketers enjoy a flexible platform where they can upload longer advertisement videos and more detailed information than television; not only this, it is also possible to receive feedback from viewers. On the other hand, thanks to HTML embed code provided by YouTube, organizations can easily share their promotional videos on official websites. Stakeholders such as customers, employees or partners, in turn, may share these promotional videos on their own websites. Thus, advertisements about the organization or company expand remotely and are disseminated broadly, potentially to millions of viewers, regardless of where they are located and when they want to watch. Television, of course, cannot boast such an advantage.

Universities have not been immune to the benefits of social media in general [14,15] and YouTube in particular and have increasingly employed YouTube as a tool for contact with their prospective students in general and international students in particular.

Information content

Previous studies have identified and investigated the kind of persuasive information content promotional videos in general and YouTube's ones in particular may contain. For example, according to Waters & Jones [10] in the not-for-profit sector, the fundamental purpose of the promotional video is to 'inform and educate viewers about . . . missions, programs, and services'. In other words, not-for-profit organizations regard promotional video as a means to build corporate identity. By analyzing the content of 100 official not-for-profit videos uploaded in YouTube, Waters & Jones [10] found that mission statements and organizational programs and services were the most frequently cited attributes (56%). Thus, we suggest that, similar to the not-for-profit sector, a promotional video issued by a university must communicate to the audience basic attributes about the institution such as its logo, mission, vision, slogan, and history and core values.

Moreover, like other methods of advertising, it is widely acknowledged that a successful promotional video must be one that addresses the demands of its intended customers [16]. In the higher education context, the 'demands of customers' equates to the motivations of mobilized students to study abroad, and these factors are well established in the literature. For example, in surveying 2485 prospective students from four countries, including Indonesia, Taiwan (R.O.C), China and India, Mazzarol & Soutar [1] developed a comprehensive 'push-pull' model for cross-border education where 'push' factors are those that operate within the source country and 'pull' factors operate within the host country. In this present paper, we hypothesize that only 'pull' but not 'push' factors are present in university promotional videos. This is for two reasons: (i) the most common 'push' factors such as 'course not available at home' or 'difficult to get entry at home' are not as relevant to students considering studying abroad. According to Mazzarol & Soutar [1], in contrast, the 'pull' factors such as 'reputation for quality' or 'qualification recognized by employers' remain at the forefront in encouraging students to study overseas. (ii) As promotional videos are created by the 'host' institution, it is more likely that their producers include information they deem attractive and persuasive in building trust and credibility among potential students. In brief, the existing research indicates that institutional attributes and 'pull' factors are likely to form the content of university promotional videos.

Emotional versus rational appealing messages

The 'emotional versus rational' appeal model is one of the most common frameworks for understanding the effect of advertising on audiences and it has been widely applied by previous authors in analyzing the advertising strategies of business [17,18]. According to Kotler [19] while 'emotional appeals attempt to stir up negative or positive emotions that will motivate [customers] purchase . . . rational appeals engage self-interest by claiming the product will produce certain benefits such as value or performance.' Existing empirical studies have shown that, based on different conditions - that is, differences in targeted customers, the nature of the business (goods versus services) and

cultural background - managerial marketers will adopt different advertising strategies incorporating different combinations of emotional and rational appeals in order to attract their targeted customers. For example, a study conducted by Albers-Miller & Stafford [17] revealed that rational appeals were used more frequently for goods compared with services, regardless of where the business transaction occurred. This argument is also consistent with other findings such as those from [18]. However, Albers-Miller & Stafford also showcased the significant role of culture in determining the use of emotional and rational appeal with the same product type (goods or services) [17]. By examining different print advertisements in financial services and travel services across four different countries, they found that advertisements in Taiwan employed a greater number of emotional and fewer rational appeals than those in Brazil, Mexico and The United States. This argument can be understood through the lens of Hofstede [20] in which Taiwanese customers, identified as having a more collectivistic cultural character, are likely to be persuaded more by emotional appeals such as 'affiliation' or 'community' over those of the more individualist and achievement-oriented cultures such as the United States, Mexico or Brazil.

However, while the research has explored various aspects of the uses and effects of advertising messages on different audience in detail, no one has yet investigated how universities use YouTube, as a social media toolkit, for promotional purposes and the kinds of messages their content contains; that is, how 'pull' factors and appeal messages are being represented in their promotional videos. This study fills this gap and addresses the following questions:

Question 1. How is YouTube used to engage with viewers across universities with different cultural backgrounds and global ranking positions?

Question 2. What information content do universities include on their YouTube promotional videos and do cultural differences and global ranking positions have an impact on this content?

Question 3. What appeal messages do universities employ in their YouTube videos and do universities' cultural differences and global ranking positions have an effect on the nature of these messages?

Materials and methods

Samples

Data collection was undertaken in September 2013. The authors used the following keywords to search for university promotional videos in YouTube's search engine: *'university + promotional video/film/movie', 'university + introduction video/film/movie', 'welcome to university'*. YouTube displayed different outcomes with different keyword commands, ranging from the lowest 79,400 outcomes with keyword *'university + promotional movie'* to the highest 8,150,000 videos with keyword *'welcome to university'*; however, there was duplication across these searches and not all were appropriate for this study. The following criteria were used to refine and focus the sample: (i) Only English speaking videos were included, based on the assumption that a university creates a video for the purpose of recruiting international students and English is widely used as the *lingua franca* in the higher education sector. (ii) All videos uploaded before 2007 were excluded in order for the analysis to be of contemporary videos only. (iii) Videos created for the purpose of promoting a sub-institutional unit such as a school, a department or a university special event/service such as an anniversary celebration, a new opening program or an alumni activity's event were dropped for data consistency (iv). Videos produced by individuals, for instance, students in journalism or communication majors who created videos for practice or educational purposes were excluded. (v) Only promotional videos from (a) English speaking countries and (b) East and South East Asian countries were selected as these groups have been the most active players in the international student market in recent years. This latter divide revises and updates Javidan, Dorfman, Luque, & House (2006)'s cultural clusters in which countries are grouped by culture [21]. For the purposes of this present study, we will adopt the Javidan et al. (2006)'s term for the English-speaking countries included in this research, thus 'Anglophone' will represent the group of the US, UK, Australia, Canada and New Zealand. We will use 'Post-Confucian' to describe the group of sampled universities from East and South East Asian countries; in this study these are China, Japan, Singapore, South Korea, Taiwan, Malaysia, Thailand, Vietnam and Cambo-

dia. This term is adopted from [22]. Following the application of the refining criteria described above, 140 videos from 14 countries were finally selected for this study (for more details see Table 2).

Coding procedures

The authors chose content analysis as the methodology to examine how universities use YouTube for identity-development and promotional purposes. The coding sheet was synthesized by the consensus of all three authors based on different coding schemes from the existing literature in various industries [17,18,10] with three different groups of items/indicators linked to the three research questions.

Two of three authors of this study, both fluent in English and whose countries of origin are the same were chosen as coders. According to Peter & Lauf [23], coders with the same cultural and language background may result in higher reliability. When an item was found present in whatever form of the 'three Vs' of communication - vocal, verbal or visual - in a promotional video, it was coded with a value of '1'; otherwise as '0'. According to Hall & Schmid Mast [24], the 'three Vs' of communication together impact significantly on an audience's awareness and interest about a video's message. To estimate reliability, Krippendorff's Alpha was employed as it is the most appropriate formula for ratio scale coding. Table 1 presents P/L Index coefficients for all coding items, ranging from lowest of 0.764 to highest of 1.000.

Table 1. Krippendorff's Alpha of reliability

Indicators	P/L Index
Degree of engagement with viewers	1.000
Information Content	
Institutional attributes	0.875
Educational quality claims	0.764
Supportive and flexible administrative systems	0.909
Facilities and Resources	0.817
Finances	0.955
Learning and employment outcomes	0.907
Environmental factors	0.852
Tourism factors	0.981
Appeal messages	
Rational appeals	0.978
Emotional appeals	0.995

Results

As mentioned earlier, a total of 140 promotional videos were identified for this study, of which 90 (64.3 %) belong to English speaking countries (the 'Anglophone cluster') and 50 (35.7 %) belong to East & Southeast countries (the 'Post-Confucian cluster'). The leading country where university promotional videos were used was the US (46 commercial clips, or 32.9%), followed by the UK (29 clips, 20.7%) and South Korea (17 clips, 12.7%). Detailed information about the selected videos with regards to cultural origin can be seen in Table 2. With regards to global ranking position, the authors chose Academic Ranking of World Universities 2013 (http://www.shanghairanking.com/ARWU2013.html) to divide the 140 selected university's videos into two clusters: 51 within the Top 500 (36.4 %) and 89 outside the Top 500 (63.6 %).

As Jarboe [25] has suggested, organizations would be well-advised to use YouTube to harness both online and offline communication with their target audience and this study's first research question asks whether there is a difference in the level of engagement of universities with viewers on YouTube's platform. Thus, we adopt four criteria to measure the degree of 'interactive openness' of a university using YouTube: (i) Does the university create an official brand channel to upload the video? (ii) Does the university upload other videos updating its daily/special activities or promoting its sub-institutional units? (iii) Does the university enable the Like/Dislike button for viewers to express their reactions to the video? (iv) Does the university enable the Comment feature for viewers to express their opinions and arguments about the video? If the answers to all four above questions are 'Yes', a university will be assigned a score of '4' reflecting a high degree of engagement with audiences and viewers. For any question to which the answer is 'No', a point will be subtracted. Thus, a university will have the highest degree of two-way communication with audiences when it gets a score of '4', or answers 'Yes' for all four questions; in contrast, the lowest degree receives a score of zero if the answers for all four questions are 'No'. As indicated in Table 3, there is significant effect for cultural background (F=14.60, p=0.0002) but not ranking position and interaction (between cultural

Table 2. University promotional video correspondent with country's origin

Country	Number of university promotional video	Percentage
Anglophone Cluster	***90***	***64.3***
Australia	8	5.7
Canada	6	4.3
New Zealand	1	0.7
UK	29	20.7
US	46	32.9
Post - Confucian Cluster	***50***	***35.7***
China	7	5.0
Cambodia	1	0.7
Japan	8	5.7
Malaysia	4	2.9
Singapore	2	1.4
South Korea	17	12.1
Taiwan R.O.C	2	1.4
Thailand	2	1.4
The Philippines	5	3.6
Vietnam	2	1.4

Table 3. ANOVA result F-tests

	Degree of engagement with viewers	Information content							Appealing messages		
		INA	EQC	SFS	FAR	FIN	LEO	ENF	TOF	RAT	EMO
Culture	***14.60***	***10.10***	1.36	1.53	0.78	0.52	2.00	0.11	0.00	3.88	1.77
Ranking	0.00	1.25	2.30	0.04	0.29	0.07	0.10	0.15	2.13	***9.79***	***6.95***
Culture * Ranking	0.60	0.11	0.07	0.10	1.30	0.69	0.09	***6.75***	0.30	0.29	0.26

Table 4. Degree of engagement with viewers

	Degree of engagement with viewers	
	Mean	Standard Deviation
Cultural Background		
Post-Confucian cluster	2.56	0.86
Anglophone cluster	3.22	1.04
Global Ranking		
Outside Top 500	2.97	0.97
Within Top 500	3.02	1.12

background and ranking position), suggesting differences in the use of YouTube in engaging with viewers based only on culture. These results are further illustrated in Table 4, which shows the degree of engagement with viewers by each cultural and ranking cluster. Regarding cultural background, universities from English-speaking countries (average score of 3.22/4, SD 1.04) appear to be more willing to interact with their audiences than East and Southeast Asian institutions (average score of 2.56/4, SD 0.86). However, there was no statistical difference in the use of YouTube for uploader-viewer communication between the two clusters of different rankings as the average scores of 'Within Top 500' group and 'Outside Top 500' group are 3.02 (SD 1.12) and 2.97 (SD 0.97), respectively.

The second research question sought to determine the nature of the information content used to promote a university. This question also asks how this content differs across cultural backgrounds and global ranking positions. As noted at the outset and as the literature describes, there are two main ways

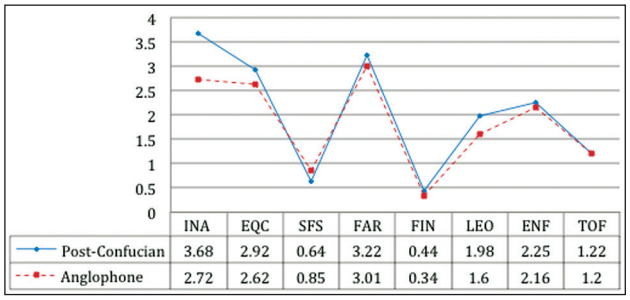
Table 5. Lists of sub-indicators

Indicators	Number of sub-indicators	Sub-indicators
Degree of engagement with viewers	4	Official Brand Channel; Uploading other relevant videos; Enable of Like/Dislike Button; Enable of Comment Feature
Information Content		
Institutional attributes	9	Ranking; Slogan; Vision; Mission; Principles/core values; History; Logo; Internationalization; Others
Educational quality claims	7	Overall quality of education; Academic staff quality; Notable professors; Ranges of courses and programs; Reputation of teaching; Reputation of research; Others
Supportive and flexible administrative systems	6	Professional support staff; Reputation for being responsive to student needs; Offer flexible entry throughout the year; Visa application and acceptance; Institution willing to recognize students' previous qualifications; Others
Facilities and Resources	6	Use of latest information technology; Large campus and excellent facilities; Dormitory; Library; Gym and pools and leisure facilities; Others
Finances	7	Tuition fees; Travel cost; Living cost; Part-time jobs; Financial aid; Scholarship; Others
Learning and employment outcomes	8	Understanding of new culture; Job opportunities after graduate; Qualification recognized by recruiters; Foreign Language improvement; Broaden personal experience knowledge; Opportunity to become a global citizen; Becoming more mature, independent and responsible; Others
Environmental factors	12	Safe (low crime) environment; Low racial discrimination; Established population of overseas students; Comfortable climate; Exciting place to live; Supportive learning environment; Strong alumni network; Lifestyle of the host country; Ranges of students clubs and society; Modern/technological advance country; Political/democratic country; Others
Tourism factors	11	Natural scenery; Entertainment and gaming; People and local resident; Historic building and heritage; Tourism facilities and infrastructure; Cultural facilities; Activities and Festivals; Flag, map and sign; Parks and gardens; Local cuisine and dining; Shopping; Others
Appeal messages		
Rational appeals	13	Cheapness/Economy; Convenience; Competition; Durability/Quality; Independence/Individualism; Modernity; Naturalness; Neatness; Technology; Safety; Wisdom; Work; Productivity
Emotional appeals	13	Adventure; Affiliation; Community; Dearness; Distinctiveness/ Uniqueness; Enjoyment/Leisure; Freedom; Maturity; Modesty; Morality; Nurturance; Tradition; Youth

that a university will attempt to sell itself: the first, similar to not-for-profit organizations (citation) is by reference to institutional attributes such as logo, mission, vision, slogan, history and core values. Given the specific context of present global higher education, we add ranking and internationalization as sub-indicators of institutional attributes. In total, the content of 'Institutional Attributes', or INA, are comprised of nine sub-indicators, including also sub-indicator others (see table 5).

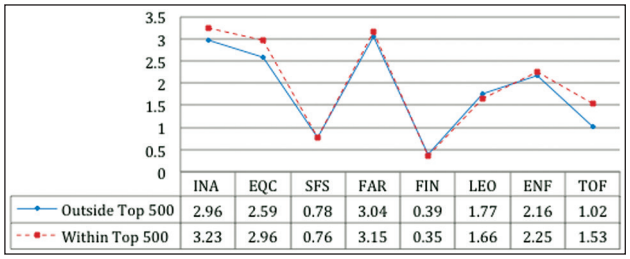
The second way a university will promote itself is through use of the 'pull' factors that have been well established by previous studies examining the drivers behind student intentions to undertake cross-

border education [1, 7]. These drivers were re-categorized into five indicators, including 'Education Quality Claims', or EQC; 'Supportive and Flexible Administrative Systems', or SFS; 'Facilities and Resources', or FAR; 'Finances', or FIN; 'Learning and Employment Outcomes', or LEO; 'Environmental Factors', or ENF; each containing six to 12 sub-indicators (these details can be found in Table 5). Apart from these indicators, we add 'Tourism Factors', or TOF (Table 5) as the last indicator that may be found in the information content of university promotional videos. This inclusion is due to the concept of 'educational tourism' that was firstly studied by Kalinowski & Weiler [26] [27], and followed by Lam, Ariffin, & Ahmad (2011). This concept describes that, while a student chooses to study overseas for educational purposes, he or she may travel around the host country for leisure purposes. As a consequence, students' choice of destination may be affected by tourism considerations. In this current study, the authors employed the categorization with 11 sub-indicators, which had been used by Dadgostar & Isotalo, Dallen J. Timothy, Choi et al. to understand how the tourism factors of host countries were projected into university promotional clips. The details of 11 sub-indicators may be found in Table 5.



	INA	EQC	SFS	FAR	FIN	LEO	ENF	TOF
Post-Confucian	3.68	2.92	0.64	3.22	0.44	1.98	2.25	1.22
Anglophone	2.72	2.62	0.85	3.01	0.34	1.6	2.16	1.2

Figure 1. Average number of sub-indicators observed per video aggregated across different cultural backgrounds



	INA	EQC	SFS	FAR	FIN	LEO	ENF	TOF
Outside Top 500	2.96	2.59	0.78	3.04	0.39	1.77	2.16	1.02
Within Top 500	3.23	2.96	0.76	3.15	0.35	1.66	2.25	1.53

Figure 2. Average number of sub-indicators observed per video aggregated across different ranking positions

Figures 1 and 2 illustrate how universities deploy information content to promote to prospective students, in respect of different cultural backgrounds and global ranking positions respectively. These figures show that the sampled universities, regardless of ranking and background, have used a very similar pattern in terms of information content. Based on these results, the pattern with the original seven indicators may be broken into three roughly equal categories: high-use (with average observation of sub-indicators per video ranging from 2.59 to 3.68 included INA, EQC and FAR); low-use (with correspondent figure ranging from 0.34 to 0.85, included SFS and FIN); and medium-use (with average observation ranging from 1.02 to 2.29, included LEO, ENF and TOF).

As indicated in Table 2, the only two significant effects were found with INA based on different cultural backgrounds ($F=10.10$; $p=0.0018$) and ENF based on interaction between culture and ranking ($F=6.75$; $p=0.0104$). Figure 1 illustrates the difference in INA's sub-indicators between the Post-Confucian and Anglophone clusters. While, on average, there are 3.68/7 INA's sub-indicators (SD=2.12) found in a promotional video produced by the Post-Confucian cluster, the corresponding number for the Anglophone cluster was 2.72/7 (SD=1.42).

Table 6 reveals a significant difference in ENF's sub-indicators with regards to a two-way interaction effect, implying that the use of Environmental Factors is dependent on both cultural background and global ranking position ($F=6.75$, $p=0.0104$). While the earlier part of this section categorized ENF as medium-use compared to other indicators, the two-way interaction indicated that with further analysis the use of ENF, in turn, may be further grouped into 3 sub-groups: high-use (Post-Confucian and Within Top 500), medium-use (Anglophone and Outside Top 500), and low-use (Post-Confucian and Outside Top 500; Anglophone and Within Top 500). To examine this relationship in detail, the means and standard deviations are represented in Table 6.

This study's final research question examines the nature of the advertising appeals employed by universities on YouTube promotional clips, asking if there were differences between universities from different cultures and ranking positions. To answer this, the coding framework identified by Waters & Jones [10] was adopted, in which 47

Table 6. Average number of environmental factors observed per video aggregated based on interaction effect

		Average number of environmental factors observed per video aggregated based on interaction effect	
Cultural background	**Global ranking position**	**Mean**	**SD**
Post-Confucian cluster	Outside Top 500	1.92	1.51
Post-Confucian cluster	Within Top 500	2.94	1.39
Anglophone cluster	Outside Top 500	2.31	1.45
Anglophone cluster	Within Top 500	1.94	1.30

advertising appeals developed by Shen and others [18, 28, 17, 29, 30, 31] and were then divided into two categories: rational (16 appeals) and emotional (31 appeals). As described by Shen [18], the range of appeals are generically applicable across any sector or type of product (goods or service). The present study found there were only 13 for each type of appeals (rational and emotional) included in the transnational higher education context (see table 5).

As illustrated in Figures 3 and 4, a common pattern emerged, in that both rational and emotional appeals were used in all the sampled universities' videos; but with rational appeals presenting slightly more frequently than emotional. With regards to the differences between clusters, contrasting results were found when global ranking position and cultural background were considered. While these were the main effects of rational appeals ($F=9.79$, $p<0.0022$) and emotional appeals ($F=6.95$, $p=0.0094$) for universities with different ranking positions, this was not the case for universities from different cultural backgrounds.

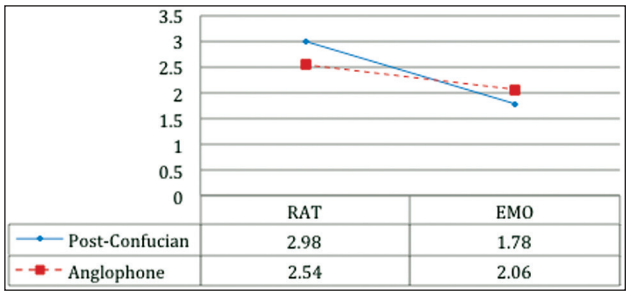


Figure 3. Average number of advertising appeals observed per video aggregated across different cultural backgrounds

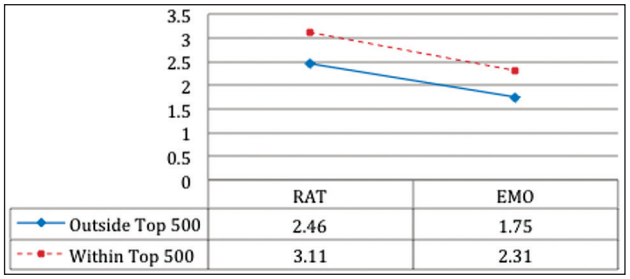


Figure 4. Average number of advertising appeals observed per video aggregated across different ranking positions

Discussion

One of the major phenomena shaping contemporary global higher education is cross-border student mobility [4]. In recent years, higher education institutions across the world, regardless of cultural origin and global ranking, have been proactively involved in campaigns to entice international 'student-customers'. To that end, universities have adopted a number of marketing methods to promote themselves to prospective students. Thanks to its many advantages over traditional advertising vehicles, YouTube is increasingly being employed by universities as a marketing tool. However, up until now, it has not been known how universities use YouTube for advertising purposes and how information content and appeal messages in these promotional videos may vary across different higher education institutions.

This current project addresses this gap and three key findings have been yielded according to three research questions as follow:

First, in respect of YouTube's use, evidence from this study shows that higher education institutions across the world have been aware of the flexibility and advantages of this social network platform in strengthening their brand identities with their 'customers'. However, as the vanguard in the interna-

tional student recruitment market, Anglophone universities tend to more radically exploit the two-way communication features provided by YouTube than their Post-Confucian counterparts.

Second, in the information content of promotional video, a quasi-homogenous pattern was found across the sampled universities. Only two distinct differences were found with the number of Institutional Attributes (INA) and Environmental Factors (ENF) observed per video when considering the main effect of cultural backgrounds and interaction effect (of cultural backgrounds and global position rankings), respectively.

Third, with regards to appeal messages, again, this study uncovered a similar pattern in which rational appeals were slightly higher than emotional appeals. However, among different clusters of ranking positions, higher-ranking universities are prone to employ more advertising (both rational and emotional) appeals than lower ones.

These results pose a number of questions that beg further investigation. These are discussed below.

The level of 'interactive openness' across different universities

Researchers have argued that the more open organizations/enterprises are to engaging in two-way communication, the more positive viewers will respond [32] which will, consequently, then lead to an increase in consumption/sales [33]. Despite this, some sampled universities, especially in the Post-Confucian cluster, appear less inclined to openness than their Anglophone counterparts. In this respect these universities appear to repeat the mistakes of companies included in Kanso et al's study that applied 'traditional advertising strategies to the dynamic web environment, while ignoring the unique features possible through the interactive nature of the medium'. While Post-Confucian universities appear to be less aware of the potential of YouTube for promotional purposes than Anglophone institutions, given the historical penetration of English-speaking countries into the international higher education market, as well as their maintained lead in the contemporary cross-border higher education market [7] it is to be expected that they would be savvy in designing advertisements and thus be more active in adopting new marketing methods.

A quasi-standardized 'recipe' in both information contents and appealing messages

As described earlier, this study found that universities across the world have employed a standardized format to design promotional clips in terms of both information contents and appeal messages. This finding is not particularly surprising and can be explained by Global Marketing Strategy theory; as described by Zou & Volz [34], in the multinational business context, the degree of global advertising positively correlates with the convergence of the customer's demands, the availability of the media toolkit and the similarity of competitive positions across different markets. These propositions had been also confirmed by earlier empirical studies, for instance Okazaki, Taylor, & Doh 2007's work on the advertising strategies of 574 American and Japanese firms in the European market. [35] Given the homogeneity of factors underpinning a student's motivation to study abroad, the ease of use and popularity of YouTube, and the development of the international higher education market, it is understandable that universities in our study should adopt a quasi-standardized pattern of information content and appeal messages.

However, what is surprising is our finding that the factors that encourage students to undertake offshore education were weighted differently to those elucidated in the student choice-behavior literature: that is, our findings are not wholly consistent with past research in this area.

For example, in one of the most cited and influential papers investigating on factors underlying international student destination conducted by Mazzarol & Soutar (2002), [1] the authors found that an institution's reputation for quality, the alumni factor and the willingness of the host institution to recognize students' prior qualification were among the top factors impacting on destination decision making of mobilized students, regardless of their cultural origins. In contrast, analysis of our results showed the above factors actually fall into three groups with different degrees of use in YouTube promotional videos. Similarly, Roberts et al. [7] suggested that scholarship, study in a foreign language (i.e. Chinese/Mandarin) and the safety of the environment are the primary factors motivating international students to choose Taiwan as

a host country for higher education services. As Kang & Mastin [16] suggested in their study on the tourism industry, marketers must consider the viewpoints and cultural orientation of targeted customers. What is the reason for this contradiction? Have the 'pull' factors motivating students to study abroad changed since Mazzarol and Soutar [1] and Roberts et al (2009)'s studies [7]? Or is it that university marketers using YouTube simply not aware of the relative magnitudes of 'pull' factors, which have been well established in the literature, when designing their promotional videos?

While the nature of 'pull' factors may be liable to change over time and across different locations, it is highly improbable that they are opposite to those observed in this study. In addition, given the broad and profound development of marketing knowledge, marketing personnel, especially those from the higher education sector are likely to understand, to a greater or lesser extent, the profile and perspectives of their targeted students. But how then can the discrepancy be explained? The answer is that universities are likely to have adopted a mixed-media advertising strategy such as that suggested by Kanso et al., in which YouTube is one part of an integrated promotion approach. Under this approach, university advertisers provide specific, 'first-step' content such as Institutional Attributes, Educational Quality Claims or Environmental Factors in their YouTube clips while other content such as Supportive and Flexible Administrative Systems or Finances will be delivered in subsequent steps through different advertising vehicles such as a website or exhibition.

Another finding of note was revealed when we considered the relative use of the two different kinds of appeal messages. Higher education institutions in this study, regardless of their cultural origins and position rankings, used both rational and emotional appeals in their YouTube clips, with the latter rating slightly fewer than the former. This finding reinforces the idea that the emergence of YouTube has radically altered promotional-video design.

As mentioned earlier, video-format advertisements were traditionally deemed less informative [9], and appropriate to emotionally congruent advertising, in contradiction of our findings. The finding also illustrates the nature of higher education as a special service. That is, once a student considers studying abroad, they will spend a relatively long time living offshore where they will 'consume' two 'bulks of services': education services as their primary purpose and all other relevant services the student accesses during his or her time living overseas, including those surrounding the campus, tourist services in the host country and so forth. On the one hand, education services are, by nature, categorized as utilitarian and a higher-involvement product, such that a rational appeal approach is appropriate and advised. On the other hand, it is reasonable to employ emotional appeals for the other services marketed to the student, which are categorized, to some extent, as hedonic or lower-involvement products (for instance tourism or the residential environment). Moreover, as education is the major reason why a student goes beyond the border of his or her country to live abroad, it is understandable that more rational appeals are used than emotional ones.

The effect of cultural background and global ranking position on the design of university promotional videos

While this study found that there were similarities between universities sampled in terms of information content and appeal messages, what became clear was the influence of institutions' cultural background and global ranking positions on the design of promotional videos.

As presented in the Results Section, significantly, Post-Confucian universities deployed more Institutional Attributes (INA) in their videos than did Anglophone universities. One explanation for this is that, as late movers in the global higher education market, universities from the East and Southeast Asian region are indisputably less popular than their competitors from English speaking countries. Thus, Post-Confucian universities must focus attention on identity-building features such as logos, slogans, and statements of vision or mission. However, an alternative explanation for this may reside in the possibility that Anglophone universities are using promotional videos to sell themselves to dual targets, that is, both international and domestic students, while Post-Confucian institutions opt for two types of videos: one in English targeted at international students and the other in the local language targeted at do-

mestic students. As emerging host destinations, it is understandable that East and South East Asian universities employ a higher number of INA in order to enhance their basic identities, with which international students are likely to be unfamiliar.

Regarding the effect of interaction, results revealed that among the four sub-clusters (Post-Confucian Outside Top 500; Post-Confucian Inside Top 500; Anglophone Outside Top 500; Anglophone Inside Top 500), higher-ranking Post-Confucian universities relied the most on Environmental Factors to entice international students, far surpassing the three other sub-clusters. As Mazzarol & Soutar [1] have suggested, although in the eyes of international students the relative magnitude of Environmental Factors (ENF) was less important than the other factors, for instance Educational Quality Claims (EQC), host nations and higher education institutions should not neglect the role of ENF when developing marketing strategies.

In the light of this, thanks to their inherent cultural background and English speaking environment, Anglophone countries enjoy the advantages of possessing Western living and learning environments that attract more mobilized students [1], so it is understandable that they do not place a lot of attention on ENF. In contrast, East and Southeast Asian universities, especially key and elite ones, with heavy support priorities and financial subsidies from their governments in recent years (Marginson, 2010) are inclined to focus more on ENF in order to overcome the inherent marketing disadvantages associated with cultural origin. In addition, the fact that lower ranking Post-Confucian cluster did not use a lot of ENF can be explained by the fact that their process of internationalization is only in its infancy and they may not yet be in a position to recruit, serve and support foreign students.

The study's results also reveal a marked difference in the use of rational and emotional appeals across different ranking groups. Analysis showed that higher-ranking universities tend to put greater emphasis on *both* rational and emotional appeals than their counterparts from the lower-ranking clusters. Based on the assumption that higher-ranking universities target to more elite students, does our finding imply that higher-knowledge students are more rational and emotional sensitive than their 'lower-knowledge' peers? The Elaboration Likelihood model (ELM) initiated by Petty & Cacioppo [36] and recently followed by Chiou, Droge, & Hanvanich [37] gives us a half the answer to this conundrum. These authors contested that higher-knowledge customers rely more on central (and less on peripheral) routes of persuasion, or more on rational (and less emotional) cues to make a final decision to consume a product or not. In contrast, the opposite trend is observed for lower-knowledge customers. On the basis of this model, to better match their prospective students' demands and perceptions [16], higher-ranking and lower-ranking universities are well-advised to reduce and enhance, respectively, their emotional cues when producing future advertisements.

Conclusion

In a newly liberalized market, transnational higher education marketing practice is a vastly under-investigated area in comparison to other sectors. To shed some light on this gap, this paper has provided one of the primary analyses of the use of YouTube as a method for universities to advertise to prospective students. Using the two lenses of cultural background and global ranking position we examined the extent to which different higher education institutions took advantage of YouTube's features and the nature of the information content and appeal messages used to entice prospective mobilized students. The results show that regardless of the institution's cultural origin or global ranking position, in general, universities adopt a quasi-standardized 'recipe' in both information content and appeal messages on YouTube. However, cultural background and global position rankings still play a significant role, such as the degree of 'interactive openness' in using two-way communication YouTube's platform and the use of Institutional Attributes as information content (effect of culture), Environmental Factors as information content (interaction effect of culture and ranking position) and the use of appeal messages (effect of ranking position).

Implications

The above findings have several implications for university marketers involved in designing advertisement campaigns. First, as suggested by Leppäniemi et al.. [32] or Chevalier & Mayzlin

[33], the more an enterprise interacts with their customers, the more benefit they earn; universities, especially late movers in the transnational higher education market such as those from East and Southeast Asia should consider using more of YouTube's features to enhance interaction with prospective students.

In addition, given the increasing convergence of the current transnational higher education market, a systematic approach should be taken by universities when conducting advertising strategies in which YouTube's video could be considered as among the first options to provide viewers with primary images and impressions of their institution. On the other hand, university marketers may follow the so-called 'distorted mirror' advertising strategy [38] in which only inherently cultural information content and appeal messages that could help generate selling products are selected to adopt in their promotional videos. Ultimately, the demands and values of different student target markets should also be considered when designing marketing strategies.

Limitations and future research

While we have endeavored to conduct this research robustly and reliably, we acknowledge that it still has its limitations. Two coders were selected among the authors, who were already familiar with the objectives of the research and this could, potentially, mean a decrease in reliability. Future research could eliminate this problem by hiring external coders blind to the research questions. Second, with only seven groups of keywords searched in YouTube's engine, we may not have captured all available videos for inclusion. Future research may broaden the selected sample and enhance objectivity through using further keywords or an innovative method of collecting data, for instance crosschecking the search results in other locations, for example, on universities' official websites. As mentioned in Discussion Section, future studies may broaden the scope of this research by examining other videos uploaded by universities on their YouTube channels as well as investigating, in tandem, other promotional programs implemented by universities (such as websites, exhibitions and printed materials).

It should also be noted that, due to limitations on scope, an important aspect of promotional video as a medium had to be neglected in this current study and that is the technical design of the videos, including their length, music choice, use of spokespersons and the use of digital effects. This also has potential for further investigation. Finally, there is an arena that this study did not attempt to address; that is, how international students actually *perceive* university promotional videos. This is, of course, a worthy topic for further investigation, which can be tapped for an emerging strategic advantage in today's fast-changing world: serendipity-based market opportunities [39].

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Globalization, europeanisation business and social policy

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Abstract

In this paper, we tried to present the basic trends in the global economic processes and the globalization of economic activities. With indications of the trends noted above, a special review of the Europeanization of business is provided, which as a special dynamic system implements the social policy in parallel and is conditioned by traditions, value systems, economic development, deployment of opportunities, income and wealth, but also with general global processes.

Key words: Globalization, Europeanization, business, social policy.

1. Introduction

More than ever in the history of the world processes there is a number of fascinating trends that consist in the fact that the global economy is increasingly interconnected and consolidates the links, so that, despite the many cultural differences, countries speak the same language - the language of money [1]. Globalized economy presents such an economy in which neither distance nor national borders impede economic transactions.

So, technological changes have progressively decreased obstacles and barriers in the process of international integration. Today's globalization processes, in contrast to earlier, are conducted through rapid communications, market liberalization and global integration of production of goods and services [2].

However, these processes are not equalized and are held to different intensities, depending on the economic, cultural and political conditions for all forms of connection process in which the actors are people, ranging from local to regional to global. Thus, the socioeconomic environment, in which these processes are run, is directly interacted with processes of globalization, and how these processes arise, so this setting is changed.

Looking at these processes from the perspective of the state, it means that the country that has taken the international economic integration implicitly accepts and restricts their activities. However, this attitude cannot be applied to all functions of the state in general, because states continue to operate individually. Thus, international power is based on the ability of individual states to provide and guarantee the stability and the globalization of the country does not make it unnecessary. On the contrary, for people to successfully take advantage of the opportunities offered by international integration they require this stable and successful country, so failed, unstable, weak and corrupted states circumvent "a wide berth" in the processes of globalization and the global economic system.

2. Globalization of economic activities

The globalization of economic activity implies a degree of functional integration between internationally scattered economic activities. The increasing globalization of the economy means that the changes that occur in one part of the world are quickly transmitted to other parts so the world is becoming increasingly economically, but also culturally homogenized. In today's economy without borders, in terms of globalization, the rapid movement of people, ideas, information and capital across national borders is characteristic. Fast and full integration into the world's economy is the main objective of development efforts at the macroeconomic level.

The objective of stable growth implies a change in the criteria of a macroeconomic development of the GNP (gross national product - gross domestic product) on GNW (Gross national welfare - gross national well-being). Global companies integrate their core business operations which are located in different countries. One of the most important indicators of increased global business operations of the company is a high proportion of sales on for-

eign markets in total sales. The production system is seen as a chain of related business functions. The chain is connected to a set of transactions, where it is particularly important the way they are structured organizationally and geographically. The fundamental question in considering the global organization of production is the extent to which the production chain is integrated or disintegrated, organizationally and geographically.

Global companies can choose the location and management approach for each element in the production chain that enables the achievement of strategic advantages. This is usually implemented in the following ways:

1. Raw materials can be purchased in a business environment that supports the technique of "just in time" inventory management;
2. A computer integrated manufacturing can be employed where there is the corresponding expert base;
3. Labour-intensive production may be located in countries with cheap labour, and capital-intensive production can be developed on sites in the world which are characterized by low cost of financing;
4. Transport to the factory for assembly or to the distribution centre can be planned so that it causes a relatively low cost. Joint sales staff can be used for more than one country, and their own marketing techniques on this basis can achieve cost reduction based on economies of scale;
5. Other strategic advantages based on economies of scale can be achieved by centralized and vertically integrated production, centralized purchasing, and the ability to link market research costs to a higher volume of production.

Acceptance of global production systems can bring the company great advantages over its competitors. Automated production and rapid development of products based on technological research may allow a global corporation supplying a quality of manufacture of the products than the competition [3].

3. The EU and business europeanization

Many describe Enlarged European Union (EU) as an economic giant.

Today we talk about Europeanization of business, which received a strong impetus from the mid-eighties of the 20th century. The current change is "from national to European companies", as some call it "corporate integration." [4].

The company is conceptually based on the idea and aspiration of creating a transnational type of company shareholders. They started from the premise that regulation of these companies must be transnational. Statute for a European company was adopted in October 2001.

The demarcation of supranational and national is made or regulation of some issues is left to the Member States. The company has the status of a joint stock company, with the initial capital of at least € 120,000. The founders of European companies can be joined by stock companies, in other words, limited liability companies. These organizational forms corporations can form European society alone or together on one of the following prescribed ways:

1. By merging of two joint stock companies from different Member States, with the establishment or acquisition of an existing society to another;
2. By establishing a joint holding company of European companies from at least two joint stock companies from different Member States;
3. By the establishment of a joint subsidiary with the status of European companies from at least two companies from the Member States;
4. By changing legal form (statute) of national stock companies in the European company.

The company policy should improve the financial environment for business, to encourage cooperation between companies and to facilitate access to new markets. This should lead to the creation of a business environment that supports innovation and change. Special importance in the European Union is given to encouraging the establishment and development of SMEs. Increasing competitiveness should contribute to measures at EU level aimed at

cooperation in the field of education, research and development and other areas of technological development. This practice is based on the concept of the development of the economy based on knowledge. The importance of intellectual capital especially stands out for the future development of the European knowledge-based society. In this context, it is important to note that in recent years in the EU the management of culture and art is especially developing. Industry culture in the European Union represents an important source of revenue and jobs. So they employ about one million people.

The European Union has agreed that innovative activity is one of the main driving forces that increase the knowledge and use of technology in the economy. When it comes to the type of innovative activities, it turned out that a large number of enterprises had innovation products and process innovation. Innovative activity was largely represented in large companies than in medium and small and has been referred to the service entities. There is an evident tendency for companies with the high technology to intensively invest in business cooperation, often on the b From the standpoint of international management, especially the significant symbolism of Europe is important and to it, there are associated various aspects of product design and packaging, corporate identity, advertising in various media, as well as communication. The symbolism of Europe comes to the fore with the design of euro banknotes.

Number twelve in the emblem and on the flag of the EU with the twelve stars on a blue background explains it as a traditional symbol of completeness and unity, a circle of stars represents harmony and harmony between peoples of the EU.

"Ode to Joy" - the European anthem. The blue colour - continuity from antiquity. Architectural styles from the cultural history of Europe are presented on euro banknotes Portals are at the front of the banknotes, which symbolize the spirit of openness and cooperation, and in particular, the bridge as a symbol of communication between Europeans and between Europe and the rest of the world.

European economic integration has an important impact on management practice in enterprises of EU member states, as well as companies of countries which are not EU members but who do business with them, or sell their products, services or know-how to the market of the European Union. Increasing competitiveness today largely derives from the joint application of new management methods and techniques, information and communication technologies and high-quality human resources.

4. European's system of social policy

Systems of social policy and social inclusion of the poor and all those who with their income cannot take care of people in the member states of the European Union are dynamic and change according to changes in:

a. the conditioned social processes (a tradition of values),
b. the economic development,
c. supporting social processes (distribution of opportunity, income, wealth),
d. the global processes.

Models of social policy occur as a civilized response to the processes that in the economic sphere form global and local circumstances of life of the individual or the general population [5].

The globalization of economic trends, the introduction of new technologies in production and living environment, increasing inequality in the distribution of newly created value, income and wealth, and in particular the demographic trend of the aging European population, significantly and directly affect the society in general and especially on some of its layers [6]. Civilization characteristics are that throughout the history, richer society, especially on the European continent, more and more responsible care about poor people and those who are unable to care for themselves (due to the different reasons).

The social concern in many ways is the civilization achievement of society where it is implemented. But what is interesting is another fact: although the per capita GDP of the richest countries are still three times higher than GDP per capita of the poorest countries in the EU, a number of allocations for social policy are seven times higher than in Sweden, for example, Latvia. It speaks to the fact that in designing a system of social care is not just about financial solvency opportunities, but also on the decisions of the kind of society we want to live in and setting goals to come to such a society.

However, a practice that occurs in the second half of the 20th century tells of the conflict between the amount of cumulated and the highest permanent social benefits and the lowest salaries in the richest countries, which motivates exit from the labour market. Since then, in a special way, it is paying attention to defining relations and financial interconnectedness between compensation for dependent population and the minimum income based on labour. Unfortunately, at the same time, a completely unproductive ideology is developed as a by-product of the popular theory of growth competitiveness, which brings the application that the systems of social assistance, due to fiscal savings, should be slightly budgetary "slack".

".How we live in circumstances that offer fewer opportunities for those who are" slower "in terms of education or social capital (networking and all the other elements necessary for finding a job and emancipation in society) and faster" consume "the man in the psycho-physical sense and diminish his ability to take care of themselves during their lifetime, social policies are needed more than ever. They should include targeting, must not be discriminatory, or have properties of accumulation which allow earnings. An illustrative example of the challenges placed before the systems of social policy concerns about the policy of the system risks associated with job loss.

A. The risks that occur when the loss of a job happens:

a. the risk of famine;
b. the risk of loss of space which we live in;
c. the risk of inability to care for the family with the consequences;
d. the risk of loss of creditworthiness and personal property due to unpaid bills;
e. inappropriate medical help;
f. loss of employability, the inability to invest in themselves, loss of self-confidence;
g. the risk of social isolation and the feeling that sustained tones;
h. risk of entering the crime or suicide.

B. The answer of social policy

The social security, welfare system in particular, should be in a special way to respond to the risks described:

1. Enable the rule: food and shelter with satisfactory hygienic and nutritional content - for all who have lost all other possibilities for self-financing of existence and who are in the process of reintegration into the world of work (public kitchens, hostels, subsidies for all institutions that provide the same - it should be an area of economic policy);
2. Enable partly institutional bridging credit risk (getting credit bureaus) for those working on flexible work contracts - provide a combination of risk-sharing between entrepreneurs and the state, to those who do not have a contract for an indefinite time in order to get, for example, a mortgage loan;
3. The active and preventive role of public employment services and entrepreneurs in terms of improving the employability of those who lose their jobs, or are getting worse paid, or allow them to transition to better-paid jobs within the company and between companies;
4. Provide access to employees one-year suspension of employment for study purposes or starting a new business (Swedish and Danish model);
5. Companies sign contracts on productivity growth, with what goes and an appropriate shift in the amount and structure of other benefits for workers. These and similar recreational models that companies can decide for are quite acceptable for integration between market-based instruments, but also a concrete way to help those in need of such assistance. In this area of social policy, which is in many ways the result of social values and economic conditions prevailing in society member states, the practice of coordination is starting to happen at European level.

This takes place through a formal system of coordination of social policies, but also by strengthening the common facilities and strengthening the instruments in formal documents of the EU, such as the Guidelines for growth and development. Nearly one-third of GDP EU Member States is related to the financing of social policy (pensions, disability benefits, social assistance, health care, family policy). If we exclude pensions from these

payments, transfers of the money to the population are 5 percent of GDP. Some of the key trends presented in the report on social practices in Europe talk about:

a. to strengthen initiatives that supported population to reintegrate into society, primarily through an effective return to the labour market;
b. is becoming more common support workers with low incomes;
c. make up the concrete steps to social support to individuals provided in the system of joint resources of the national and local levels;
d. more attention is paid to the analysis of reasons for long-term sick leave and disability, in order to reduce the possibility of hidden "early retirement";
e. activities that should enable each citizen to return to the labor market as part of its economic and psychosocial capabilities;
f. social protection policies carried out in close coordination with developing tax policy and active labour market policies;
g. it is carried out a very careful policy of distribution concerns about individuals between families, associations and state institutions (as well as transferring part of providing public services to social care in private companies) - especially as some activities "relieve social care" state in countries such as Germany and France welcomed with great indignation and criticism, as well as a high political price for its promoters.

In European countries, the expenditures for social policy are rising. This reflects an increase in compensation and more users who are left without any source of income, or not in the Member States participated in the labor market (immigrants). In Europe, spending on health care and unemployment are growing fast. Sweden and the United Kingdom are the only countries in which it was recorded reduced allocation for unemployment due to a dynamic labour market and employment. In terms of social welfare highest allocations were recorded in the Czech Republic, Greece, Italy and Luxembourg. What is happening in the Baltic countries, like Estonia, it is indicative of all transition countries.

It is difficult to discuss the reform of the social policies outside the context of the pension system and health care system. The principles emphasize that part of the economic growth must focus on transfers to the elderly and the health system. The increasing importance is being given to activation measures or policy of social inclusion and financing of such a policy.

Increasing importance, except for the planning of social policy, has mechanisms for monitoring their implementation, eliminating inconsistencies and inefficiencies, training. Monitoring of policies of social inclusion of members of the EU allocates several areas of particular interest, with which the various States, with more or less success, are grappling: non-existent or inadequate access to education and retraining; eradication of child poverty; making it difficult for youth employment in quality jobs, ensuring decent man and worthy of housing, especially the elderly and single-person households; reducing discrimination among residents; and greater involvement in the labour market of persons with disabilities, minorities and immigrants. In the system of implementation of these policies is necessary to modernize budget planning process (from national to local levels), as well as inclusion in the programs of the European Social Fund and the European structural and regional aid programs.

5. Conclusion

Representing only some indication of the globalization process in the sphere of economic activity, in this paper we tried to address the globalization processes in the European Union with a focus on the Europeanization of business. As we stressed, the European Union represents a very powerful actor of the globalization process, but, also, it is an "old lady" to heritage enormous concentration of cultural and historical values that has humanity. In these values, it is significant and social sensitivity as traditional European value, and thus a moulding appropriate of social policy in the processes of globalization, which, regardless of the well-being of many, lead to the impoverishment of a significant part of the population in the richest European countries, not to mention the countries in transition.

So, dealing with a wide variety of social situations is also coping with demands for adequate and strong social policy. As it can be seen from specific data and facts of this work, the strengthening of social policy and taking adequate measures are not only relevant to economic forces of European countries, but also to the merits of the principle of social justice in their tradition and culture. Therefore, it is one of the priority tasks of further strong monitoring social policies of Member States, with the responsibility of democratic institutions of Europe to more timely and more specifically intervene economically and politically everywhere where there is a common assessment that it is necessary. This relationship gets even more significant if we take into account the new situation mass exodus of refugees from Syria, Iraq, Afghanistan and other countries on European soil.

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Students' preferences on basic functionality of e-learning platforms in the context of blended learning

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Abstract

In recent years, especially after active financial support through various national funded projects the use of electronic platforms in university training in Bulgaria has significantly increased. Widespread learning management systems provide a common set of basic functionalities. In this study an assessment of the preferences of the students in physical education major and sport coaching major on the main functionalities of the electronic platforms used in the context of blended learning in university education is presented. The results reveal a preference on organizational and informational functionalities and less on communication features.

Key words*:* blended learning, e-learning platform, functionality, preferences, physical education, sport coaching

1. Introduction

The necessity to improve the quality of higher education and the rapid development of information and communication technologies and their intrusion in everyday life govern the application of educational technologies and practices based on using electronic educational platforms at different levels of university education. Widespread learning management systems such as Blackboard or Moodle provide a common set of basic functionalities. Extending or adapting these functionalities is more or less dictated by the current trends in information and communication technologies, the social networks and the mobile media. Other functionalities include the legacy from the first steps in the development of learning management systems. The contemporary requirements to educational environment guarantee a high level of individualization in education based on the construction of pedagogical situations.

Born as an alternative caused by concerns on pure e-learning, blended e-learning has been presented as promising. The realization of blended learning at universities is dependent on the level of motivation and interest on part of the students as its subjects as well as on its potential for information processing within the integration of elements of electronic and traditional education.

Over the recent years the Bulgarian Ministry of Education has invested 30 million BGN through European Structural Funds in the implementation of distance education in Bulgarian universities. Various approaches for transforming traditional courses into online ones were developed and various practices of blending face-to-face with online teaching and learning have given rise to intensive processes of theoretical reflection of these practices in an attempt for them to be conceptualized by existing pedagogical theory or used as a basis for creating new pedagogical paradigms [1].

Due to the growing of blended learning some researchers have already studied students' expectations from [2] and satisfaction with [3]. blended e-learning system environment.

We focus our empirical study on the preferences on basic functionalities of e-learning platforms used in the context of blended learning and the interest and motivation of the students in physical education major and sport coaching major at the South-West University, Bulgaria.

2. Theoretical Background

Blended learning is a type of new rather than innovative education which is supposed to change the structure of educational content. It implies information environment and sources as a prerequisite for turning the educational platform into an algorithmic

rather than human space. Through blended learning we economize time, means and efforts.

Blended education is the result of the convergence of two classic learning environments - the traditional face-to-face learning and online training. The implementation of blended education in universities enriches the face-to-face teaching and e-learning by increasing the degree of interactivity and thus enhancing the requirement for a significant commitment to self-sustained training. It is also motivated by the need to increase the availability and flexibility of learning in the context of lifelong learning and the need to increase cost efficiency because universities are looking for ways to use technology to achieve both improvement of the quality of education and reduction of costs. The search for opportunities to fully design and implement blended education requires systematization of several of its main models, which play the role of conceptual frameworks. They enable its operationalization and technological realization in practice. Although the "patterns are abstract in their nature, they facilitate effective learning, which requires a specific understanding of the needs of learners, the educational content, the target groups and the organizational conditions and environment" [4].

Blended education does not provide the whole range of options for its implementation, but represents a good basis for defining the features in accordance with the objectives, resources and opportunities for its practical implementation. In the context of these, the realization of blended education at universities seems to be highly dependent on the level of motivation and interest on part of the students as its subjects as well as on its potential for information processing within the integration of elements of electronic and traditional education.

The implementation of blended education through a specific e-learning platform and selection of appropriate media and design of the learning environment is in the context of Gagne's theory, which outlines the following instructional events and the corresponding cognitive processes:

- attracting attention (reception)
- informing learners of the objective (expectations)
- stimulating the recall of prior learning (retrieval)
- presentation of the stimulus (selective perception)
- providing guidance on the education (semantic encoding)
- provoking action (response)
- providing feedback (reinforcement)
- assessment of the performance (recall)
- increasing the absorption and transfer (generalization).

These events must meet or provide the necessary conditions for learning and serve as a basis for designing the training and selection of appropriate media [5].

The use of such electronic platforms in university education of students in physical education and sport coaching provides a further opportunity to enrich their digital competence.

Digital competence, defined as one of the eight key competences for lifelong learning includes "the confident and critical use of information society technologies for work, leisure and communication" [6]. Digital competence implies connectivity with the skills to use digital technologies that allow teaching professionals to work with modern information and communication technology, computers, software applications and databases, helping them to realize their ideas and objectives in the context of their work. It is important for pedagogical specialists, particularly physical education teachers and sports coaches to have the ability to search, collect and process information and approach it critically and systematically as well as the skills to use the design tools for media information and the capacity to access, search and use Internet-based services, especially in the context of their future activities and opportunities for continuous professional qualification.

All this is successfully assisted during their university education through the techniques of blended learning and targeted implementation of electronic platforms in it.

3. Design of the Empirical Study and Analysis of the Results

The focus of the presented study is related to the survey of the students' preferences on basic functionalities of electronic platforms used in the con-

text of the implementation of blended learning in university education. This mainly operational level of attitude is directly related to the interest and motivation of students and their adequate involvement in the organization and implementation of their training in specific subjects, using the options for integration of traditional and electronic forms.

The paper studies the functionality of e-learning platforms in the context of blended learning (traditional and electronic) of physical education major and sport coaching major.

The aim of the study is to pinpoint the students' preferences on the functionality of a particular e-learning platform and motivation in the course of the implementation of blended learning.

The empirical study was conducted from September 2015 to February 2016. The sample consisted of 240 students enrolled in physical education major and sport coaching major. The tools for conducting the empirical study include a survey for evaluating the level of motivation and a Questionnaire for the preferences of students on basic functionalities of Blackboard Learn LMS platform.

The survey for assessment of the level of motivation consists of: Introduction with guidelines for assessing and completing the survey, which contains 42 statements with answers on a 7-point grading scale in which the answers comply with a certain sequence. The questionnaire was developed by V.K. Gerbachevski [7]. in order to identify the components of the motivational structure associated with the level of claims immediately advanced in the course of operations and are completed by students in the course of solving specific educational cognitive tasks through the use of the e-learning platform Blackboard Learn for Academic Collaboration.

The examiner fixes in advance a certain stage during the exercises after the completion of which students must fill cards received earlier and continue their work on the assignments during the exercises in the course.

The main purpose of using the proposed questionnaire is to study and assess the level of motivation of students while they use the Blackboard Learn for Academic Collaboration e-learning platform and to track and differentiate the attitudes of students towards the use of the electronic platform and its functionalities in course training where the experiment was conducted.

For the level of educational and cognitive motivation, during solving a specific task, by using the e-learning platform (Blackboard Learn for Academic Collaboration), there can be deduced, according to the degree of manifestation, a high, moderate or low level of student's response to success or failure, increase or decrease in the willingness to work on the task. Later in the study the motivation for achievement will be analyzed, which occupies a significant place in the motivational regulation of the learning process, which dramatically affects the objectives, content, activities, efforts and determines the individual behavior of students within the established situation.

The result analysis of this study shows that 48% of the students included in the control group have an indifferent attitude to its results, and for 31% from them the task does not cause interest, 55% are ready to get involved in anything else but simply not with study. In the experimental group, only 11% are indifferent to their results, and for 64% of them the task is provocative. Indifferent to its results are 63% of students in the control group, while with 64% of respondents in the experimental group that is not the case. The results analysis clearly outlines that 71% of the control group anticipate that they would not be able to manage the task, while 78% of the students in the experimental group did not believe that they came to nothing. Some of these results are related to the emotional orientation of students in the activities and are indicative of their motivation throughout the use of the e-learning platform.

76% of the students in the control group showed indifference to their success by failing to be interested in the fact whether their results are better than those of others. This shows that they are reluctant to seek opportunities and alternatives for achieving success in solving the task. All this is related to the perception of students to avoid the low score after solving their assignment - 80% of the experimental group want to avoid the low result, while this is important to only 8% of the students surveyed in the control group. Here it should be underlined that 67% of the students in the experimental group nourish a desire to achieve the best results, while only 6% of their fellow students included in the control group want their result to be one of the best.

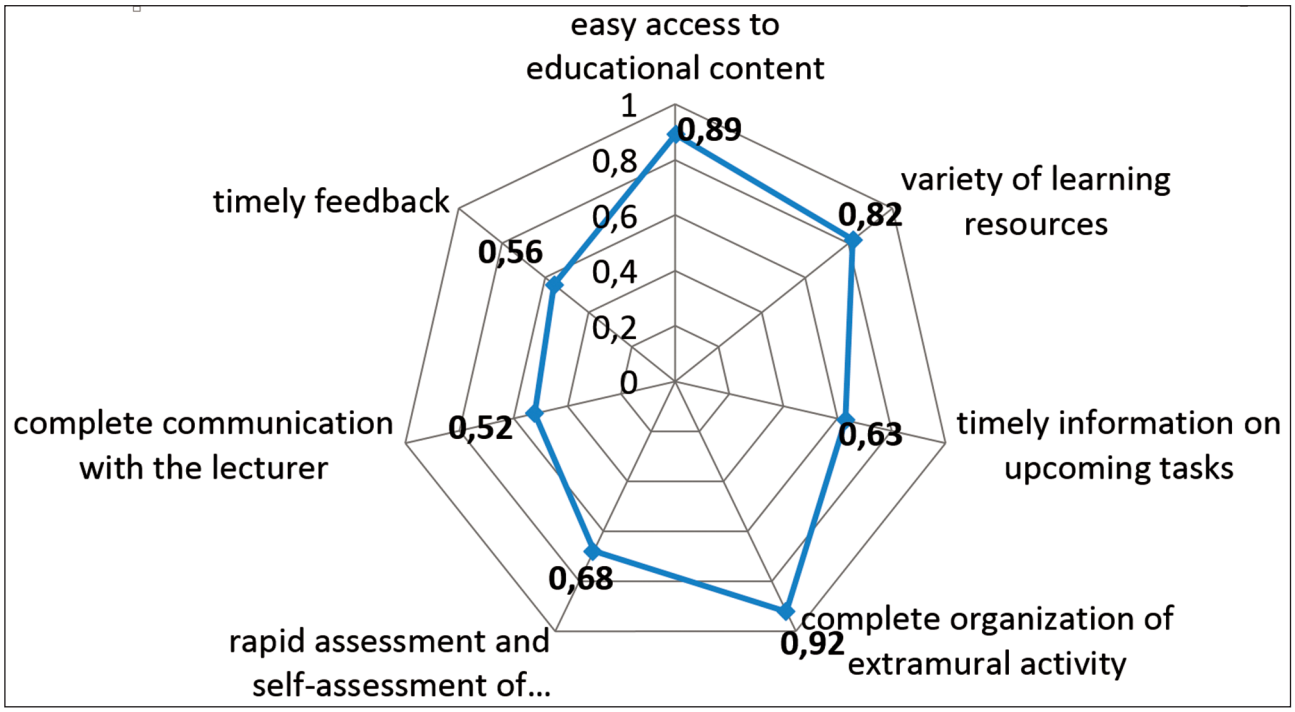

Figure 1. Factor analysis on main functionalities of the platform

Although both groups - about 42% of the students consider the task difficult, 49% of them in the experimental group were motivated to do everything in their power to reach the goal while such readiness express only 17% of the control group. 87% of the respondents in the experimental group are interested in their limits, while 9% of the control group are showing interest in this matter.

The results regarding the level of motivation in the course of using the electronic platform Blackboard Learn for Academic Collaboration are statistically significant and give a good idea of the impact of technology on the motivation for achievement, which is crucial to the overall educational and cognitive motivation. Although the study of motivation is a very complex process involving various factors that guide, regulate and maintain individual actions in the learning process, examining it in the course of using the electronic platform enables us to make conclusions about the attitude of students towards the activities and their results.

In order to establish a correlation between success in solving the task and the level of motivation a chi-squared test (test) is applied, since empirical data are represented by variables of two scales - ordinal (success) and nominal (level of motivation, which is characterized as mainly qualitative). If the null hypothesis () states that between the success rate of students in the application of e-learning platform and the level of motivation for excellence, there is no logical connection, then the alternative hypothesis states that such a relationship exists. The empirical characterization of the hypothesis is , while . Comparing the theoretical to the empirical characterization of the hypothesis namely , gives us reason to reject the null hypothesis in favor to the alternative one, which means that there is a logical connection between success in using the e-learning platform and the level of motivation for achievement.

Factor analysis has been performed on the basis of the conversion of the set of correlating data in a new set of non-correlating variables (or factors) that explain the highest possible fraction of the total variation of the output data, thereby reducing the number of input variables by grouping those which correlate with each other in a common factor and separating uncorrelated ones at different factors.

In Figure 1 a factor analysis shows the distribution of the results about the preferences of students from different physical education majors and sports coaches majors on e-learning system functionality according to their factor weights.

The results highlight primarily the demand for capabilities to facilitate easy access to information about extramural activity and study matter; timely

access requirements on monitoring and examination procedures; opportunity to create an electronic portfolio, ensuring better preparation for the exam. Features as feedback and communication with lecturers are also demanded.

4. Conclusions

When experimenting with educational techniques and technologies in university education, priority is given to new information and communication networks. The principle of their selection will be determined by the ability not just to know electrons platforms, resources and formats activity but primarily by the personal expectations and attitudes of students determined by the motives for purposeful behavior in training.

The survey results give reason to appreciate the dynamics of educational activity and its relation to motivation as a process. In this sense, "blended learning" is a new opportunity to establish priorities for studies related to the idea of innovative models of interaction between classical education and e-learning, stimulating a motivational mode of behavior in in students' learning according to the functionalities of the selected electronic platform.

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