

Vol. 12, No. 2, 2017.

ISSN 1840-1503

TECHNICS TECHNOLOGIES EDUCATION MANAGEMENT

ttetm

JOURNAL OF SOCIETY FOR DEVELOPMENT OF TEACHING AND BUSINESS PROCESSES IN NEW NET ENVIRONMENT IN B&H



ISSN 1840-1503



9 771840 150002



TECHNICS TECHNOLOGIES EDUCATION MANAGEMENT

EDITORIAL BOARD

Editor	<i>Dzafer Kudumovic</i>
Secretary	<i>Nadja Sabanovic</i>
Technical editor	<i>Eldin Huremovic</i>
Cover design	<i>Almir Rizvanovic</i>
Lector	<i>Mirnes Avdic</i>
Lector	<i>Adisa Spahic</i>
Members	<i>Klaudio Pap (Croatia)</i>
	<i>Nikola Mrvac (Croatia)</i>
	<i>Damir Modric (Croatia)</i>
	<i>Davor Zvizdic (Croatia)</i>
	<i>Janez Dijaci (Slovenia)</i>
	<i>Tadeja Zupancic (Slovenia)</i>
	<i>Rajendrakumar Anayath</i> <i>(India)</i>
	<i>Anastasios Politis (Greece)</i>
	<i>Jelena Ivanovic Sekularac</i> <i>(Serbia)</i>
	<i>Hasan Hanic (Serbia)</i>
	<i>Dragan Peric (Serbia)</i>
	<i>Samir Causevic</i> <i>(Bosnia and Herzegovina)</i>
	<i>Amir Pasic</i> <i>(Bosnia and Herzegovina)</i>
	<i>Vesna Maric-Aleksic</i> <i>(Bosnia and Herzegovina)</i>
	<i>Avdo Voloder</i> <i>(Bosnia and Herzegovina)</i>

Address of the Editorial Board *Sarajevo,*
Hamdije Kresevljakovica 7A
phone/fax 00387 33 640 407
ttem_bih@yahoo.com,
http://www.ttem.ba

Published by *DRUNPP, Sarajevo*
Volume 12 *Number 2, 2017*
ISSN *1840-1503*
e-ISSN *1986-809X*

Table of Contents

Cognitive-behavioral treatment of depressive disorder: review of the case.....	87
<i>Amela Abidovic-Mackovic</i>	
Analyzing the digital practices of university students to improve learning	93
<i>Marta Lopez-Costa</i>	
CFD analysis of fluid streaming in rotary dryer with innovative design.....	101
<i>Izudin Delic, Amel Mesic</i>	
A Review on Challenges and Trends in Page Replacement Algorithms	109
<i>Hitha Paulson, Rajesh R</i>	
Role of Management in a Learning Organization.....	114
<i>Jasmina Starc, Sabina Blatnik</i>	
Inspection of the relationship between mosques and wellbeing: a case study of patients with diabetes in the Kingdom of Saudi Arabia.....	124
<i>Bhzad Sidawi</i>	
Techno - economic analysis of reverse engineering usage in design applications.....	139
<i>Stadjan Lovric, Alan Topcic, Edin Cerjakovic, Muhamed Heric</i>	
Instructions for the authors.....	148

Cognitive-behavioral treatment of depressive disorder: review of the case

Amela Abidovic-Mackovic

Centre of mental Health, Zavidovici, Bosnia and Herzegovina.

Abstract

The article shows cognitive-behavioral therapy of depressive disorder. Cognitive-behavioral treatment of depression is highly structural, practical and successful intervention which treats depression through finding out of behaviour and patterns of thoughts which cause depression. Interventions which are generally used in the treatment of depression involve planning of the chart of activities, prediction of joy and gradual tasks, training of social skills and assertiveness, consolidation, asking about and changing of negative automatic thoughts, assumptions and schemata, deduction and changing of plans, examination of dysfunctional thoughts connected with despair. Some of techniques used in this case are: abdominal breathing, keeping a diary of activities with notes of programme of activity and mood in a week, planning of programme in a week: prediction of pleasure and achievements, self-observation of food taking in and making of plan for meals, psychoeducation, cognitive restructuring, reduction of self-critic and increase of self-respect, then construction of affirmation and writing them down.

Key words: depression, behavioral theory, cognitive theory, cognitive-behavioral therapy

1. Introduction

The author Harrington [1] distincts depression as isolated symptom which can be a part of normal scope of human emotional reactions, which many people experience at some time of their life; then depression as syndrome which is usually defined as combination of depressive mood with certain joined symptoms. Depression as disorder of mood (lat. depressio – push, press, bulge inward or oppress) is the most common psychological disorder today, and its main characteristics are depressive mood, loss of interest and joy in almost all activities, strenghten tiredness, psychomotorical agitation, feeling of guilt

and decreased self-respect, disorder of sleep and appetite, and loss of concetration. The symptoms may become chronic and lead to significant loss of person's ability to take care of himself/herself. In the worst case depression can lead to suicidal ideas and attempt to commite suicide [2].

1.1. Clinical picture of depression

There are two main symptoms of depressive episode: depressive mood or sadness and/or significant decrease of joy or interest for mostof other activities, and this include the fact that the symptoms have to be present in the period of at least two weeks. Depression causes deep suffering of ill people, and most of the experts agree that it belongs to the most painful life experiences for man today [3].

Other key symptom of depressive episode is significant decrease of joy or interest in almost all activities (apathy). This symptom is almost always present, at least to some extent.

Persons usually describe it as feeling of loss of interest for their hobbies or that they don't feel pleasure anymore in activities which created pleasure for them earlier.

Beside two key symptoms, Diagnostic and statistical manual for mental illness quote seven more symptoms, beside two mentioned, which belong in Criterion A for establishment of diagnosis of depressive episode [4].

Although we have clearly selected clinical characteristics of depression, large number of persons who have depression never get help. Researches of the authors Pratt and Brody (2008) show that 76% of persons with moderate depression and 61% of persons with hard depression never get help [5].

1.2. Theory of depression

Theoretical models which show the origin of depression can be sort out in two main categories psy-

chosocial and biological models. Biological models are based on biochemical and genetic researches, and psychosocial models include psychoanalytic, behavioral and cognitive explanation, and understanding of influence of social environment (interpersonal models and theories of life stress).

Behavioral theory of depression

Behavioral theories are based on cognitions that depressive behaviour appears at the places where existed inadequate and insufficient stimuli which lead to the feeling of life without love and rejection, and as result of this we have creation of bad picture about ourselves, and that represents the essence of depressive behaviour [6]. In the frame of behavioral theory of depression two theories are going to be mentioned:

- Theory of social skills by Peter Lewinsohn and
- Theory of self-control by Lynn Rehm

Theory of social skills by Peter Lewinsohn

The author Lewinsohn [7] connected insufficient source of reinforcement and phenomenon of depression. They think that the low level of positive reinforcement from the environment is critical accident for appearance of depression. Positive reinforcement has to follow behaviour or it will be lost and the person becomes passive. Low level of reinforcement is also connected with the feeling of dysphoria which is actually essential in the appearance of depression. The second reason of depression can be in the presence of great number of punishing experiences. The punishing experiences can be directly or indirectly connected with the lack of personal investments, activities and the feeling of pleasure in the future, and this at the end leads to appearance of depression. Lack of positive reinforcement affects at appearance of few symptoms of depression; loss of positive sexual experience, reduced social interaction, pleasure activities, and competent abilities. Punishing experiences are connected with next groups of depressive symptoms: instability of marriage, problems at work and larger number of negative reactions from other people [8].

Theory of self-control by Lynn Rehm

The theory of self-control by Rehm [8] directed to unsuitable ways of confrontation with

stress, especially on the field of self-observation, self-evaluation and self-confirmation. The wrong evaluation of depressive person directs attention to negative events and wrong evaluation of own achievements which result with self-infliction, stating of unreal aims and by realization of short-term consequences of man's behaviour. The treatment of depression by theory of self-control is realised with stress about generated deficits in self-regulation: self-observation/selective directions on negative events, self-evaluation/strict standard and self-confirmation/excessive self-infliction – hypercriticality and feeling of guilt.

Cognitive theories of depression

Cognitive theories of depression are directed to self-disastrous thought processes of depressive person. Cognitive processes have key role in emotional behaviour. According to some theories of depression, thoughts and beliefs are considered as important factors which cause emotional conditions or affect them. In the frame of cognitive theories of depression we're going to mention theory by the author [9].

Cognitive theory of Aaron Beck

An important contemporary theory, in which thought processes have casual role in depression, is theory by Aaron Beck [9]. Depressive persons have thinking which is biased aimed at negative interpretations.

According to Beck in the childhood and adolescence period depressive persons get negative schema because of loss of parents, constant series of tragical happenings, social rejection from peers, teacher's reproofs or depressive attitude of parents [10]. These negative schemata later become their beliefs about themselves and the world around them. Negative schemata or beliefs, which exist at depressive person are activated every time when they are in some new situations which remind him/her on circumstances under which the schema was learned. Negative schemata, together with cognitive distortions, reflect negative triad: negative thoughts about yourself, about the world and the future. Main cognitive distortions of depressive person are: personalization-interpretation of events by egocentric/subjective way; need for comparison with others; polarized opinion/ dichotomic-opinion in terms

„everything or nothing“; selective extract/ mental filters – it is taken only individual details in each situation and after that it is formed generalization and taken negative conclusions based on that detail, these generalization and conclusions are relevant for man's own value; outrageous generalization – one or smaller number of events are taken as proof which is used for creation of general conclusion about man's own behaviour/value/happiness; arbitrary extract – creation of conclusion about events/experience, although there are no evidence which can affirm that conclusions or they are completely opposite to the proof [5]. Some other cognitive distortions like: cataclysm, emotional conclusion, outrageous exaggerating/remission; reading of thoughts, statements should and have to and tunnel viewing are also known. Beck and sur. showed that depression and certain forms of thinking are in corelation, but nothing is known about specific casual connection. It is possible that depression causes negative thoughts, but it is also possible that negative thoughts cause depression [9].

2. Study of the case according to KB model

2.1. Introduction

Treatment of the person who has depression is implemented by guidelines from the book *Plans of treatment and interventions for depression and anxious disorder* [5]

Client: The client is 45 years old, he finished secondary school, profession forestry technician, unemployed today, he has never had a job. He lives with his parents.

Main complaint: The client came because psychiatrist suggested that because of depressive symptoms. His main complaints are: apathy, loss of interest, hopelessness, lethargy, disinterest, problems with sleep, loss of appetite. He often thinks about illnesses, and he is afraid that he can get some hard disease, until now he had several physician's examinations because he was afraid (test results are mostly proper).

Time frame: the problems he has the client explained as „extension“ to anxious problems which he had before. He said that in 2004 he had had his first panic attack, which wake him up and he was very terrified and scared for his life. Next panic attac

happened while he was travelling to Sarajevo. Last panic attac he connects with the situation when his mother went to have a surgery in the hospital. Beside this, the client says that in 2011 and in 2012 he had as he said obsessive thoughts, which disturbed his car driving, standing by the road etc., while he denies presence of obsessive thoughts today. Thoughts which he has now are: „I am weak, alone and miserable“, „I feel bad and can't do anything“, „I'm apathetic“, „I'm weak and powerless“, „I'm incompetent and worthless“, „I'm ill and depressive“, „I have strong symptoms of depression“, „I can't work because I'm ill and weak“, „other people bother me and they waste my energy“. Because of all these things the client spends great part of the day in his bed, he gets up from his bed at noon because he believes it can help him to have a rest, he doesn't go to noon's socializing with his friend as he did before, and he especially avoids going out at night, he doesn't look for job and he doesn't show any interest to work, he doesn't read books because he doesn't have concetration, he avoids to ride a bike. His only activities lately are connected with late getting up from his bed, breakfast, making the bed, going to physician's examination, lying, the Internet, relaxation and communication with his parents. Further about physiological problems he emphasizes heaviness in his body, fatigue, quick tiredness, loss of strenght, loss of weight, choking in his chest.

Disponating factor: After his brother's death, the client was mostly too protected, when he was under stress he often relied on his parents, primarily his mother. When he returned home from abroad he didn't manage to fit into new environment, to find a job, he became occupied with illnesses and that caused concern of his parents in addition. A few friends with who he was in contact found a job and got married, and he stayed alone, that was the moment when he started to develop negative opinion about himself, based on the fact that he is weak and incompetent.

Moderator influences: The client stays in bed till late hours with hope to have a good rest and more strenght for the following day with that kind of behaviour. He trys to reduce his activities to minimum to save his energy. It helps when his friend calles him to have a coffee because then he doesn't think about problem, it also helps when he drives his frient to another town, when he talks

with his parents who understand him and try to resolve the problem together with him. However, all these activities he can do only for a short time, because when he does them longer he becomes tired.

Maintenance factors

Behavioral: when he is tired he also has the feeling of sadness and hopelessness, whenever he can he goes to his room, lies on the bed, tries to sleep and to find answers for next questions „ why is this happening to me, when I’m going to be better, for how long this is going to last, when will the pills have an effect, is this therapy good for me at all, maybe I need another therapy etc.“.

Cognitive: Thoughts which predict that maybe it will never be better, that only treatment in the hospital can help him, that he will become so unwilling and tough that one day he won’t be able to get up from his bed, and that the therapy will never start to have an effect.

Affective: Expressed sadness, grief and anxiousness because of the mood collapse.

Avodiance: he avoids to do everything concerned with physical activity, because he believes that in that case he will lose strength, he avoids

more often and longer meetings, going out to have a coffee, visiting of his friends and relatives, and doing some household jobs.

Confrontations: He seeks to visit psychiatrist regularly, to take therapy and to be informed about antidepressants.

Mental condition: depressive, anxious

2.2. Plan of the treatment

Applied therapy interventions are behavioral (abdominal breathing, and progressive muscular relaxation, keeping a diary of activities with notes of programme of activities and moods in a week, planning of programme in a week: prediction of pleasure and achievements, planning of pleasant activities, behavioral experiment, enforcement of survey, technique of the most terrible event, exposure, development of statements for overcoming, „ cards for facing“) and cognitive (psycho-education, cognitive restructuring – work with negative automatic thoughts, modification of mediate rules basic belief, training of social skills and treatment of insomnia). Table 1 shows the aims of treatment with applied interventions.

Table 1. Aims of treatment and interventions

Aims	Interventions
Reduce the symptoms of depression (decrease the feeling of hopelessness, dejected and disinterest, BDI-II is less than 10 during one month)	Psychoeducation, cognitive restructuring, examination of reasons for hopelessness, examination of evidence for and against that, development of adaptive answers, behavioral experiment, technique of survey, technique of the most terrible event, schedule of activities
Elimination of behaviour of avodiance (staying in bed, in the house, in the room, silence...)	Making a hierarchy of situations which are scary and situations of avoiding, exposing in vivo, refocusing/ distractions, coping cards
Changing of believes about dangerous from depressive symptoms	Psychoeducation, cognitive restructuring, behavioral experiments
Changing of rules/ assumptions / believes	Cognitive restructuring, exposition, training of assertiveness, examination of self-critical thoughts, self-rewarding, creation and use of positive affirmation
To visit family with his mother and to stay till the end	Exposition, refocusing, coping cards, techniques of relaxation
To improve the hygiene of sleeping (sleep 7-8 hours)	Relaxation, plan of treatment for insomnia
To increase number of pleasant activities (go out with friends more often, ride a bike, read books, contact with relatives)	Planning of endorsement, schedule of activities, gradual tasks
To increase number of social contacts (three in a week)	Training of social skills, exposition, planning of endorsement, schedule of activities

3. Results of treatment

The aims which are set, except the one to find a job, are accomplished in a period of three months, and a meeting every week. The patient went to sleep around 11 p.m. and woke up at 7 a.m. He woke up several times during the night but he went to sleep again. When he woke up himself he wouldn't stay in bed anymore but got up immediately and started with morning activities. He increased the number of pleasant activities: he spent time with his friends in the noon, and he started to go out in the evening usually on weekend, he visited other towns, he drove his mother to nearby town and visited family with her, and he didn't avoid family meetings, his appetite was better and he had three meals a day, he got some weight – two kilograms, he wrote his biography and applied to find a job and by himself asked to talk with one director about the job. He started to read novels, and he managed to watch the whole movie. Now you're going to see Table 2. which shows patterns of new believes.

4. Conclusion

The aims of the treatment which are accomplished by usage of the cognitive-behavioral therapy result in important and visible changes in behaviour, mood and cognitions of the client, which are seen in improvement of general levels of functionality and motivation for further expositions to situations of avoidances. During the treatment

it was necessary for the client to take prescribed pharmacotherapy, and that helped in the process of treatment. Application of behavioral methods affected on decrease of avoidance and facing with stressful and difficult situations, and cognitive methods provided restructuration of negative believes and forming of new more functional believes. In the case of new depressive disorder or similar comorbid conditions standard cognitive-behavioral treatment should be adjusted to the client and it should involve additional psychotherapy interventions.

References

1. Rudan V, Tomac A. *Adolescencija i njezine promjene: privid ili stvarnost? Socijalna psihijatrija, Journal of Abnormal Psychology, 2011; 140-146.*
2. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, American Psychiatric Association. 2013.*
3. Filipčić I. *Frequence of depression and influence of treatment to the quality of life of the patients who have chronic body illness, Medical Faculty, University in Zagreb, 2008.*
4. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), American Psychiatric Association. 1995.*
5. Leahy RL, Holland SJ, McGinn LK. *Plans of Treatment and Intervention for Depression and Anxious Disorders. Jastrebarsko: Naklada Slap, 2014.*

Table 2. Result of cognitive restructuration

Old beliefs	Before	Now	New believes	Now
I'm weak and powerless	100%	30%	Depression makes me powerless. As I work on myself I'll surely be stronger and more powerful	100%
I'm incompetent.	100%	50%	I am competent and I accept myself the way I am, sometimes I failed but that is normal.	70%
I'm ill man.	80%	50%	Sometimes we can feel pain but that doesn't mean that I'm very ill.	80%
Others are better than me.	90%	40%	Nobody is always strong and we all have something what we don't have, something what we can't accomplish. I have to work harder to succeed, and that doesn't mean I won't manage that.	

6. *Kocigan Hercigonja D, Hercigonja Novković V. Children's Depression, MEDICUS, 2004; 13(1): 89-93.*
7. *Lewinsohn P, Mischel W, Chaplin W, Barton R. Social competence and depression: The role of illusory self-perceptions, 2011, Journal of Abnormal Psychology, 203-213.*
8. *Paykel E S. Handbook of Affective Disorders, Second Edition Hardcover, 1992.*
9. *Aaron B. Depression: Clinical, Experimental, and Theoretical Aspects, First University of Pennsylvania press edition, 1967.*
10. *Davison GC, Neale JM, Kring A. Abnormal Psychology, Naklada slap, 2003.*

Corresponding Author

Amela Abidovic-Mackovic,

Centre of mental Health,

Zavidovici,

Bosnia and Herzegovina.,

E-mail: amela_abidovic@yahoo.com

Analyzing the digital practices of university students to improve learning

Marta Lopez-Costa

Department of Theory and History of Education, University of Barcelona, Barcelona, Spain.

Abstract

Not all young people have high digital technology competences, and they do not use them to do the same activities and practices on the Internet. Students recognize that its use in classrooms in higher education is much more restrictive and traditional [1][2][3]. New student profiles and the features of a digital society have prompted a need to change educational approaches so that they are more focused and adapted to students and their learning. For this reason, it is necessary to listen to what students say about their Internet practices in both a personal and academic context.

The main goal of this paper is to analyze student practices and digital spaces requiring participation on the Internet, where technology acts as an intermediary for the university student's learning, and how it impacts higher education. The "Day Experience Method" [4], has been applied in order to obtain data from students that are related to their online activities in different contexts (academic, personal and professional). The analysis of the results provides us with a good foundation on which to build proposals that will improve teaching and learning practices at university.

Key words: Digital practices, higher education, Day Experience Method, Internet participation, digital education

1. Introduction

The high levels of online participation of young people and their regular use of smartphones, has led us to assume that they have high digital capabilities. However, the literature [1][2][3] shows us that this assumption should not be generalized. Not all young people have high ICT (Information and Communication Technology) competences. Besides, outside of the classroom, students are recognized as being average and expert users of the Internet with objectives of communication, so-

cial interaction and finding information [5][6]. At the same time, they recognize that there is a much more restrictive and traditional use within tertiary classroom environments. There is a big gap between students' informal use of technologies and their use within the university [7].

The new student profiles and the characteristics of a digital society have prompted a need to change educational approaches for others that are more focused and adapted on student learning. Moreover, educational institutions haven't integrated the digital technologies alongside emergent educational approaches, and elements like ubiquity, open access and participation in the communities [8]. Some studies have suggested different educational strategies to promote deep learning such as engaging students in research activities. Many of the conclusions concerning this research show us that when teachers focus on students and their learning, students then tend to approach their studies in a more in-depth way.

The main goal of this article is to analyze student practices and participatory digital forums on the Internet, where technology acts as an intermediary for university student learning, and how it impacts higher education.

The first analysis of the use of ICT among youths [9][10][11][12] defined the high frequency of ICT use by young people and assigned a number of features and digital skills throughout this generation. This research attempts to analyze how young people use ICT and their digital skills, taking into account only the variable generation.

Recently researchers [1][2][3] have shown that just because they are frequently online and using specific digital tools, like Facebook, not all young people have acquired the same level of digital skills. Having access to an Internet connection does not translate to all young people having the same digital skills. In short, being born in the digital age does not guarantee a high level, and appropriate use, of ICT in all contexts (both social and professional).

Young people use social networks with great frequency, specifically, 85% of young people communicate with friends through social networks [7][8]. However, there are only a few other activities that are carried out just as often. They do not use a variety of activities or digital tools on the Internet. It is dangerous to assume that young people have automatically integrated digital competence. It is also naive to assume that non-digital natives have nothing to offer. Even those who fear technology can provide a valuable critical perspective [3] neither the young nor adults have a homogeneous profile and there is no direct relationship between skill sets and generations. Whether in school or in an informal context, young people need opportunities to develop the skills and knowledge related to the effective use of digital technology.

Technological developments and digital societies point to a number of trends that are constantly evolving. From a cross-sectional view, these trends are present in the online activities of young people. These trends are related to 1) ubiquity 2) new forms of participation in communities 3) the creation of new content, and 4) management and content searches and information.

Ubiquity. Mobile and ubiquitous technologies are starting to play a very significant role among young people. The coexistence of non-mobile devices and phones does not imply an equitable use of the devices by users. Teenagers are more likely to have a mobile phone than a desktop computer. Increasingly, smartphones are providing a variety of Internet activities and a higher frequency of uninterrupted connection. Different digital tools are chosen for their functionality and service. Young people use ICT when they find it useful and they can use it in different places. For this reason, ubiquitous technologies are one of the most desirable technologies to the young [13].

New ways of participation in communities. The Internet and its tools and virtual spaces are an important issue in developing personal networks. People often have to actively look for a variety of appropriate people and resources for different situations, rather than search for it within a single community. The Internet is a tool that benefits the people's social life in a world that is moving towards "networked individualism".

Creation of new content. ICT makes various tools and virtual spaces available that allow for the creation and dissemination of information and content globally. However, creating content is not an activity that is completely widespread among youths. Moreover, it is an activity that young people have been increasingly undertaking more year after year. There were very few young people that created a blog (19%) or maintained their personal pages (22%). Currently, there are more young people who have either personal pages or a profile on social networks (71.6%) [14]. The dissemination of such content is generally made on websites, blogs and through social networks.

Management and information and content searches. ICT has influenced the way young people manage information held in their memory. Some of the young resort to accessing information online when they encounter difficult problems or questions [15].

These characteristics that define the new digital practices of young people, which often have to do with multi connectivity and multitasking, are making more complex their cognitive activity and their capacity to maintain high levels of intellectual productivity. Therefore, it is increasingly important for students to develop skills to reflect on their online and offline activity in relation to their learning, in order to regulate it and direct it according to their own interests and objectives [16].

Research has shown that giving their students opportunities for choice, control, and collaboration increases their motivation and engagement. Research on student engagement is devoted to the analysis of proposals based on encouraging active involvement and commitment on the part of students. It is assumed that offering opportunities for students to take control of their learning activities, reflect and become aware of what they do to learn, may favor the adoption of deeper learning approaches. The study of "student voice" places students as active agents in the analysis and review of teaching and learning proposals [17]. From this perspective, students' perception and experience about their learning is recognized as unique and essential to the improvement of education [18]. Applying student voice principles involves therefore taking also into account students' digital practices on a daily basis, meaning also the tools they

use, the spaces they participate in, the type of connections to others they establish, etc.

This research aims to collect the perspective of university students regarding sociocultural practices that shape their digital identity. The intention is, based on the understanding of these practices, to develop proposals for teaching and learning at the university, that are more coherent and tailored to the learning ecologies where university students participate.

2. Material and methods

This paper aims to analyze students' practices and participatory online scenarios where technology acts as an intermediary for university student learning. Specifically, the goals of the paper are to:

- Define which components of the students' digital practices have an impact on learning activities by analyzing the tools and digital platforms that students use in different contexts (academic, personal, professional).
- Create proposals based on the digital practices of students to improve teaching and learning practices.

To achieve the first purpose, the research is based on the Day Experience Method (DEM). The aim of this method is to reduce the spread and ideological prejudices that other instruments, such as interviews, surveys and focus groups, pose. The method is particularly suitable for qualitative examination of activities performed on a daily basis. The DEM has been used for other investigations, such as the case of *You are here: Students map their own ICT landscapes* [19][20][4].

Previously, in the first phase of the research, before applying the DEM, we developed a questionnaire based on different Internet participation theories [21] in order to classify students into different participation profiles (low, medium and high). Thereby, we obtained an equitable diversity of student profiles for developing and implementing the DEM. Data collection was conducted using sequential sampling. For this reason, part of the sample that participated in the questionnaire also participated in the DEM. The sample of the questionnaire was 368 university students attending 2 Spanish public universities (Universitat de

Barcelona, an on campus university; and Universitat Oberta de Catalunya, an online university).

The sociodemographic characteristics of the questionnaire sample are that 33% of the university students are studying at the UOC (Universitat Oberta de Catalunya) and 66% at the UB (Universitat de Barcelona), representativeness calculated according to each university's student population. On the other hand, 63% of the students are female and 37% are male, and 50% of the participants are aged between 18 to 21 years old with the remaining 50% aged between 22 and 50 years old.

The results of the questionnaire show us students' data regarding their relationship with the Internet that enables us to categorize the sample into profiles of participation levels of the use of the Internet. However, we found common trends among students: Most students are online for between three and five hours daily (45.8%). The rest of the sample are distributed fairly equally among more than 12 hours, between 9 and 12 hours, between 6 and 8 hours, and from 0 to 2 hours. Besides, students most often connect at home, where 85.5% of the sample frequently or always connected. In contrast, students were least connected while at a bar or restaurant, with 67.8% of the sample having rarely or never connected there. On the other hand, university is the place where students occasionally connect, either in the classroom or in an informal context. However, we should take into account that 60.1% of students do not or rarely connect in the classroom. Furthermore, the most frequent daily use of digital tools are to send emails (84.7%); search for information (73.3%), instant message (81.7%), connect to a social network (55.9%) and view videos (33.3%).

Questionnaire data allowed the categorization of the sample into 3 profiles of participation levels of the use of the Internet. Each dimension of the questionnaire (devices and connection, ubiquity, participation in communities, content creation tools, search content tools, management tools, academic context, personal context and professional context) has assigned different items in question form. Each item has the following score: 1 point to 5 points. Finally, if a student scores from 63 to 101 points he will be categorized as a low profile, if he scores from 102 to 128 as a medium profile, and from 129 to 182 as a high profile.

In the following table we can see that profile the student is placed according to the score obtained in the questionnaire. The following table details how those students that participated in the questionnaire were distributed across the different participation profiles. Each profile has different features and uses of ICT. Low profiles tend to not make any creation content activity, they just read information, forums or blogs, or sometimes visit their profile on social networking sites, but they do not comment or contribute. In contrast, high profile students usually publish their blog or webpage, upload videos and also write information such as comments in forums or on social networks. Finally, medium profiles are those that have a few common characteristics, they are a very heterogeneity profile. However, a great majority of these students have a social network profile and they usually look for information online, reading websites or blogs.

Table 1. Participation Profiles

Low profile	25.9%
Medium profile	48.2%
High profile	25.9%

In order to delve deeper into the students' online activities, we undertook out the main area of the research, the DEM. After analyzing the results of the questionnaire, we randomly picked 4 students of each profile, using RandomPicker software, to obtain representation of all participation profiles. Therefore, a total of 12 students participated in the DEM. The results obtained are detailed in the following section.

The DEM consists of the application of two instruments, the first is based on a series of questions that researchers send participants via WhatsApp. Expressly, five questions every 90 minutes over an 8-hour period (what time is it? where are you? who are you with? what are you doing; what is the purpose for doing this activity?). The answers can be sent using text, audio, images or video. Then, after applying the first instrument, all participants take part in a focus group where the second instrument is applied. The focus group aims to delve deeper into the activities that were carried out during the DEM. The data collection takes place over three weeks, as proposed by the instrument's authors. The following table shows the overall timeline:

Table 2. DEM Timeline

Week 1	- Experience Day 1: Monday - Analysis: Wednesday - Focus group: Thursday
Week 2	- Experience Day 2: Monday - Analysis: Wednesday - Focus group: Thursday
Week 3	- Experience Day 3: Monday - Analysis: Wednesday - Focus group: Thursday

The data obtained through the questionnaire have been analyzed using two softwares. One hand SPSS statistical analysis software that allows you to anticipate and generate reports descriptive statistics such as charts trends, and other statistical analyzes complex. For the analysis of data from the questionnaire with SPSS statistical tests were performed following descriptive: Frequencies and Contingency tables contrast with the Chi-square to analyze whether there is correlation between variables.

The analysis of data extracted through the DEM has been realized using the software NVIVO 10 that supports the qualitative and mixed methods research. For the exploitation of the results were used NVIVO the following tools: Analysis of nodes, search text, frequency of words, matrix codes.

3. Results

High participation profiles are who most frequently cited digital practices during DEM (a total of 126 activities in 3 days), while medium profiles cited 52 activities in 3 days, and low profiles cited 21 activities in 3 days. Activities related to communication are the most cited by the medium and high profiles, while low profiles mentioned activities relating to leisure. In addition, most of the communication activities for personal and academic purposes were carried out using mobile phone tools such as WhatsApp and Facebook.

Regardless of the student's profile, university students carry out more activities for personal purposes. Students then carry out academic activities, and lastly those for professional purposes.

Table 3 shows the results according to the purposes for which students undertake activities online.

Table 3. Profiles and context (DEM citations)

	Academic	Personal	Professional
High	46	83	14
Medium	21	34	2
Low	8	24	0
Total	75	141	16

In the focus groups, students explained these results by stating that all activities related to personal purposes imply more online participation during all everyday tasks.

“It takes a long time if, for example, you have a WhatsApp group. You have to connect all day to see what they are saying.” (Subject 2, UOC, Focus group).

Another argument given by students is that it is much easier to find digital tools for personal purposes rather than academic ones. In addition, friends or relatives recommend downloading applications or visiting specific websites, and only a few teachers make these kinds of recommendations.

“I think that there are so many applications to enhance your personal life rather than your academic life... In academia, if you’re interested in some topic, you are responsible for looking it up on the Internet. (Subject 11, UB, Focus group).

Students think that digital tools for academic purposes are not as attractive or functional as tools for personal purposes. They said that sometimes there is software that does not work well or is difficult to use.

“There are academic websites and apps that I don’t want to use, because of software that does not work well” (Subject 5, UB, Focus group).

However, a student with a high Internet participation profile said that if a digital tool is interesting, she has the same motivation and desire to use the app than as if it were for personal purposes. To exemplify, she said that her teacher showed the class an app to analyze molecules in 3D and that all students use, and find, this application very useful.

In relation to their online activities for academic purposes, the most cited and highlighted by students is the virtual campus. In the DEM and the focus group, students frequently referenced access to the virtual campus, albeit through limited devices such as a PC or laptop, and not when using smartphones or tablets. Moreover, many emphasized that the main physical space where they connect to the campus is at home, not at the university.

Virtual Campus (5,94 %) is one of the most cited words in DEM related to academic purposes. Dropbox (4,65 %), Whatsapp (3,53%), Facebook (2,6 %) and Google (1,74%) are other words that students cited when they were doing academic practices. However, Virtual Campus and Google were used to find information and content, Dropbox to share content with their classmates, and Whatsapp and Facebook to communicate with their classmates for academic issues.

Figures 1 and 2 show us how students navigate across the virtual campus. The UOC students must use virtual classrooms, because they are studying at a distance university, but the UB students, who attend classes on campus, also used the virtual campus with a very high frequency.

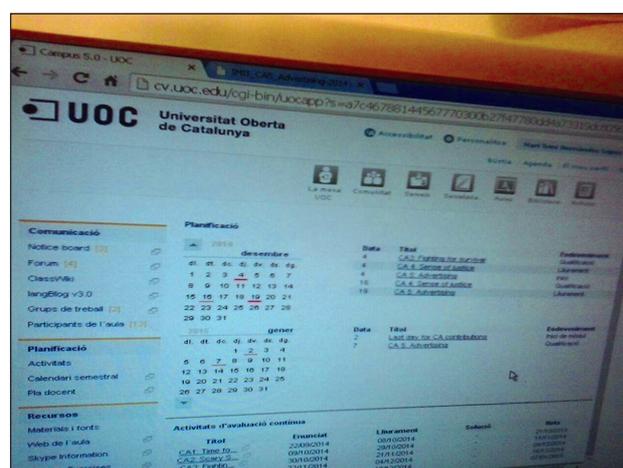


Figure 1. The UOC Campus, Subject 2

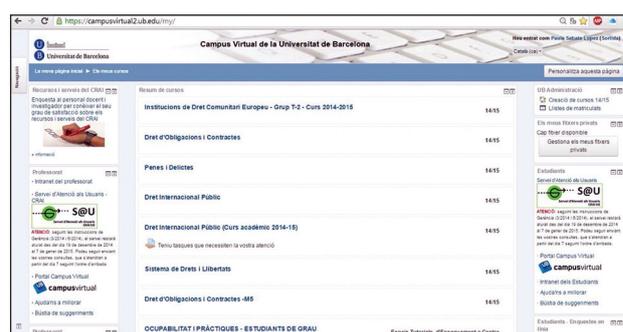


Figure 2. The UB campus, Subject 4

In the focus group, all students corroborate the DEM data related to the high frequency of using the virtual campus. They add that sending emails is the second most frequent activity for academic purposes.

Use of the virtual campus is quite similar for all students regardless of the profile they have. Basically, students reference PowerPoint present-

tations, links or documents that have been uploaded by the teacher. Therefore, its main feature is as a cloud storage service or for document sharing, similar to their use of Dropbox.

During the focus group, students generally said that digital tools help them to receive more feedback from the teacher. However, this also depends on the teacher's ICT profile. They also indicate that the majority of teachers only use the virtual campus to upload documents, whether these are presentations or articles. Most teachers do not plan activities on the virtual campus or use it to interact with students.

"There are many teachers who don't do anything on the virtual campus, but there are a few that send links or files, and they announce news on the campus" (Subject 4 UB Focus group).

During the discussion about the digital tools used by the teachers in the classroom, students point out that they would like to use some of the digital tools used by them for personal purposes, for instance, YouTube and Facebook.

"I have had teachers who have uploaded videos on YouTube. For example, a video with a PowerPoint and they recorded the voice. (Subject 7, UB, Focus group).

With regards to self directed work and group work among the students, they often commented that it is very useful to use a digital tool to upload and share documents, mostly Dropbox. On the other hand, they point out that in some cases they created a communication channel where they plan tasks via WhatsApp or Facebook.

"We always use Dropbox to share work documents that we had divided. We then use WhatsApp to talk about questions" (Subject 1, UB, Focus group).

Many students expressed that they are already using this method, and students that are not using it (two students: one middle profile and the other a low profile) think it would be very useful to start doing so regularly in their learning (two students, one for middle and low profile).

4. Discussion and conclusion

The results of this body of research are in line with other research [22][23][1][2], which show the heterogeneity of university students in relation to their use of ICT. This means students come to

university with different skills and uses of technology, both in the personal and academic spheres.

The results also show that students are not afraid of using new platforms and digital tools, but they must have a reason to do so. It is evident that digital practices are defined according to the needs of individual' developmental stage and not by the potential offered by the Internet [24][10]

Moreover, we can see that virtual campus is frequently used by students. In fact, we can say that it is one of the few tools they use for academic purposes, even though their activity on this platform depends on the digital profile of the teacher. The majority of students suggest that they find it useful when teachers upload audio-visual content, not to replace classes, but just to have multimedia resources. In addition, they say that they would like more digital activities available on the virtual campus.

On the other hand, when students have to work individually, they use tools that allow easier access to communicate ubiquitously such as Facebook or WhatsApp. They organize and distribute academic work on these platforms and then they start to work individually using a desktop computer.

These results allow us to suggest that high education should promote collaborative practices between students. Other recent similar research [25][26] points to the same pedagogical approach, where students have to be active in their learning sharing and doing activities and projects with other classmates. Students tell us that when it is necessary they do not find any problem with share documents or working in groups online to develop a project or participate in an activity. However, if they do not need to do so because the teacher uses a lecture methodology, students will not use it on their own. For this reason, the use of online collaborative tools (such as Google Drive, Dropbox, Teamwork, etc.) has to be related to an educational methodology that encourages collaborative work between students. After the application of this kind of methodology, students appreciate their learning experience, and recognize having a deeper learning. One example of this could be Inquiry Based Learning (IBL), where students lead the process of inquiry and search for solutions around an issue or problem. In this context, technology should provide opportunities for interaction with the teacher and peers, opportunities for reflection and a space for the collection of various learning resources.

Moreover, expanding the use of audio-visual resources has to be pushed by teachers. Most of the students point out that they would like to have access to audio-visual resources, not only papers or PowerPoint presentations. As we have seen in the results, students demand video resources because they want to take advantage of this kind of ubiquitous and useful resource. They can watch videos anywhere using smartphones (public transport, home, bars, etc.). Moreover, it is easy to navigate through the content, advancing or rewinding. Teachers have the possibility of sharing different ICT with students that are related to the subjects they teach. On the one hand, teachers could make videos using video screenshots of the computer and adding their voice. Another possibility may include recording themselves using a camera. These kinds of videos can be made public, uploaded onto a platform such as YouTube, or kept private, only shared on the virtual campus with their students. However, the easiest options for teachers who do not have high digital skills are to look for open audio-visual resources uploaded online. A lot of researchers, teachers and experts from different subjects around the world share the quality videos they have made [27]. These resources can include conferences, talks, interviews, online classes. There are some platforms specialized in this kind of resource (TED, YouTube Education, KhanAcademy, etc.). Students do not want to replace the teacher, only request resources that suit their needs.

Finally, it is necessary to share different ICT uses in education between teachers and students. The heterogeneity of university students in relation to the use of ICT is clear. For this reason, teachers can provide a variety of resources and students can choose which of these they prefer to work with in order to have digital tools that suit their needs. For example, teachers do not have to assume all of their students will know how to work with Google Drive, or search for academic information online. If students need to use some digital resource, teachers may provide a tutorial to aid learning how to use a specific digital tool. In addition, it is not necessary that teachers always force students to work with a particular tool.

References

1. Kennedy G, Krause K-L, Gray K, Judd T, Bennett S, Maton K, et al. *Questioning the Net Generation: A collaborative project in Australian higher education*. In L. Markauskaite, P. Goodyear y P. Reimann (Eds.), *Who's learning? Whose technology? Proceedings of the 23rd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education* Sydney: Sydney University Press. 2006; 413-417.
2. Gros B, Garcia I, Escofet A. *Beyond the net generation debate: A comparison between digital learners in face-to-face and virtual universities*, *The International Review of Research in Open and Distributed Learning*, 2012; 13(4): 190-210.
3. Boyd D, Heer J. *Profiles as conversation: Networked identity performance on Friendster*. In *System Sciences, HICSS'06. Proceedings of the 39th Annual Hawaii International Conference*; 2006; 59-60.
4. Riddle MMD, Arnold DMV. *The day experience method: A resource kit*, 2007.
5. Freire J. *Monográfico Cultura digital y prácticas creativas en educación*, 2009.
6. Buckingham D, Willett R. *Digital generations: Children, young people, and the new media*. Routledge, 2013.
7. Caruso JB, Salaway G. *The ECAR study of undergraduate students and information technology*, 2007; 8.
8. Lenhart A, Kahne J, Middaugh E, Macgill AR, Evans C, Vitak J. *Teens, video games, and civics: teens' gaming experiences are diverse and include significant social interaction and civic engagement*. *Pew internet & American life project*, 2008; 76.
9. Tapscott D. *Educating the net generation*. *Educational Leadership*, 1999; 56(5): 6-11.
10. Prensky M. *Digital natives, digital immigrants part 1*. *On the horizon*, 2001; 9(5): 1-6.
11. Oblinger D, Lippincott JK. *Learning spaces*. Boulder, Colo, EDUCAUS, 2006.
12. Mari V. *Jóvenes, tecnologías y el lenguaje de los vínculos [Youth, technologies and the language of links]*. *Comunicar*, 2006; 27:113-116.
13. Myers KK, Sadaghiani K. *Millennials in the Workplace: A Communication perspective on Millennials' Organizational Relationships and Performance*. *Journal of Business Psychology*, 2010; 25: 225-238.

14. Boase J, Wellman B. *Personal relationships: On and off the Internet. The Cambridge handbook of personal relationships*, 2006; 709-723.
15. Sparrow B, Liu J, Wegner D M. *Google effects on memory: Cognitive consequences of having information at our fingertips. Science*, 2011; 333(6043): 776-778.
16. Toshalis E, Nakkula M.J. *Motivation, engagement, and student voice. Education Digest*, 2012; 78(1): 29-35.
17. Bragg S, Manchester H. *Pedagogías de la voz del alumnado: Pedagogies of student voice. Ministerio de Educación*, 2012.
18. Cook-Sather A, Bovill C, Felten P. *Engaging students as partners in learning and teaching: a guide for faculty. San Francisco: Jossey-Bass. 2014.*
19. Kahneman D, Krueger A B, Schkade D A, Schwarz N, Stone AA. *A survey method for characterizing daily life experience: The day reconstruction method. Science*, 2004; 306(5702): 1776-1780.
20. Gaver W, Dunne A. *Projected realities: conceptual design for cultural effect. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems, ACM. 1999; 600-607.*
21. White DS, Le Cornu A. *Visitors and Residents: A new typology for online engagement. First Monday*, 2011; 16(9).
22. Li C, Bernoff J. *Groundswell: Winning in a world transformed by social technologies. Harvard: Business Press, 2011.*
23. Tan K, Chong S, Lin B, Eze U. *Internet-based ICT adoption: evidence from Malaysian SMEs. Industrial Management & Data Systems*, 2009; 109(2): 224-244.
24. Sánchez SMT. *Educación en la nube. Un nuevo reto para los docentes de Educación Media Superior. Revista Iberoamericana para la Investigación y el Desarrollo Educativo ISSN: 2007-2619*, 2015; 10.
25. Beetham H, Sharpe R. *Rethinking pedagogy for a digital age: Designing for 21st century learning. Routledge*, 2013.
26. O'Donnell AM, Hmelo-Silver CE, Erkens G. (Eds.). *Collaborative learning, reasoning, and technology. Routledge*, 2013.
27. Roach T. *Student perceptions toward flipped learning: New methods to increase interaction and active learning in economics. International Review of Economics Education*, 2014; 17: 74-84.

Corresponding Author
 Marta Lopez-Costa,
 Department of Theory and History of Education,
 University of Barcelona,
 Barcelona,
 Spain,
 E-mail: m.lopez@ub.edu

CFD analysis of fluid streaming in rotary dryer with innovative design

Izudin Delic, Amel Mesic

Faculty of Mechanical Engineering, University of Tuzla, Bosnia and Herzegovina

Abstract

Computational fluid dynamics (CFD) is a numerical tool that is highly accurate to simulate a very large number of applications and processes. The CFD analysis has emerged as a reliable technique to provide effective and efficient design solutions. The dryer, in which drying of material is performed with streaming of hot air around moving trays, represents innovative technical solution. Counter-streaming movement of the rotor with drying trays through the stream of hot air enables a higher drying intensity. In order to get a better picture of the hot air streaming among the drying trays and the effects of the individual components on the streaming of fluid through rotary dryer, it is necessary to perform a detailed CFD analysis.

Key words: Rotary dryer, streaming, drying, CFD, air flow

1. Introduction

Drying is the simplest and most natural way of all procedures for food conservation. In this case food freshness and quality is preserved by extraction of free water from it.

Drying may be carried out naturally, on the sun (direct drying on the sun), or air streaming can be added in order to accelerate drying process (electro, gas or diesel drying plants.) Dry, warm air is ideal for drying but only if air temperature is strictly controlled.

The tray dryer is widely used in a variety of applications because of its simple design and capability to dry products at high volume. However, the greatest drawback of the tray dryer is uneven drying because of poor airflow distribution in the drying chamber. Several designs and methods can be implemented to improve tray dryer performance, increases quality of dried product and produces uniform drying as reported by Misha *et al.* [1]. Nowadays, given the increase in computing power,

the application of Computational Fluid Dynamics (CFD) can be a valuable tool for engineering design and analysis of solving complex fluid flow aiding in the better design of tray dryers and produce high quality of dried product. CFD simulation is used extensively because of its capability to solve equations for the conservation of mass, momentum, and energy using numerical methods to predict the temperature, velocity, and pressure profiles.

Since the CFD analysis has been used for predicting the air velocity and temperature distribution in a large number of applications, many researchers have shown interest in this topic. Dionissios and Adrian-Gabriel Ghious [2] studied the numerical simulation inside a drying chamber. A set of measurements was obtained experimentally above one single tray to validate the model. The validation between the measured data and the simulation results by CFD shows that the standard $k-\epsilon$ model is the most adequate turbulence model. An industrial batch-type tray dryer for drying fruits has been designed and constructed by Mathioulakis *et al.* [3]. CFD is used to simulate the air pressure and the air velocity profiles in the drying chamber. Comparison of the simulation result by the CFD and experimental data shows a strong correlation between drying rate and air velocity.

Design optimization of a drying chamber is necessary to achieve higher heat/mass transfer rates and uniform drying by avoiding an unfavorable aerodynamic phenomenon in the chamber. The objective of this research is to predict the drying uniformity for the new tray dryer design for agricultural product. The CFD is used as a tool to predict the airflow distribution in the drying chamber. CFD has also been widely used in food industry to investigate the flow pattern of the air in the drying chamber [4], [5]. Uniform airflow distribution in drying chamber is very important because it gave significant effect on the efficiency and the homogeneity of the product that has being dried.

Prukwarun *et al.* [6] reported a CFD simulation of fixedbed dryer by using porous media concepts. Román *et al.* [7] studied the improvement of air distribution in a fixed-bed dryer using CFD. Mirade and Daudin [8] presented a study of the airflow patterns in a sausage dryer by comparing numerical results with experimental air speed data. Weigler *et al.* [9] proposed experimental studies on a mixed-flow dryer. Tzempelikos *et al.* [10] presented an analysis of air velocity distribution in a laboratory batch-type-tray dryer. Other similar types of dryers were proposed in [11-12]. In these studies, CFD has proven to be an important simulation tool for the analysis and improvement of such dryers.

1.1 Design of a new drying chamber

Convective dryer for fruits and vegetables is based on innovative solutions and complete control of all drying parameters (temperature, humidity and air circulation rate). During the first half of 2015, a prototype of innovative dryer for fruits and vegetables was successfully designed. In the dryer of “Eco – Rotary Dryer” type biomaterial is dried at low temperatures (max. T=55-70°C) and low humidity (RH= 20-25%).



Figure 1. Representation of the rotary dryer interior

The operation principle of the innovative solution “Eco-Rotary Dryer” is reflected in the radial movement of the trays with the material for dry-

ing. Pre-heated air is blown into the chamber to circulate around the material that is being dried in the opposite direction of the movement of the rotor with the drying trays. This counter-streaming movement enables the increase in the drying intensity as well as moving material for drying through various thermal zones in the drying chamber.

The first proposed design is shown in figure 1.

In order to determine the nature of the air streaming around the rotor and the drying trays with material for drying, a detailed CFD analysis was performed.

2. Methodology

Good approximation of the real process with numerical model is done, when we have set up good mathematical model and when we have done good spatial discretization. Such numerical model gives us reliable results that can be easily validated. The basic things about selected mathematical model, boundary conditions, and spatial discretization will be presented below.

2.1 Basic mathematical equations

Heat and mass transfer are accomplished by solving the continuity, momentum and energy equations with boundary conditions. It is important to emphasize that in this study, the fluid flow was considered to be incompressible, stationary, three-dimensional, chemically inert and turbulent.

These equations are expressed below:

Continuity equation

$$\nabla \cdot (\rho \vec{u}) = 0 \dots\dots\dots (1)$$

Momentum equation

$$\nabla \cdot (\rho \vec{u} \vec{u}) = -\nabla p + \nabla \cdot (\vec{\tau}) + \rho \vec{g} \dots\dots\dots (2)$$

Energy equation

$$\nabla \cdot (\rho \vec{u} H) = \nabla \cdot \left(\frac{k_t}{C_p} \nabla H \right) + S_h \dots\dots\dots (3)$$

$$H = \int_{T_0}^T C_p dT$$

Where \vec{u} is the velocity vector, ρ is the density, p is the pressure, \vec{g} is the gravity, μ is the viscosity, H is the enthalpy, kt is thermal conductivity, Cp is specific heat, Sh is a source term, T is the temperature, \vec{I} is the identity matrix and $\vec{\tau}$ is the stress tensor defined as:

$$\vec{\tau} = \mu \left[\left((\nabla \vec{u}) + (\nabla \vec{u})^T \right) - \frac{2}{3} \nabla \cdot \vec{u} \vec{I} \right] \dots\dots\dots (4)$$

As it is mentioned earlier it was assumed that air flow is turbulent. Of course, due to the fact that κ - ϵ model in literature [13-15] is the most widely validated turbulence model, this model is also used in this case. In the κ - ϵ model, κ is the turbulence kinetic energy and ϵ is the turbulent dissipation.

2.2 Spatial discretization

One of the main factors that has influence on quality of the obtained results is spatial discretization. In this case, spatial discretization has been done by using polyhedral mesh, while, for representation of results, several suitable plains have been chosen. In particular areas, the mesh optimatisation has been done with the aim to reduce the number of cells, depending on the needs and wanted accuracy of the simulation results, which can be seen in the figure 2.

2.3 Numerical methods and boundary conditions

To determine the air flow distribution inside the dryer, with a specific geometry, the governing equations were solved numerically using the commercial CFD code, Star CCM. This CFD code uses the finite volume method (FVM). FVM uses a volume integral formulation of the problem with a finite partitioning set of volumes to discretize the partial differential equations.

Of course, essential step in conducting the numerical simulation is proper defining of the initial and boundary conditions. Therefore, while defining boundary conditions, the specific features of the process were taken into account.

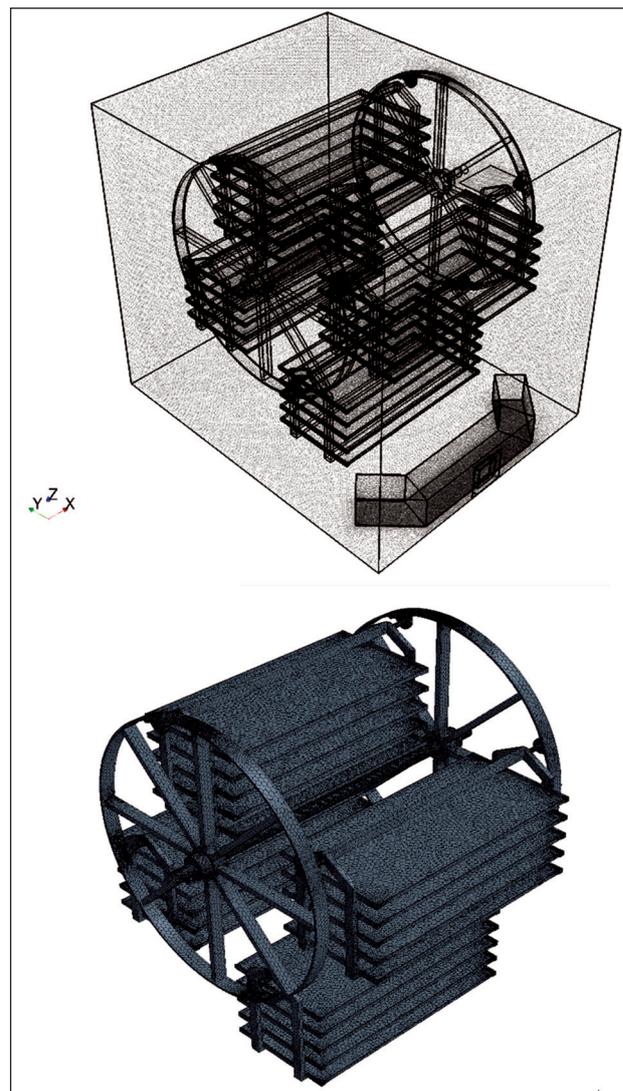


Figure 2. Numerical mesh of the model with defined boundaries [16]

For that purpose, four regional boundaries were defined:

- Fluid inlet (the boundary where inlet velocity and temperature are set up);
- Fluid outlet (the boundary where fluid leaves the domain);
- Wall (the boundary where the value of thermal flux is defined). The entire chamber was thermally insulated with a layer of glass wool (0.05m of thickness) with a thermal conductivity of 0.03 W/mK, and
- Internal construction (the boundary which is defined as adiabatic).

On the basis of the data obtained from the thermal calculation, the following starting conditions have been defined.

Table 1. Initial data for the calculation of the air streaming in the rotary dryer.

Size	Value	Dimension
Air velocity	5	m/s
Air temperature	70	°C
Environmental temperature	20	°C
Thermal flux (floor)	17.65	W/m ²
Thermal flux (ceiling)	9.39	W/m ²
Thermal flux (side walls)	17.07	W/m ²
Thermal flux (back wall)	17.21	W/m ²
Thermal flux (doors)	53.40	W/m ²

3. Results and discussion

The main parameters that determinate drying process are temperature, velocity and humidity of drying air, if air is used as drying fluid.

This preliminary numerical analysis will considered only two parameters (velocity and temperature of drying air), due to the fact that humidity and temperature are in very complex relation, and numerical modeling of that kind of processes requires additional submodels. Of course, humidity analysis will be considered in the future experimental work.

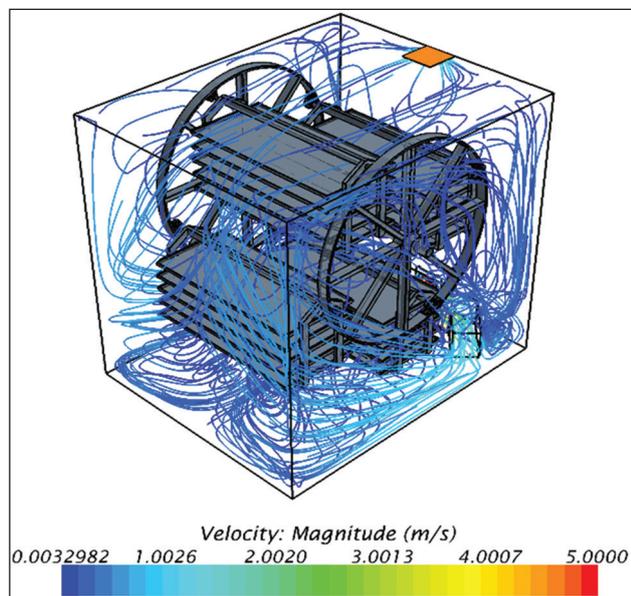


Figure 3. Representation of the fluid streaming in the drying chamber, front side

The Figure above shows the streaming of the fluid in the drying chamber, where the nature of the air streaming around the trays (for material) could be identified.

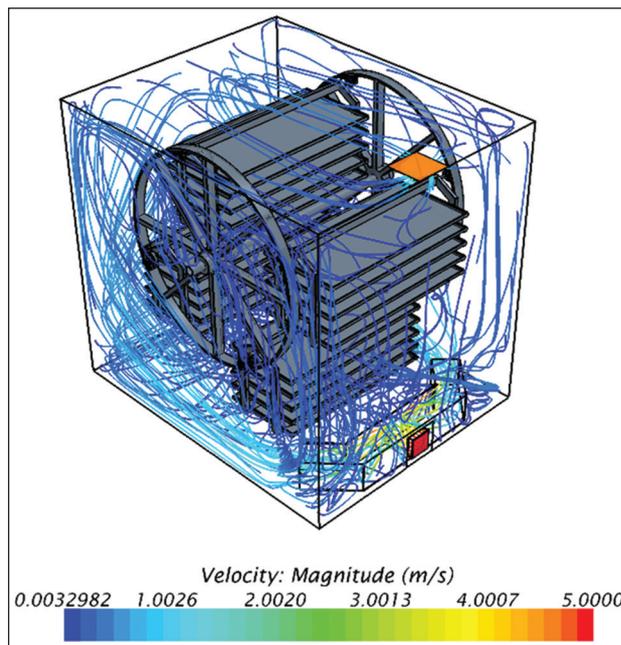


Figure 4. Representation of the fluid streaming in the drying chamber, back side

It could be noticed that there is an intensive turbulent and almost symmetric streaming in the lower part of the chamber with two large vortex, while the streaming in the upper part of the chamber is less differentiated regarding to the vortex structures.

On the figure below, it can be noticed which drying trays aren't streamed properly with hot fluid.

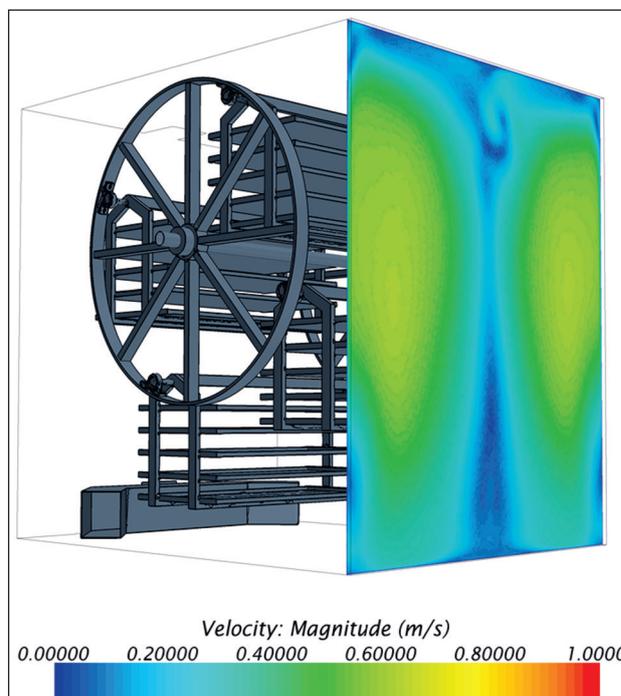


Figure 5. Representation of the scalar-velocity fields in cross-plane near doors

So, lower trays are the most streamed area, while, those trays located just above distribution air channel are the least streamed area.

Detail fluid streaming can be noticed in characteristics fields that have been chosen for analysis.

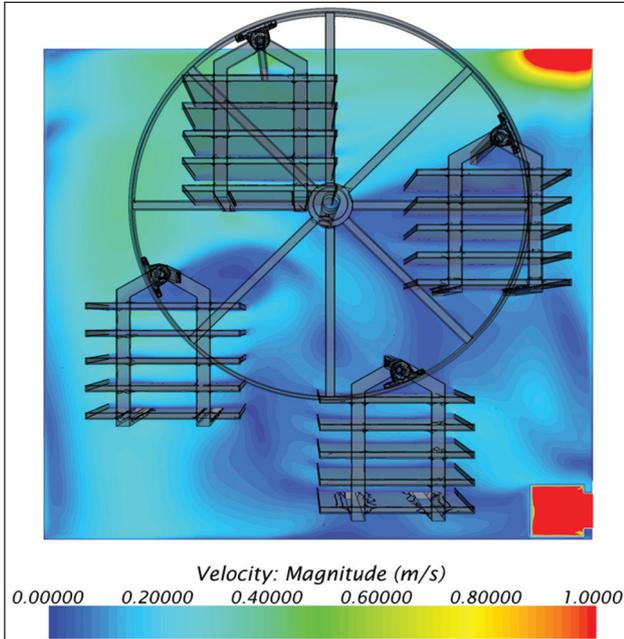


Figure 6. Representation of the scalar-velocity fields in main cross-plane

It is clearly visible that there is a significant decrease in velocity magnitude of the fluid through distribution channel used to supply the hot air. According to the previous research and from the aspect of energy dissipation it is completely clear that the distribution channel isn't well geometrically dimensioned.

If we consider the position of trays, it will be completely evident that trays will be supplied with hot air of different speed, therefore, in the same chamber, we will have zones with different drying intensity.

It can be also identified that there are some places where positioning of the suitable fluid routers is needed, in order to balance streaming around all drying trays and to improve the drying process.

Such orientation of the distribution channels in which the hot air, with maximal speed, hits the side walls and causes the loss of the streaming energy is completely undesirable. Therefore, below it will be considered fluid flow inside the drying chamber with new distribution channels.

The flow analysis through the distribution channel identifies errors in its design, Figure 6.

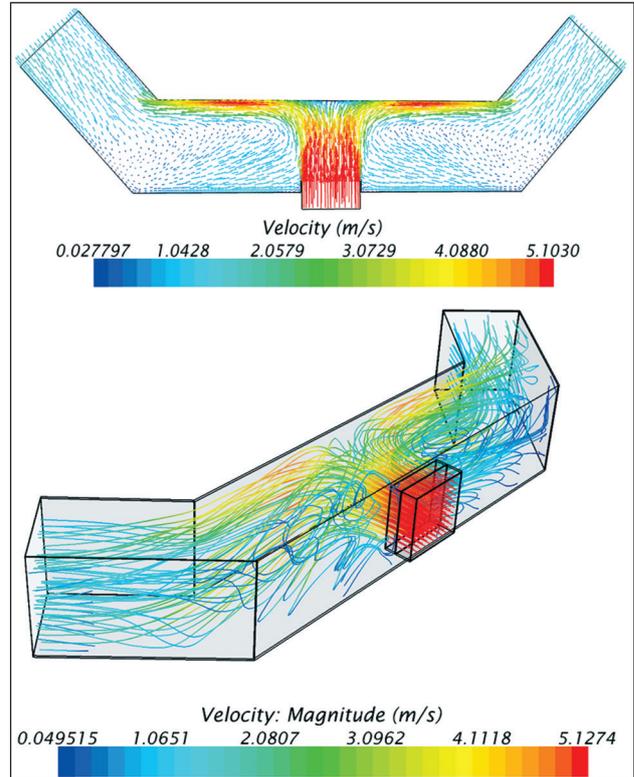


Figure 7. Analysis of the distribution channel design on the prototype

Redesigning the hot air distribution channel allows better flow through the channel itself (Figure 8), which is reflected in increased energy efficiency.

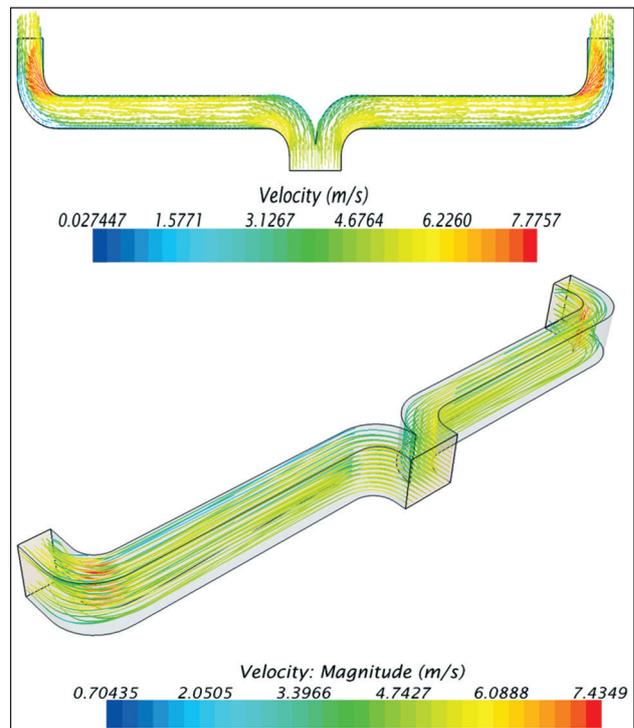


Figure 8. Analysis of redesigned distribution channel

For different input speed values, the design of the distribution channel has evident influence on the output air velocity in the chamber. The nature of design influence on output speed is illustrated by the diagram in the Figure 9.

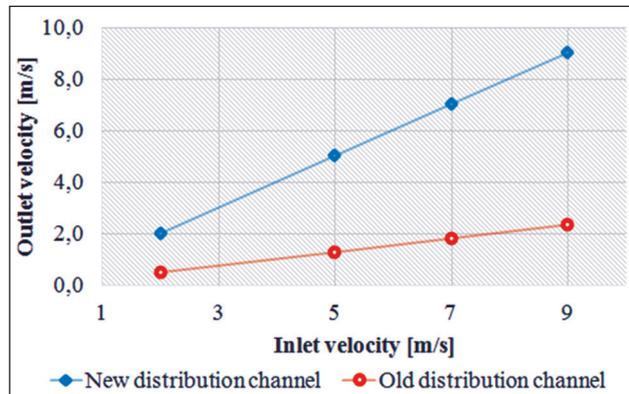


Figure 9. Design influence on output speed

Consequently, CFD analysis of air flow through the drying chamber was repeated. The simulation results are shown as streamlines in the chamber (Figure 10 and Figure 11) and in the characteristic planes (Figure 12 and Figure 13) that have already been used in the previous simulation.

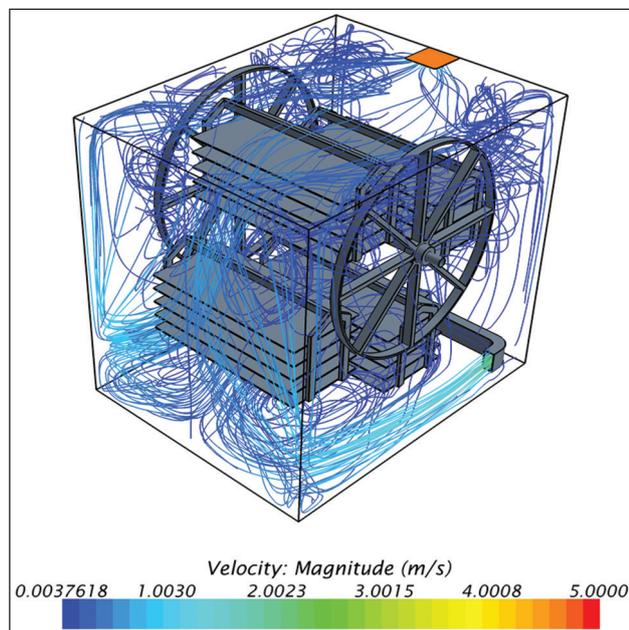


Figure 10. Representation of the fluid streaming in the drying chamber, front side

As it can be noticed, in the distribution of the streamlines over the drying trays, the redesigned drying chamber has a more favorable distribution of the current through the drying trays. This results

in the flow of larger amounts of air over the drying shelf, thus accelerating the process of extracting moisture from the material being dried.

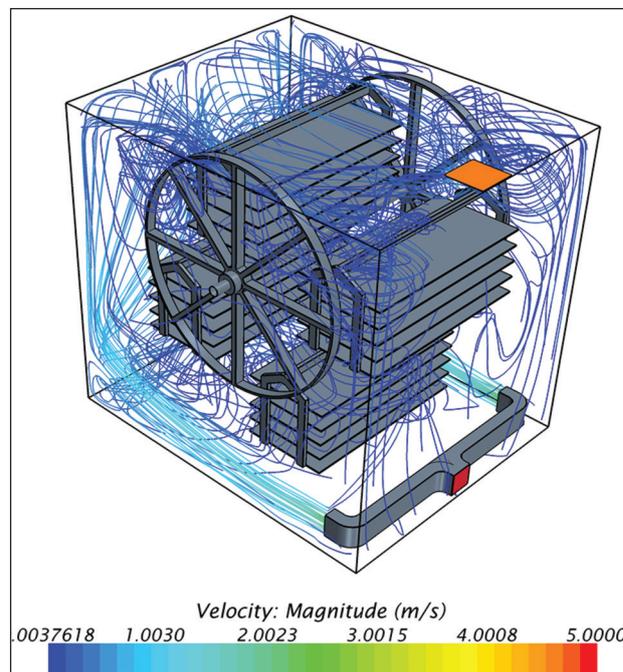


Figure 11. Representation of the fluid streaming in the drying chamber, back side

On the other hand, when comparing the velocity distribution for Figure 12 and Figure 5, one may notice that the fluid flow division was significantly reduced, which was significant in the first simulation.

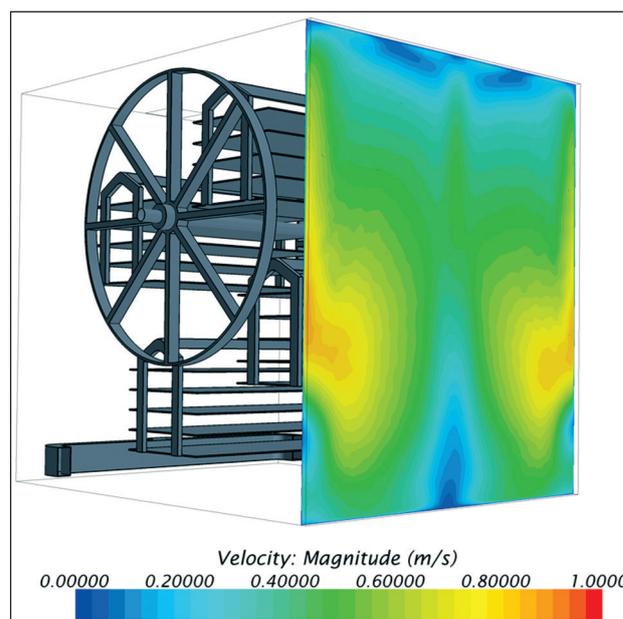


Figure 12. Representation of the scalar-velocity fields in cross-plane near doors

Also, the analysis of the velocity distribution in the main plane shows that all four trays have better opacity than it was in the previous case. This allows uniform moisture removal from all trays and improves the quality of the final product.

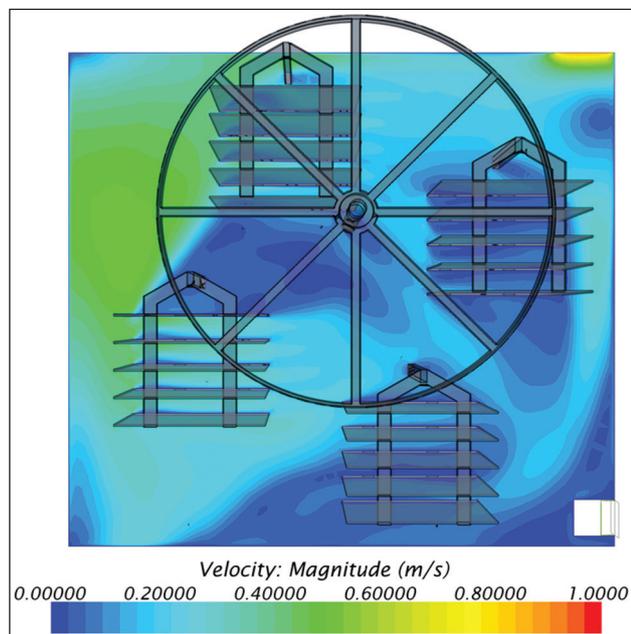


Figure 13. Representation of the scalar-velocity fields in main cross-plane

The redesign of the distribution channel definitely improves the fluid flow into the drying chamber. Of course, this is just one of the views on the possible reconstruction of the first design.

4. Conclusion

Good air flow distribution through the drying chamber can improve the drying uniformity. CFD is considered as an integral part of engineering design and analysis, because of its capability to solve equations for the conservation of mass, momentum, and energy, using numerical methods to predict the temperature, velocity, and pressure profiles in the drying chamber. Therefore, the performance of new dryer designs may be predicted by simulation of its work.

The first proposed design was modified to improve the air flow distribution. Additionally, the effects of different inlet air speeds were considered in order to improve the air flow uniformity inside the chamber.

Based on the results of the simulation, it can be concluded that the air streaming inside the chamber

of the rotary dryer doesn't have a suitable feature for a biggest interval of the process parameters. In addition, the analysis of the air streaming has shown that the trays for drying do not receive enough amount of the hot streaming fluid. There are visible places where directors of the air should be installed in order to decrease the streaming losses and to direct the flow of the fluid through the drying trays.

Also a regulation dampers should be mounted at the distribution channel in order to direct the hot air, depending on the required conditions of the drying process. These changes would increase the drying intensity, which will cause lower duration of the drying process.

Proper controlling of drying parameters (temperature, humidity and rate of air circulation) would provide a proper drying kinetics for many kinds of fruits, vegetables, forest fruits and medical herbs.

References

1. Misha S, Mat S, Ruslan MH, Sopian K, Salleh E. Review on the application of a tray dryer system for agricultural products, *World Applied Sciences Journal*, 2013; 22(3): 424–433.
2. Margaris PD, Ghiaus AG. Dried product quality improvement by air flow manipulation in tray dryers, *Journal of Food Engineering*, 2006; 75(4): 542–550.
3. Mathioulakis E, Karathanos VT, Belessiotis VG. Simulation of air movement in a dryer by computational fluid dynamics: Application for the drying of fruits, *Journal of Food Engineering*, 1998; 36(2):183–200.
4. Verboven P, Scheerlinck N, De Baerdemaeker J, Nicola BM. Computational fluid dynamics modelling and validation of the temperature distribution in a forced convection oven, *Journal of Food Engineering*, 2000; 43: 61–73.
5. Scott G, Richardson P. The application of computational fluid dynamics in the food industry, *Trends in Food Science & Technology*, 1997; 8(4): 119–124.
6. Prukwarun W, et al. CFD simulation of fixed bed dryer by using porous media concepts: Unpeeled longan case, *International Journal of Agricultural and Biological Engineering*, 2013; 6(1): 100–110.
7. Román F, et al. Improvement of air distribution in a fixed-bed dryer using computational fluid dynamics, *Biosystems engineering*, 2012; 122, 4: 359–369.

8. *Mirade P, Daudin J. A numerical study of the airflow patterns in a sausage dryer, Drying Technology, 2000;18(1): 81–97.*
9. *Weigler F, et al. Experimental studies on a newly developed mixed-flow dryer, Drying Technology, 2013; 31(15): 1736–1743.*
10. *Tzempelikos D, et al. Analysis of air velocity distribution in a laboratory batch-type tray air dryer by computational fluid dynamics, International Journal of Mathematics and Computer in Simulation, 2012; 5(6): 413–421.*
11. *Aissa W, et al. Performance of solar dryer chamber used for convective drying of spongecotton, Thermal Science, 2014; 18(2): 451–462.*
12. *Zdanski P, et al. Numerical Assessment of the Air Flow Behavior in a Conventional Compact Dry Kiln., Journal of Applied Fluid Mechanics, 2015; 8(3): 367–376.*
13. *Versteeg H, Malalasekera W. An Introduction to Computational Fluid Dynamics the finite volume method, Pearson Education Limited., London, United Kingdom, 2007.*
14. *Launder E, Spalding B. Lectures in Mathematical Models of Turbulence, Academic Press, London, England, 1972.*
15. *Cengel Y, Cimbala J. Fluid mechanics fundamental an applications, McGraw-Hill, New York, USA, 2015.*
16. *Delic I, Mesic A. CFD analysis of fluid streaming in rotary dryer, 13th International Conference on Accomplishments in Mechanical and Industrial Engineering, DEMI, Banja Luka, 2017.*

Corresponding Author

Izudin Delic,

University of Tuzla,

Faculty of Mechanical Engineering,

Tuzla,

Bosnia and Herzegovina,

E-mail: izudin.delic@untz.ba

A Review on Challenges and Trends in Page Replacement Algorithms

Hitha Paulson¹, Rajesh R²

¹ Bharathiar University, Coimbatore Dept of Computer Science, Little Flower College, Guruvayoor, Kerala, India,

² Dept. of Computer Applications, Sree Narayana Gurukulam College of Engineering, Kadayiruppu P.O, Kolenchery, Ernakulam dist., Kerala, India.

Abstract

In a virtual memory environment the basic principle of program execution is the adaptiveness of an Operating System environment to larger programs with in the limitation of the addressable small primary memory. Page Replacement algorithms play an important role in implementing this memory setting with an aim to accomplish less page fault, high hit ratio and minimum overhead. Over the years many page replacement algorithms were designed and proposed. As the memory types and program designing approaches improved, the need for betterment in algorithms existed as a need. This paper summarizes the techniques and challenges behind the major traditional page replacement algorithms and accounts on the various research outcomes in this area.

Key words: LRU, CLOCK, FLASH, CACHE, Page Replacement Algorithm

1. Introduction

The idea of virtual memory paved way to the execution of programs larger than main memory. Advancement in technology led to execution of more than a program at a time, and these multi-programming systems demanded more from the memory management techniques of virtual memory environment. The method of segmentation and paging supported these techniques. Through paging the real/physical address space of a process can be noncontiguous. Since pages are small in size compared to segments the problem of fitting in to memory blocks reduced considerably [1].

Rather than loading the pages before access request, they are brought into memory only when the executing process asks for them. This process is known as demand paging. A page fault occurs when a demanded page is not in the main memory

and has to bring them from secondary memory. If the memory is full in this situation an existing page needs to be abandoned. Page replacement algorithms helps in identifying the victim by overlooking at the future references expected [2]. The placement and replacement strategies of the algorithm take the page trace as input. Record of the trace of pages accessed by the process previously is known to be the page trace. The algorithms relay either on local replacement – replace a page of the faulting process or global replacement – replace the page of another process. The number of frames allocated to a program and the replacement algorithm used determines the speed of demand paging. Major research is going on in the area of page replacement techniques and this paper also accounts on the key research outcomes in the area.

2. Performance parameters

The efficiency of page replacement algorithms depends on the following parameters.

Page fault rate – p , indicates the rate by which page miss occurs for a set of page references. The value of p lies between 0 and 1. Less the page fault rate, high the efficiency of the algorithm.

Hit rate - ht , indicates the rate by which page hit occurs for a set of page references. The value of ht lies between 0 and 1. High the hit rate, high the efficiency of the algorithm.

Effective Access Time- EAT, indicates access time needed for a page reference considering the various factors of page acces.

$EAT = (1 - p) \times \text{memory access} + p (\text{page fault overhead} + \text{swap page out} + \text{swap page in} + \text{re-start overhead})$ [3]

3. Challenges

The ever existed challenge of page replacement algorithm is to find the right victim to swap out during a page miss with fully occupied frames. All major versions of Windows use the clock algorithm (LRU) for uni-processor systems and a random-page replacement algorithm on multi-processor systems. Linux uses LRU. Clock algorithm is the efficient LRU algorithm reported still.

The second major problem faced is to find the no of frames to be allocated in the main memory to a process. It is the number of frames relocated which influences the page fault rate to a certain extend. The least number of frames allocated to a process depends on system architecture and on the number of pages that could be referenced by a single instruction. Certain instructions refer multiple pages even for its fetch [4]. Certain allocation policies followed are *Equal Allocation – where all n processes get m/n frames when m is the total number of frames. The remaining frames are kept in free pool. *Proportional Allocation - Distribute the frames proportionally according to the size of the process. So if the size of process i is S_i , and S is the sum of all S_i , then the allocation for process P_i is

$$a_i = m * S_i / S \quad [5].$$

When the memory frames allotted filled up completely, in certain cases processes goes on much of its time for paging rather than utilising CPU. This problem is termed as Thrashing. Adding up of more processes (increasing multiprogramming level) is also another cause for thrashing. Figure 1 illustrates Thrashing.

To prevent thrashing grant processes with adequate frames as they really need presently and also should control the level of multiprogramming in a system. Working Set Algorithm proposed reduced thrashing to certain extend. To lessen thrashing, paging algorithms experimented with allocating more number of frames to a process. But in certain algorithms increasing the number of page frames results in an increase in the number of page faults for a given memory reference pattern and the phenomenon is known as Belady’s Anomaly [1]. The First in First Out (FIFO) page replacement algorithm often suffers from this.

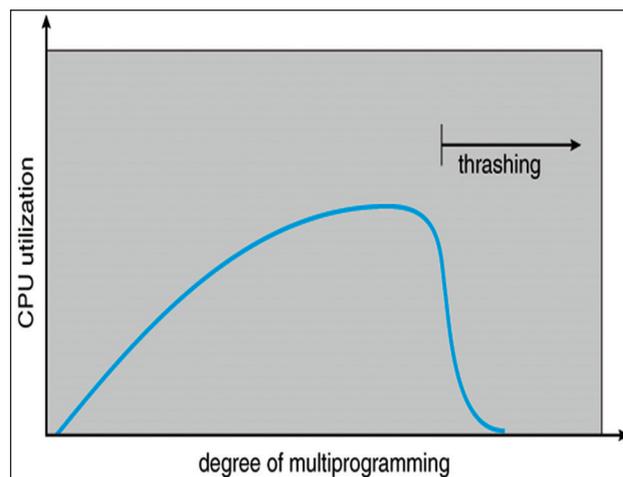


Figure 1. Thrashing [5]

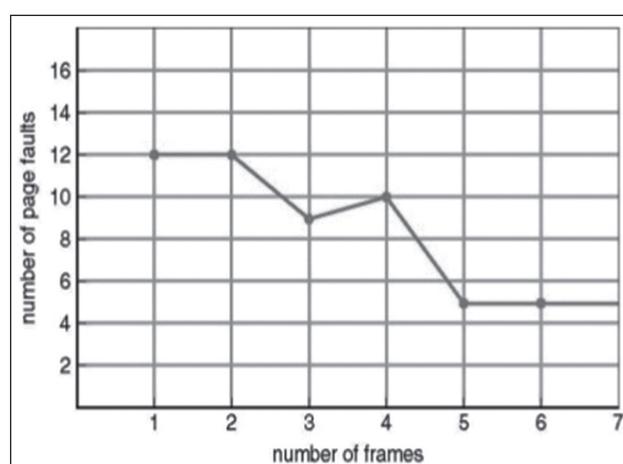


Figure 2. Belady’s Anomaly in FIFO algorithm [5]

Now a days various memory types with varying life time and speed of access are used. They demands less page fault rate with less read and write to memory. These are the base challenges faced by algorithm designers in page replacement.

4. Base techniques

First in First out:

Here usually a linked list is used for page management. The list is created according to the time of arrival of pages to main memory. When a page fault occurs delete one at the head and attach the newly added page to the tail of the list. In certain implementations rather than using a linked list, a time stamp field is used to identify the order of page arrival. Another implementation is: when a fault occurs the page pointed by the pointer is replaced and at the same place the new page is swapped in. After this, the pointer moves to the

next page [6]. An average of 50 percent hit ratio is reported by FIFO algorithms.

Least Recently Used (LRU):

Usually the page references from a process follow the fact that they cluster in a same area. This algorithm believes in this principle and selects the victim page as that which is not been demanded for access for a long time. The implementation of this technique is a bit difficult since a proper history recording is needed for the technique. Tagging of each page reference with its time is one technique of implementation [3]. An average of 60 percent hit ratio is reported by LRU algorithms.

Optimal Algorithm:

This algorithm, selects victim whose reference is furthest. This algorithm is known to be a non implemental one, since it requires to know the future. But it has the best page fault behaviour reported [6]. Certain threaded programming environments uses algorithms with properties of optimal replacement, since they can predict the further memory reference to certain extend. This optimal result is referred to as Belady's MIN algorithm or the clairvoyant algorithm.

The Not Frequently Used (NFU) Algorithm:

In this algorithm a counter is related to each page. On every timer interrupt, the Operating system checks each page and If the Reference Bit is set, page counter is incremented and clear the bit. The counter specifies often the page is referred. For replacement, the page with minimum counter value is selected. The disadvantage with this technique is if the page is greatly used its counter value will be so high and that page cannot be replaced for a long time even if it is not referenced again.

The Second Chance Page Replacement Algorithm:

Modification to FIFO. Pages are kept in a linked list so that the oldest page will be in the front. If its "referenced bit" is 0, the page is made as victim, Else Clear its "referenced bit" and Move it to the end of the list. Repeat steps.

The Clock Page Replacement Algorithm:

In this algorithm all page frames are arranged in a circular queue and a pointer is used to point to the oldest page in the circular queue. The reference bit related to each page get set when the page is referenced. The replacement victim page is selected in such a way that if it is set in the page, that bit is reset to zero and its points to next older page. This step continuous until a page with reference bit zero is found. The victim is removed and a new page is placed in the same position with reference bit equals zero. This algorithm abstracts LRU very proficiently with less overhead [2].

Working set page replacement:

This algorithm follows pre paging property. The group of pages a process needs is called the working set. If working set is in memory, no page faults. Rather than loading pages on demand, pages are pre paged so that the working set exists. The technique is efficient but difficult and costlier to implement.

5. New trends

New page replacement algorithm designs where developed in view of tremendous changes reported in the area of processors and operating system. This section summarises major research outcomes in the area of replacement algorithms and focuses on the new replacement algorithms developed for flash memories.

Replacement techniques in Primary Memory and Cache

Pooja Khulbe and Shruti Pant suggested an algorithm Hybrid (LRU) Page-Replacement Algorithm uses an extra feature that is total number of references (TNR) for each page which will be counted on each referred page. It uses the idea of modified reference, when a page is modified, a modified reference is set i.e. $M=1$ for that page[4]. When a page fault occurs the page with minimum TNR will be chosen as the victim. If many pages share the minimum TNR, basic LRU is applied. HLRU reported better hit ratio than normal LRU.

Yifeng Zhu, Hong Jiang et al.[7] proposed a Robust Adaptive buffer Cache management scheme (RACE). In this scheme block access is initiated in a cache. To track the referencing pattern it uses

hash table technique. The hash tables uses parameters like inode, start and end block number, the last access made to the first block, looping period, last access to the referenced block, last accessed block, fresh counter, reuse counter. After reference detection block is allotted in the cache allocation or replacement is done with a known replacement policy fit for the identified pattern.

Reetu Gupta et.al. [8], Proposed Block Pattern Based Buffer Cache Management technique. It works in program context level and file level. This method tracks the program activities and predicts the access pattern. Hash table method is used here. Hit ratio increased to a large extend with this prediction technique. Namrata Dafre and Deepak Kapgate [9] suggested a novel cache replacement policy. This method also predicts the future references and uses the concept of inter-reference recency for prediction and uses response time recorded to find the replacement victim.

K. Ravindra Babu and G. Pavan Kumar [10] proposed Enhanced Hybrid LRU Page Replacement Algorithm which is the combination of Hybrid LRU and Enhanced second chance algorithm. This algorithm uses an extra feature STR (spent time since last reference) for each page that holds the time when that page was referenced. Two parameters TNR (Total no. of references) and STR are used for evaluation. Page with minimum number of references and maximum spent time since last reference are selected as victim.

The concept of Inverted Page Table also contributed to new trends in algorithm design. Inverted page table is a global page table rather than a process wise table. Since multiple entry of page information in process wise page table is eliminated here a memory optimization to a large extend is achieved here. The virtual address to the physical address transformation time is also reduced [11].

Replacement in Flash System

The write operations in flash memory are complex and costlier than hard disk operations. Also erase operations are more costlier than write operations. The life period of flash systems are shorter than hard disk, so careful and wise transfer of pages are needed in flash systems. With in these limitations, the low power consumption of memories and speed in accessing the data made this memory popular. Table 1 shows the major differences in hard disk and flash memory parameters.

S.Y. Park and D. Jung in [12] proposed the Clean First LRU (CFLRU) replacement policy which considers the balancing issues in the cost of read and write operations of the flash memory when performing page replacement. Here certain amounts of dirty pages are kept intentionally in page cache to lessen the number of flash write operations. This is the first replacement algorithm proposed for flash memory. H. Jung et al. proposed LRU-WSR with the objective of minimizing the number of replacements of dirty pages during page replacement [13]. The strategy used to achieve this objective is delaying the replacement of pages which is dirty and has higher reference frequency as possible [13].

Xian Tang and Xiaofeng Meng introduced an adaptive cost-aware replacement policy (ACR) which is using three cost-based criterions in order to select the victim page [14]. The algorithm works really well for different types of flash disks. They divided the buffer pages into two lists: clean and dirty lists and follow LRU replacement method. The page out victim is selected from clean list usually so that page writes can be avoided.

Table 1. Hard disk VS Flash

Memory Type	Hard disk Drive	Flash
Read/ Write Performance	Largely Symmetric	Heavily Asymmetric
Background ops	Rare	Regular
Wear Out	Largely Unlimited	Limited Write
Latency	10s milli sec	10s – 100s micro sec
Addressing	Sequence sector	Direct, byte addressable

6. Conclusion

Studying various page replacement algorithms pointed out that the LRU algorithm has had the better results than many other algorithms but has room for improvement. Optimal algorithm which is the superior one theoretically needs to be addressed more seriously for a better implementation. The earlier focus of the page replacement algorithms was on the selection of victim and to lessen the page fault, but as the memory types with varying speed demanded less page write and page read the existing algorithms need to be addressed in a different view angle.

References

1. Silberschatz A, Galvin PB. *Operating System Concepts*.
2. Chavan AS, Nayak KR, Vora KD, Purohit MD, Chawan PM. *A Comparison of Page Replacement Algorithms, IACSIT International Journal of Engineering and Technology*, 2011; 3(2): 171-174.
3. Chavan A S, Nayak K R, Vora K D, Purohit M D, Chawan P M. *A Comparison of Page Replacement Algorithms, IACSIT*, 2011; 3(2).
4. Khulbe P, Pant P. *Hybrid (LRU) Page-Replacement Algorithm”, International Journal of Computer Applications (0975 – 8887)*, 2014; 91(16): 25-28.
5. Silberschatz A, Gagne G, Galvin PB. *Operating System Concepts, Ninth Edition*.
6. Saxena A. *A Study of Page Replacement Algorithms, International Journal of Engineering Research and General Science*, 2014; 2(4).
7. Zhu Y, Jiang H. *RACE: A Robust Adaptive Caching Strategy for Buffer Cache, IEEE Transaction on computers*, 2007.
8. Shrawankar U, Gupta R. *Block Pattern Based Buffer Cache Management, The 8th International Conference on Computer Science & Education, April 26-28, Colombo, 2013*.
9. Dafre N, Kapgate D. *Novel Cache Replacement Algorithm, International Journal Of Engineering And Computer Science ISSN: 2319-7242*, 2014; 3(6): 6260-6266.
10. Babu, et al. *Enhanced Hybrid LRU Page Replacement Algorithm, International Journal of Advanced Research in Computer Science and Software Engineering*, 2016; 6(1): 417-421.
11. Sultanov Y. *Design and Implementation of Page Replacement Algorithms based on an Inverted Page Table, International Journal of Advanced Engineering Technology and Application*, 2016; 2: 35-39.
12. Park Y, Jung D. *CFLRU: A replacement algorithm for flash memory, Proc. of the 2006 International Conference on compilers, Architecture and Synthesis for embedded systems*, 2006; 234-241.
13. Jung H, Shim H, Park S, Kang S, Cha J. *LRU-WSR: Integration of LRU and writes sequence reordering for flash memory, IEEE Transactions on Consumer Electronics*, 2008; 54(3): 1215-1223.
14. Tang X, Meng X. *ACR: an Adaptive Cost-Aware Buffer Replacement Algorithm for Flash Storage Devices, Eleventh International Conference on Mobile Data Management, IEEE Computer Society*, 2010; 33-42.

Corresponding Author
Hitha Paulson,
Bharathiar University,
Coimbatore,
Dept of Computer Science,
Little Flower College,
Guruvayoor,
Kerala,
India,
E-mail: hitha.paulson@gmail.com

Role of Management in a Learning Organization

Jasmina Starc, Sabina Blatnik

Faculty of Business and Management Sciences Novo mesto, Higher Education Centre, Slovenia.

Abstract

The basic purpose of the paper was to determine the most important roles of a manager in a learning organization based on a review, analysis and synthesis of scientific information from the following databases: Academic Search Elite, Business Source Main Edition, Cobib.si, D-lib, Google Scholar and Master File Premier. The key search phrases were: learning organization, management role, authentic leadership, knowledge management, managerial skills, organizational learning, employee empowerment and managing knowledge. The narrow search criteria were: the time frame from 2013 to 2016 and the full text of articles. The initial criteria were met by 405 units and 20 select original scientific papers. 17 codes were identified and combined into 4 content categories: management style, creating a working environment, abilities and qualities of managers, knowledge management. The research has shown that management has many different roles in a learning organization, which, when implemented successfully, contribute to innovativeness, success and competitiveness on an increasingly dynamic market.

Key words: management, learning organization, knowledge management, authentic leadership, managerial skills

1. Introduction

It is commonly believed that in the long run modern organizations can ensure their existence and further development only by discovering and understanding the causes for past events, predicting the needs and demands of the future, and basing their operation on continuous learning and knowledge management [1]. To do this, employees constantly need new knowledge and skills. Responsiveness and flexibility are ensured through continuous learning and training. If an organization does not promote learning, it sooner or later becomes uncompetitive, starts losing its best staff, and its

workers become unmotivated [2]. In a knowledge society the need for learning must be the first priority. The basis for creating a competitive advantage is the will to learn and the ability to learn [3].

Learning organizations are those in which employees are constantly working as a team in order to develop their ability to create the future. They are those which are capable of creating, gaining and transferring knowledge and, moreover, of changing their behaviour so that it reflects the new knowledge and understanding of things or of phenomena [4]. A learning organization is founded on equality, open information, low degree of hierarchy, and a culture that promotes flexibility and cooperation, and consequently the creation of ideas anywhere within the organization, so that the latter is able to find opportunities faster and deal with crises [5]. We must realize that a learning organization not only highlights learning as such, but also the learning methods, as employees are being trained in gaining knowledge correctly and guiding themselves. Such an organization is extremely well integrated into the environment and makes sure that information, data and knowledge are continuously flowing into the organization [6].

In a learning organization, employees are one of the most important assets of the company, which must be understood, respected and systematically implemented. In this process, management has a key role in developing the ability of employees to gain and apply the growing amount of new knowledge [7]. Thus, in a learning organization the management focuses on people and their knowledge as an asset and value. The goal is not knowledge itself but the management of people who possess that knowledge [3]. Thus a manager's work is becoming more and more complex, and in addition requires a wide range of knowledge and abilities.

In addition to qualities relating to communication, understanding, transparency of roles, and behaviour, we must point out six key abilities that a modern manager must possess. These abilities are leading, decision making, motivating, manag-

ing teams, quickly adapting to change, being a visionary and goal-oriented [8]. Besides all of these qualities, Možina [9] stresses the importance of managers being hard-working, that they strive for achievement, are able to learn lessons from difficult situations, are devoted to their job, work with people, and are creative. These are the key characteristics of managers that enable their success.

All of the above primarily means that managers must be very flexible, open and susceptible to change, and capable of taking on new roles [4]. A learning organization namely requires a new role for the leader, manager and management. The modern leadership model is based on a horizontal connection among members of an organization, which is why the role of leadership is changing from controlling and managing limited resources to influencing a network of self-interested members within and outside the borders of a learning organization. The main emphasis is placed on mutual encouragement, training, and on developing the knowledge of the entire organization [10]. In this way, management shifts from self-sufficient, closed leadership to a variable, open managerial style, which takes into account the needs of individual employees under different circumstances that are connected with realizing a learning organization. This most often means that they relinquish control and power, and establish a partnership with their employees. Essential to the constant change and learning is the so-called employee empowerment, which is the delegation of power or authority to the subordinates within the organization, meaning that the employees are given greater power, freedom, information and knowledge, which they need in order to make decisions. Empowerment provides a basis for attaining a competitive advantage, as it increases the overall power within an organization, boosts the motivation of employees and, last but not least, helps to retain quality personnel and their knowledge [11].

The effort to systematically accumulate knowledge, ensure it is widely accessible, and create a learning culture is called knowledge management. In addition to the process of gaining, retaining knowledge and organizing, the entire management system in a learning organization also encompasses methods of creating new knowledge and of exchanging or transferring knowledge within the

organization. In order for a manager to be able to manage knowledge, he/she must understand what knowledge is and how to utilize it efficiently. The manager must be able to understand all of the processes connected with knowledge, set up formal and informal communication structures, and build such networks that enable the spreading of knowledge within the company. One important element is undoubtedly the creation of a company environment in which people trust one another and are willing to share their knowledge with others with the intention of contributing to the company's successful business operations [3].

Enabling each individual to acquire some of the intellectuality, imagination, potential and enthusiasm of all who are working in and with the organization, is the goal of an effective and successful manager in a learning organization. In the majority of cases thus far, this has proved to be a goal that is very difficult to achieve [12]. Perhaps the reason for that is that some organizations do not possess the characteristics needed by a learning organization.

With the above-mentioned roles, managers promote creativity, innovativeness and the willingness to take risks. By doing so, they detect comprehensive problems, simplify them and motivate their co-workers to learn and be active. The employees, on the other hand, recognize the need for continuous learning.

2. Methodology of research

2.1 Literature review method

A meta-synthesis of a scientific literature review was chosen. The following databases were used: Academic Search Elite, Business Source Main Edition, Cobib.si, D-lib, Google Scholar and Master File Premier. The key search phrases were: learning organization, management role, authentic leadership, knowledge management, managerial skills, organizational learning, employee empowerment and managing knowledge. The narrow search criteria were: the time frame from 2013 to 2016 and the full text of articles. All of the abstracts of the selected hits were reviewed for the purpose of finding potentially suitable papers and selecting those that would be suitable for further review.

From the aspect of the hierarchy of evidence in scientific research work, the aim was to find potential publications of various analyses, comparative studies and other basic, development or applied research studies in the Slovenian and English language in the database. The number of units found is listed separately according to the publication time frame from 2013 to 2016, which enables us to infer an increase or decrease in the topicality of the issue in question or in the frequency of the use of individual terms or phrases.

2.2 Review results

The strategy of searching through databases yielded 3,106 units in total. The initial criteria for inclusion in the research were met by 405 potentially relevant units. 20 relevant papers were used in the literature review (Table 1).

Because of the specified details and the number of keywords used, some hits were duplicated, which is why the total number of hits is not an accurate indicator of the actual production. The number of hits was also the result of the keywords, which are umbrella terms for the phenomenon under discussion.

Table 1. Number of search results by key words

Database	Key words	x (y)	z
Academic Search Elite	Learning organization	46 (13)	1
	Knowledge management	390 (18)	3
	Authentic leadership	59 (6)	1
	Employee empowerment	67 (7)	
	Managing knowledge	55 (3)	
	Organizational learning	126 (15)	1
Business Source Main Edition	Learning organization	30 (8)	1
	Authentic leadership	18 (13)	
	Management role	17 (1)	1
	Employee empowerment	16 (2)	
Cobib.si	Learning organization	201 (67)	1
	Management role	36 (2)	
	Knowledge management	663 (124)	1
	Authentic leadership	48 (18)	
	Transformational leadership	14 (2)	
	Organizational learning	48 (4)	
D-lib	Learning organization	1 (1)	
	Management role	4 (1)	
	Knowledge management	17 (2)	
Google Scholar	Management role	124 (14)	3
	Authentic leadership	290 (1)	
	Management in a learning organization	82 (9)	4
	Knowledge management	342 (17)	2
Master File Premier	Learning organization	32 (9)	
	Authentic leadership	21 (9)	
	Knowledge management	96 (6)	
	Organizational learning	2 (2)	
	Managerial skills	44 (9)	1
	Employee empowerment	217 (22)	
Total		3,106 (405)	20

Legend: x – the number of units found according to the publication time frame from 2013 to 2016; y – reviewed and presented; z – selected hits for the review of full text

Table 2. Literature review

Author	Year of publication	Research design	Sample (size and country)	Key findings
Afshari, M. et al.	2013	quantitative research	128 employees in different companies; Iran	Managerial skills play an important role in developing the characteristics of a learning organization. The most important ones are human resource management and conceptual abilities.
Luo, S. and Lee, G.	2013	quantitative research	147 employees in the personnel department, Taiwan	Effective knowledge management is influenced by the ethics, trust, effectiveness and strategy of the organization.
Hussein, N. et al.	2013	quantitative research	150 employees in different companies; Malaysia	A manager in a learning organization must employ transformational leadership, with which he/she has a positive impact on the motivation of employees, on their intellectual capital and on creating new knowledge.
Noruzi, A. et al.	2013	quantitative research	280 employees in different companies; Iran	A manager in a learning organization improves the innovativeness and efficiency of employees through appropriate leadership.
Rudawska, A.	2013	qualitative research	Poland	A learning organization is connected with the implementation of organizational learning, knowledge management and other concepts, in which the manager plays the key role.
Bhaskar, A and Mishra, B.	2014	quantitative research	87 managers in different companies; India	A manager's role is important in all areas of a learning organization, but he/she must devote most attention to creating an appropriate culture and empowering the employees.
Stefanchin, J.	2014	qualitative research (case study)	USA	Transformational leadership has a great impact on a learning organization.
Suhaimi, N. and Kassim, N.	2014	qualitative research	Malaysia	A manager must pursue transformational leadership if he/she wishes to introduce a learning organization into the company.
Al-Zahrani, A.	2015	qualitative research (making a model)	Spain	A manager in a learning organization must employ transformational leadership, see to a flat organizational structure, create an appropriate culture and remuneration system, and empower employees.
Gorzelany, Dzlackowiec, M.	2015	quantitative research	25 companies, Poland	The task of managers is to trigger a desire in employees to do new things.
Khan, I. et al.	2015	qualitative research	Pakistan	The role of managers is to create an organizational culture which supports learning.
Klinge, C.	2015	qualitative research	USA	Mentoring plays a major role in creating a learning organization.
Scotney, D. and Kiwell, N.	2015	qualitative research	USA	Creating an organizational culture that supports learning is the task of the manager. In doing so, he/she must be active and greatly emphasize open communication.

Soliman, F.	2015	qualitative research (literature review)	Australia	In order for an organization to become and stay a learning organization, managers must pursue the transformational leadership style.
Tan, C.	2015	quantitative research	214 employees in different companies; Malaysia	Knowledge management is influenced by individual, organizational, technological and communication factors.
Zubair, A. and Kamal, A.	2015	quantitative research	277 employees in different companies; Pakistan	Authentic leadership encourages employees to develop their intellectual capital and become more creative.
Cai, H. et al.	2016	quantitative research	550 managers, China	Through his/her behaviour, a manager influences knowledge sharing and strengthens the relationships between the employees and the organization.
Kareem, J.	2016	quantitative research	750 employees in different companies; India	The leadership style plays an important role in the implementation of a learning organization.
Kozjek, D. and Ovsenik, M.	2016	quantitative research	69 companies, Slovenia	Motivation and teamwork greatly influence the creation of an organizational culture which supports learning.
Uymaz, A. O.	2016	qualitative research	439 in a company; Turkey	The transformational leadership style has a great impact on learning within an organization, on the development of employees, and on the realization of the goals and concepts of a learning organization.

In order to assess the quality of the analysed papers, criteria were used which, according to Vogrinc [13], are the most suitable for assessing the quality of a literature review in a qualitative research study. These criteria are authenticity, familiarization with the background of origin, the message conveyed, and understandability.

The final analysis thus included only those papers that were based on genuine and unbiased statements, and contained accurate and authentic data. The background of the origin of an individual study was also examined. In addition to the author and his/her level of education, we also examined the purpose for which the work had been written. Based on the criterion of communicative value, we included research studies with rich contents or those which contained information relevant to the aims of this research study. Last but not least, we assessed the quality based on the understandability of the document, which included the technical aspect and the understandability of content. In the case of the latter, we paid attention to literary language, potential grammar mistakes, and technical

terms which might make the contents of the document more difficult to understand.

3. Data analysis and results

To better present the literature units that were used, the results are given in tabular form, stating the name of the author, the year in which the research report was published, the type of research, sample, the country in which the study was conducted, and the key findings reached by the authors mentioned (Table 2).

17 codes were identified and combined into 4 content categories based on their properties, dimensions and interconnections: leadership style, creating a working environment, abilities and qualities of a manager, knowledge management (Table 3).

4. Discussion

By collecting and analysing the literature, it has been established that empirical studies are rare in this field and that they have mostly been con-

Table 3. Codes sorted by categories

Category	Codes	Authors
Leadership style	<ul style="list-style-type: none"> – transformational leadership – authentic leadership 	Zubair, A. and Kamall, A. (2015); Noruzy, A. et al. (2013); Al-Zahrani, A. (2015); Soliman, F. ();
Creating a working environment	<ul style="list-style-type: none"> – organizational structure – organizational culture – organizational climate – communication – teamwork – employee empowerment 	Tan, C. (2015); Rudawska, A. (2013); Cai, H. et al. (2016); Bhaskar, A. and Mishra, B. (2014); Rijal, S. (2016); Scotney and Kiwell (2015)
Abilities and qualities of a manager	<ul style="list-style-type: none"> – understanding employees – behaviour – mentoring 	Klinge, C. (2015); Stefanchin, J. (2014); Hussein, N. et al. (2013); Kozjek, D. and Ovsenik, M. (2016); Khan, I. et al. (2015); Gorzelany-Dzladkowiec, M. (2015); Afshari, M. et al. (2013);
Knowledge management	<ul style="list-style-type: none"> – managing knowledge – sharing knowledge – innovativeness – learning – intellectual capital – organizational learning 	Zubair, A. and Kamall, A. (2015); Tan, C. (2015); Luo, S and Lee, G. (2013);

ducted in foreign countries. In Slovenia, studies that research the role of management in a learning organization are almost impossible to find. Nevertheless, based on the review of accessible sources, we have defined the context of the role of management and explained its impact on a learning organization. By doing so, we have achieved the purpose of our research and enabled the development of a potential new perspective for researchers, and presented the knowledge already created to experts in management, which they can refer to when forming a learning organization.

In today’s organizations, the learning and implementation of knowledge has become an essential component and foundation of growth, survival and success. Due to the dynamic changes in the environment, organizational learning has become a necessity. The key role in the process is held by management, which enables an organization to realize all of the components of a learning organization. Namely, research has shown that the manager is the one in charge of strengthening the dimensions of a learning organization [14,15,16].

Authors who have researched learning organizations have identified many conditions, guidelines and managerial practices, which managers must consider when implementing or maintaining a company founded on knowledge. These authors

list the following components as the most important ones: a flat organizational structure; creating an appropriate organizational culture and climate; continuous learning and development of employees; teamwork; openness and integration with the environment; proper motivating of employees; mentoring; and posts that are the least specific [15,16,17,18].

The first condition for a company to change into a learning organization is appropriate leadership. In learning organizations, people are guided towards seeing the system as a whole [19], teamwork is encouraged [20,21], changes are triggered, and the capabilities of employees are increased [22]. Managers must show that they are willing to make changes, before presenting that idea to their employees. They must adopt a participatory leadership style, which enables all individuals to quickly start working towards realizing a learning organization [14,19,23,24].

The highest form of leadership is transformational leadership [25]. Numerous studies have shown that transformational leaders support and encourage their employees to learn continuously by motivating them, setting an example, and providing them with opportunities to acquire abilities and competences, which enables the employees to create, accumulate, share, retain and apply knowl-

edge [14,21,24]. Transformational leadership therefore has a positive impact on organizational creativity and enables the transformation of knowledge into learning and, consequently, innovativeness [24]. It enables managers to build common interests with their employees and, through developing a good interrelationship, realize a common vision [14]. The common vision provides employees with better insight into what managers expect of them [26], which leads to greater effectiveness and, consequently, success.

The research conducted by Hussein et al. [26] has shown that transformational leadership leads to organizational learning, appropriate support from the leader, employee empowerment and interconnectedness. Through stimulating intellectual capital, through empathy, motivation and proper influence, managers who pursue transformational leadership can more easily create a learning organization and strive for progress. This means that the transformational leadership style generates more benefits for the organization than the leadership styles focused on autocratic behaviour.

There are many studies on the transformational leadership style in connection with a learning organization [19,26,27,28]. Even though the studies were conducted in different countries and cultures, and were based on different samples, the results have shown that the leadership style has an important impact on all factors of the organization, including an impact on organizational culture and employee behaviour. Research has shown that transformational leadership has a great impact on the organizational and personal development of employees and hence on the concept of a learning organization. According to Uymaz [27], transformational leaders value the development of the personal knowledge and skills of employees, because they facilitate the realization of the organization's goals.

While reviewing the literature, we often came across the so-called authentic leadership in connection with the leadership style in a learning organization. According to Dimovski et al. [29], what separates authentic leadership from other concepts is the fact that it does not define the leadership style which a leader should adopt, but highlights the leader's personality. Thus, authentic leaders are those who know who they are, what they believe in and what they value, and who con-

stantly act in accordance with their values and beliefs when interacting with others. In their study, Zubair and Kamal [30] analysed the impact of authentic leadership on the components of a learning organization and discovered that it has a powerful impact on the intellectual capital of employees and on employee innovativeness, and is therefore suitable for a learning organization.

Regardless of the leadership style, the management must be able to create a learning environment [28]. In their study, Bhaskar and Mishra [31] researched the impact of individual managerial roles on employee effectiveness when creating a suitable working environment. They divided the roles into seven dimensions, namely: creating opportunities for continuous learning; open communication; teamwork and cooperation among employees; creating systems that enable knowledge sharing; employee empowerment; integrating the organization with the environment; and strategic leadership which promotes learning. They have established that of these seven dimensions the ones which influence workers' effectiveness the most are strategic leadership which promotes learning, employee empowerment, and creating opportunities for continuous learning. The study by Al-Zahrani [14] states that the most important tasks of managers are changing the organizational structure and culture, and empowering employees. A similar conclusion has been reached by Khan et al. [32], who maintain that employee empowerment and support of learning are of the greatest importance for a learning environment.

A learning organization therefore needs an environment that supports learning, as it plays a great role in whether employees are creative and willing to learn [20,32]. The creation of a working environment that supports learning mostly depends on the management. Only the latter can help to create conditions under which individuals can more easily understand the complexity and vision, and thus improve their effectiveness [17]). The foundation for the success of every company is a clearly outlined vision, values and business goals. Dimovski and Penger [5] state that the most important role of a manager is to teach the organization how to form a common vision, which includes what the organization will look like in the future, and the results and values that support this vision. It is especially

important that the management of a learning company ensures an efficient transfer and coordination with all employees. Uymaz [27] has established that if an organization wishes to achieve the set goals, a manager must create opportunities, remove barriers, and offer support.

The organizational culture in a learning organization must support and encourage the collective to create, share and apply knowledge in practice. It is important that the employees know how to learn, are aware of the leadership style, and remove bureaucratic and cultural barriers to learning. However, we must realize that an organization can learn only if the manager values learning [32].

A culture that supports learning increases employee satisfaction [30]. It also has a positive impact on knowledge sharing. In his study, Tan [33] reached the conclusion that the more an organizational culture is focused on learning, the more often knowledge is shared among employees. That is why such a culture is a foundation for implementing knowledge management [34].

Motivation and teamwork also have a great impact on creating a culture [20]. The managers of learning companies are aware that the success of the company depends on all employees, particularly on their cooperation [33]. This is the so-called team management, in which co-workers are focused on results and on building good relationships with one another. Managers must be capable of creating teams and guiding them, providing them with energy, and leading them towards creating a process of change, especially on the path toward organizational learning [21].

Effectiveness and success are the two most important criteria of organizational activity, and primarily depend on the abilities and skills of managers. In light of the unstable and dynamic environment, management must have well-developed abilities in order to lead an organization toward success. Nowadays, a manager needs the appropriate abilities and competences, especially in human resource management, at all organizational levels. Only that way can a manager demonstrate a sense of responsibility towards others, teamwork, and a positive attitude towards employees, which has a great impact on organizational learning [18]. Furthermore, the author of this research study has established that conceptual abilities, for instance

the identification of goals, and the planning and development of a strategy, are also connected with organizational learning, and enable the manager to create an organization that pursues long-term goals and is ready to face challenges.

A learning organization must consciously and effectively employ organizational learning and manage knowledge, which leads to obtaining and maintaining a competitive advantage. Mihalič [6] states that a manager in a learning organization must see to the development of knowledge management and must therefore plan, organize, lead, supervise and analyse the processes of gaining knowledge, and of applying that knowledge in practice. Kozjek and Ovsenik [20] have also proved this in their research study, establishing that the task of management is to support the creation of new knowledge, knowledge sharing, and its application in practice. In his research study, Uymaz [27] has established that in organizations which have well-developed knowledge management, managers support the creativity of their employees more and promote the sharing of knowledge and ideas.

Trust plays an important role in knowledge sharing within an organization [34]. Trust is identified as the willingness of an employee to establish a relationship with a co-worker, which leads to knowledge sharing [33]. If employees feel a close connection to the company and believe in the organizational goals and values, they are more willing to establish mutual trust [34]. Numerous research studies [22,33,35] have shown a strong positive correlation between trust and knowledge sharing. Since trust cannot be gained quickly, the research study by Rijal [36] suggests that management should create more opportunities for employees so that they could interact with one another more often.

5. Conclusion

It can be inferred from the above-mentioned findings that the various authors of theoretical and empirical research studies have reached similar conclusions regarding the key roles of a manager in a learning organization.

Management has many different roles in a learning organization, which, when implemented successfully, contribute to innovativeness, success

and competitiveness on an increasingly dynamic market. The research has shown that the management's most important role is creating an appropriate organizational culture, which leads to continuous learning and further training; motivating and empowering employees; promoting teamwork; enabling open communication; taking on the role of mentor; and effective knowledge management. The role of a manager is therefore to develop a culture, relationships and activities within an organization that guide employees towards openness and learning. The management must promote a sense of community and safety within an organization; provide employees with the opportunity to express themselves creatively; and highlight the importance of organizational achievements. By doing so, employees become convinced that they are valued as individuals and that their contribution matters. The most suitable leadership styles which enable effective implementation of the above-mentioned roles are transformational and authentic leadership. The more a manager pursues the elements of these two leadership styles, the more an organization shifts towards a learning organization.

References

1. Akella D. *Learning organizations, Managerial Control Systems. Global Business Review*, 2007; 8(13): 13-28.
2. Ivanko Š. *Teorija organizacije, Fakulteta za upravo, Ljubljana*, 2015.
3. Gomezelj OD. *Podjetništvo in znanje, Fakulteta za management, Koper*, 2010.
4. Možina S. et al. *Management: nova znanja za uspeh, Didakta, Radovljica*, 2002.
5. Dimovski V, Penger S. *Temelji managementa, Pearson Education Limited, Harlow (Essex)*, 2008.
6. Mihalič R. *Kako upravljam znanja: 30 minut za vodenje, Mihalič in partner, Škofja Loka*, 2010.
7. Kovačič A, Vukšič B. In. *Management poslovnih procesov: prenova in informatizacija poslovanja s praktičnimi primeri, GV Založba, Ljubljana*, 2005.
8. Uršič D, Nikl A. *Učeha se organizacija: sistemsko-organizacijski vidik, Management Forum, Maribor*, 2004.
9. Možina S. *Vloga menedžmenta znanja v podjetju. In: Možina S. and Kovač J. (Ed.). Menedžment znanja: znanje kot temelj razvoja: na poti k učečemu se podjetju, Založba Pivec, Maribor*, 2006; 129-151.
10. Dimovski D. et al. *Učeha se organizacija: ustvarite podjetje znanja, GV Založba, Ljubljana*, 2005.
11. Dimovski D. et al. *Napredni management, Ekonomska fakulteta, Ljubljana*, 2013.
12. McKenzie J. *Understanding the knowledgeable organization: nurturing knowledge, Thomson*, 2004.
13. Vogrinc J. *Kvalitativno raziskovanje na pedagoškem področju, Pedagoška fakulteta, Ljubljana*, 2008.
14. Al-Zahrani A. *A Model of Learning Organization: Leadership Role*, 2015. Retrieved from: <https://www.westeastinstitute.com/wp-content/uploads/2015/02/Abdullah-Al-Zahrani.pdf>
15. Gorzelany-Dzladkowiec M. *The Model of Leadership in Learning Organization*, 2015. Retrieved from: <https://depot.ceon.pl/handle/123456789/9907>
16. <http://web.b.ebscohost.com.eviri.ook.sik.si/ehost/detail/detail?vid=6&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm c9c2wmc2l0ZT1laG9zdC1saXZI#AN=113929284&db=afh>
17. Rudawska A. *The Learning Organization Idea in the Context of Organizational Learning and Knowledge Management*, 2013. Retrieved from: <http://web.b.ebscohost.com.eviri.ook.sik.si/ehost/detail/detail?vid=18&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhb mc9c2wmc2l0ZT1laG9zdC1saXZI#AN=109188141&db=afh>
18. Scotney E, Kivell N. *The transformation team: an enabling structure for organizational learning in action*, 2015. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1002/jcop.21756/full>
19. Afshari M. et al. *The Role of Managerial Skills in Developing Characteristics of Learning Organization in Physical Education Organization*, 2013. Retrieved from: <http://web.b.ebscohost.com.eviri.ook.sik.si/ehost/detail/detail?vid=4&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm c9c2wmc2l0ZT1laG9zdC1saXZI#AN=108333768&db=afh>
20. Kareem J. *The Influence of Leadership in Building a Learning Organization*, 2016. Retrieved from: <http://web.b.ebscohost.com.eviri.ook.sik.si/ehost/detail/detail?vid=24&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm c9c2wmc2l0ZT1laG9zdC1saXZI#AN=113422672&db=bme>
21. Kozjek D, Ovsenik M. *Knowledge Factors and Their Impact on the Organization. Revija za univerzalno odličnost*, 2016; 5(4): 283-299.

22. Noruzy A. et al. *Relations between Transformational Leadership, Organizational Learning, Knowledge Management, Organizational Innovation and Organizational Performance: An Empirical Investigation of Manufacturing Firms*, 2013. Retrieved from: <http://web.b.ebscohost.com/ehost/detail/detail?vid=10&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#AN=85134095&db=afh>
23. Klinge C. *A Conceptual Framework for Mentoring in a Learning Organization*, 2015. Retrieved from: <http://web.b.ebscohost.com/ehost/detail/detail?vid=20&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#AN=110343145&db=afh>
24. Suhaimi N, Kassim N. *Transformational Leadership and Pattern of Decision towards Organization's Development in Learning Organization*, 2014. Retrieved from: http://s3.amazonaws.com/academia.edu/documents/40859395/Transformational_leadership_and_pattern_of_decision.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1492285726&Signature=qLQFFuXJKSUVzs1LupdabNsBaLA%3D&response-content-disposition=inline%3B%20filename%3DTransformational_leadership_and_pattern.pdf
25. Soliman F. *From Knowledge Management to Learning Organization to Innovation: Role of the Transformational Leadership*, 2015. Retrieved from: <https://www.wbiconpro.com/438-Fawzy.pdf>
26. Kramar Zupan M. *Menedžment vs. vodenje, Fakulteta za poslovne in upravne vede, Novo Mesto*, 2009.
27. Hussein N. et al. *Building a Learning Organization: Do Leadership Styles Matter?*, 2013. Retrieved from: http://flanagan-hyde.com/wp-content/uploads/2015/06/Building_an_Evaluation_System.pdf
28. Uymaz A O. *The Influence of Transformational Leadership on Personal Branding through the Learning Organization and Consideration of Future Consequences*, 2016. Retrieved from: http://s3.amazonaws.com/academia.edu/documents/43716794/The_Influence_of_Transformational_Leadership_on_Personal_Branding_through_the_Learning_Organization.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1494083597&Signature=WnjdDXaL7LdCrCaXpUrVIVmbBb8%3D&response-content-disposition=inline%3B%20filename%3DThe_Influence_of_Transformational_Leader.pdf
29. Stefančin J. *Leadership and the Learning Organization*, 2014. Retrieved from: <http://>
30. Dimovski V. et al. *Avtentično vodenje v učenci se organizaciji*, Planet GV, Ljubljana, 2009.
31. Zubair A, Kamal A. *Authentic Leadership and Creativity: Mediating Role of Work Related Flow and Psychological Capital*, 2015.
32. Bhaskar A. and Mishra B. *Organisational Learning and Work Engagement: Study of an IT Organization*, 2014. Retrieved from: <http://web.b.ebscohost.com/ehost/detail/detail?vid=26&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#AN=96441370&db=bme>
33. Khan I. et al. *Role of Leadership Behaviour in Supportive Learning Environment of a Learning Organization*, 2015. Retrieved from: <http://ajms.co.in/sites/ajms2015/index.php/ajms/article/view/1354>
34. Tan C. *Enhancing Knowledge Sharing and Research Collaboration among academics: The Role of Knowledge Management*, 2015. Retrieved from: <http://link.springer.com/article/10.1007/s10734-015-9922-6>
35. Luo S, Lee G. *Key Factors for Knowledge Management Implementation*, 2013. Retrieved from: <http://web.b.ebscohost.com/ehost/detail/detail?vid=8&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#AN=87083379&db=afh>
36. Cai H. et al. *Fostering Managers' Knowledge Sharing Behaviour: The Impact of the Employee Organization Relationship*, 2016. Retrieved from: <http://web.b.ebscohost.com/ehost/detail/detail?vid=22&sid=51108046-e859-4a53-87d9-b87e4cd91eb2%40sessionmgr104&hid=123&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#AN=115452459&db=afh>
37. Rijal S. *The Influence of Transformational Leadership and Organizational Culture on Learning Organization*, 2016.

Corresponding Author
 Jasmina Starc,
 Faculty of Business and Management Sciences,
 Novo Mesto,
 Slovenia,
 E-mail: jasmina.starc@guest.arnes.si

Inspection of the relationship between mosques and wellbeing: a case study of patients with diabetes in the Kingdom of Saudi Arabia

Bhzad Sidawi

Imam Abdulrahman Bin Faisal University, Dammam, Kingdom of Saudi Arabia

Abstract

Cities in the Kingdom of Saudi Arabia (KSA) have experienced rapid uncontrolled urbanism due to the absence of robust planning measures. This causes lack or ill distribution of facilities and segregation between these facilities and the residences in districts and neighbourhoods across the Kingdom. It encourages citizens adopt unhealthy lifestyles which in turn aggravate their health conditions. This paper examines the critical relationship between the unhealthy lifestyle of patients, the prevalence of diabetes and proximity of mosques. A survey on 76 diabetic patients and their living conditions was carried out. The study found significant links between the unhealthy lifestyle of patients, clinical assessment results and diabetic symptoms they have with number of mosques and proximity in their neighbourhoods. The results indicated that cities in the Eastern province in KSA have unhealthy urban and suburban settings in terms of the location and characteristics of mosques. Therefore, urgent action should consider how to adjust the present planning regulations of mosques. This would improve the mosque's role in the local community.

Key words: mosque, diabetes, lifestyle, wellbeing

1. Introduction

Since the establishment of the oldest mosque in Islam in AlMadina, mosques have a special place in the hearts and minds of Muslims. Mosques serve for Muslims as a place to worship god, get relieved, socialize and obtain the community's support. In the past couple decades, and due to urban planning errors, the KSA has experienced quick uncontrolled urbanism and this caused unhealthy built environment conditions including lack or ill distribution of

facilities such as mosques and wide spread of vacant lands. This has encouraged citizens to adopt unhealthy lifestyles and created unhealthy physical, environmental and psychological conditions in the KSA's cities and have adversely affected people's health and help spreading non-communicable diseases such as diabetes.

This study investigates the relationship between mosques' proximity with the health and wellbeing (i.e. feeling good and functioning well) of diabetic patients who live in the metropolitan area of Dammam-AlKhobar-Dhahran, Eastern Province, KSA. For the purposes of the study, qualified medical practitioners of the University of Dammam determined the diabetic patients' physical, social and emotional health. A questionnaire survey and medical exams were carried out on 76 diabetics who usually visit the Teaching Hospital of the University, Al-Khobar in the Eastern province of KSA. Thus, the location of mosques and vacant lands around the patients' (home) postal addresses were identified using ArcGIS software. At early stage, the researcher visually assessed the mosques and vacant lands in the patients' neighbourhoods. The medical conditions of patients, visual survey results and questionnaire data were all merged into one file and analysed using ANOVA test and Structural Equation Modeling (SEM) techniques. For thorough understanding of the relationship between patients' conditions and mosques' characteristics, vacant lands were introduced as mediating variables and the data was examined from patients' socio-economic and neighbourhood's backgrounds.

The present researcher found significant links between clinical assessment tests, diabetes' symptoms with the proximity of mosques, and vacant lands. The relationship has also been examined from the perspectives of neighbourhoods' density and type; and patients' age and gender. The results

have been reinforced and compared with the previous research highlighting the areas of overlap and variance. The results confirmed the present researcher concerns regarding the built environment in the KSA and how its' exposed to a number of factors such as unhealthy conditions which act as impediments to the role of mosques as catalysts of diabetics' health and wellbeing.

2. Historical review of the role and planning of mosque

Al-Masjid an-Nabawi (i.e. Prophet Mohammad's mosque) is one of the oldest mosques -that was built after Quba mosque which located in a village outside AlMadinah city- in Islam that is built ah city where to the Prophet Mohammad (PBUH) migrated and was built by Prophet Mohammad and his companions in 622 G. The mosque served as a place of worship, a community centre for the city where Muslims got advice about various aspects of their social, financial and spiritual life affairs, a political and financial hub wherein political decisions were made and charity and nation wealth was declared and distributed amongst Muslims. The mosque thus played a significant role in the formation of the new Islamic society.

Throughout the Islamic history, central mosques located in the heart of Islamic cities, wherein the market (for strong relationship between mosques and markets see Raymond) [1], Madrasaa (i.e. Religious school or College), public library, and Bemarstan (i.e. health clinic or hospital with a medical institute) are in a proximity to the mosque. Mosques accommodate the following activities: daily prayers (five times), Friday prayer in Friday mosques (once a week), Eid prayer (twice a year), and night prayers in Ramadan (i.e. every night after evening prayer).

In respect to the relationship between the Friday's mosques and the neighbourhoods, AURI-AHC [2] analysed the centres of historical districts in Cairo, Egypt and the analysis revealed the following facts:

- the connections between the Friday mosque and the main routes;
- there is a square/ open space in front of the Friday mosque that is usually used for social and commercial activities; and

- the spatial configuration of the streets is human scale, the volume of traffic, the architectural building styles in each historical period
- Mosque's development committee (2014) [3] indicated in its' guidebook; development regulations of Abu Dhabi Mosques, that mosques should have a nursery, an Islamic school for learning and recitation of Quran, and places for societal activities. Abdullah, Yusof, Kamaruddin, and Rasam [4] defined the following criteria that help planners selecting suitable site for mosques:
 - The mosque should have smooth accessibility to pedestrians or motor vehicle users;
 - If possible, the mosque should not be located on steep land;
 - It should serve as a focal point in the area;
 - The site should have enough space as a buffer zone to reduce disturbance such as loud noise from unsuitable activities; and [5] indicated that mosques and Islamic centres should have the following features:
 - Pedestrian circulation paths should be smooth, convenient, safe, and separated from vehicular circulation;
 - Landscape principles should be applied in the site design to balance and harmonize the visual environment to preserve natural resources and provide comfortable environmental conditions for users. This includes maintaining positive environmental biodiversity (i.e. vegetation, soil, air, and water);
 - Shaded places should be provided outside of the mosque so these would be used by people to socialize.

The Ministry of Municipal and Rural Affairs (MEMORA) [6], KSA defined the residential neighbourhood as that compromises 3000-6000 inhabitants and the residential quarter as that compromises 10000-15000 inhabitants. It sets a number of planning guidebooks for the design of cities, its' services and recreational facilities [6]. MEMORA defined three types of mosques: local mosque, Friday mosque and Eid mosque. Local mosque serves 750-1500 people, with the walking distance of 150-200 m. These mosques should be accessible, well

connected neighbourhoods with pedestrian walkways, away from pollution, noise and other environmental hazards. The Friday mosque would serve 3000-7500 people for a neighbourhood or quarter. The walking distance to the mosque is defined as 500-800 meters. There should be space for women in the Friday mosque. The Eid mosque is an open area with no defined walking distance and it can be reached by car. Men are obligated to pray five prayers a day, (i.e. near dawn (Fajr), after midday or (Zuhr), in the afternoon or (Asr), just after sunset and around nightfall (Isha) at the local mosque and the Friday prayer at the Friday mosque whereas the attendance of these prayers at the mosque is optional for women. The men's performance of five-time formal prayers throughout the day suggests a high frequency of movement to and from the mosque [7]. It should be noted that Friday mosques are used for daily prayers.

3. Why lifestyle matters?

3.1 Lifestyles, diet and diabetes

Diabetes mellitus is the most common non-communicable disease worldwide and the fourth leading cause of death in developed countries (International Diabetes federation, 2012) [8]. In general, there are two types of diabetes. In diabetes type I (T1DM), the body itself has destroyed the insulin-producing beta cells in the pancreas. However, numerous studies found that unhealthy lifestyles and lack of physical activity is the main cause of many non-communicable diseases as type II diabetes mellitus (T2DM). The incidence of this disease is projected to increase as populations age, urbanization increases (Bray, Vakil, & Elliott, 2005) and diets become 'westernized' (Schulze, Manson, Willett, & Hu, 2003). Lifestyles would deteriorate the medical conditions of individuals and these habit-persistent practices are imbalances between energy intake (i.e. food consumption) and expenditure (i.e. physical activity), a situation leading to obesity [9]. These lifestyles comprise of poor diet and "bad behaviours", such as smoking, alcohol consumption and lack of physical exercise. Passive entertainment exemplified by television viewing and computer games along with intake of meals; all contribute to disorders of lifestyle [10]. This imbalance between

energy intake (i.e. feeding) and energy expenditure (i.e. physical activity) unfortunately leads to obesity. Physical activity has been found to reduce the symptoms of coronary heart disease and strokes associated with T2DM. Meckel et al. [11] have linked the lack of physical activity with diabetes. However, recent research found that physical activity is ineffective against obesity without having a healthy diet [12]. On the other hand, outdoor conditions such as environmental pollution would contribute to the development of T2DM (see for example Relished et al. [13] which aggravate the complications of the disease such as blindness in adults [14] and non-traumatic lower-limb amputation [15]. Outdoor polluted conditions, particularly during heat waves, affect the number and function of sweat glands in diabetic patients which reduces the volume and rate of evaporation needed for the body to dissipate heat. This can considerably increase the risk of hyperthermia and heatstroke [16, 17].

3.2 Religious attendance and public health

Koenig et. al [18] reviewed research that had been conducted between 1960 and 2010 which found a correlation between religious involvement and better mental health, social health, health behaviours, and overall physical health. In another research, Koenig et al. [18] found that despite differences in the Christian and Muslim faith traditions, there is considerable overlap between these religious groups in beliefs, practices of worship, moral beliefs and values, and emphasis on family life. These contribute to better feeling of wellbeing. Ferraro and Kim [19] investigated potential health benefits of religiosity to protect against chronic inflammation associated with the risk of cardiovascular diseases. The study used longitudinal data from a representative survey of adults 57-85 years old. Religious attendance was associated with lower C-reactive protein (CRP) concentration (mg/L) for white respondents and a change in CRP over time among the black respondents. Also, it has beneficial effects on chronic inflammation among older adults, especially for black Americans, which may be useful in reducing the prevalence of hypertension and cardiovascular disease. Hamada et al. [20] reported that in the United States, people who consider themselves religious are happier and doing

religious rituals has a positive relationship with the feeling of good life. Hadianfard [21] reported that people acting on religious beliefs have a better welfare and mental health.

3.3 Impediments to physical activity

Vulnerable people who are tied to locality, elderly people, children, young parents, unemployed people and immobile people may experience a decline to regular daily activity e.g. walking and cycling. Cayden et al. [22] argued that segregation of open spaces and residences by streets has made these spaces less accessible and more dangerous for pedestrian movement, which in turn negatively affects the liveability and general health of residential areas [23].

This would result in increased obesity and risk of diabetes and cardiovascular diseases [24] With regards to cardiovascular disease, obesity and mental health, Handy [25] noted those living in more “walkable” neighbourhoods, characterized by high population density, mixed land use and high levels of connectivity (e.g. good pedestrian and cycling facilities), are more physically active. Consequently, these individuals are less likely to experience cardiovascular disease, obesity and mental health [26]. By contrast, access to open urban spaces may encourage physical activity, especially for young people thus improve public health.

On the other hand, vacant land constitutes a significant economic, environmental, and social problem for many cities, and affects the health and safety of residents. Garvin [27], conducted a survey in Philadelphia Pennsylvania, USA and the participants in the survey described a neighbourhood physical environment as dominated by decaying abandoned homes and overgrown vacant lots. This affected community well-being, physical health, and mental health. Vacant land affects community well-being by overshadowing positive aspects of the community, contributing to fractures between neighbours, attracting crime, and making residents fearful. Vacant land was described by respondents as impacting physical health through injury, the build-up of trash, and attraction of rodents, as well as mental health through anxiety and. Living in a rundown unkempt environment has been shown to be related to wellbeing and improvements to vacant sites in the

local neighbourhood has been shown to be related to a range of health-related indicators such as reduced stress and inspected the relationship between people health and proximity to derelict land and their deprived areas in Glasgow. Garvin [27] found that people are significantly more likely to be hospitalized for respiratory disease and cancer; and these for men to have much lower life expectancy than those not living in the high deprivation areas. Garvin [27] recommended community members should be engaged in identifying local health impacts and generating solutions to vacant land would include the following, transformation of vacant lots into small park spaces for the elderly and playgrounds for youth, and the use of abandoned homes for subsidized housing and homeless shelters [27]. In the KSA, there are no legislations at present that enforce owners to build their lands within a designated period. The Saudi government has recently applied low tax rate on vacant lands to promote owners to build on their vacant lands. The taxes however, are imposed on vacant lands wherever their locations are i.e. city, urban or suburban areas. Also, it seems the tax policy is ineffective and owners found their ways to avoid these taxes such as transferring the ownership or part of it to close relatives.

3.4. Impediments to the physical exercise in the KSA

In KSA, impediments to the physical exercise include the following: the living (i.e. physical, social and environmental) conditions, and the proximity of amenities and vacant lands from people’s homes.

3.4.1 *Living conditions as triggers to unhealthy lifestyles*

There are several housing arrangements such as: gated compounds; terraced housing, villas, blocks of flats, or mixed development. The gated compounds are usually well fenced and guarded and have facilities that are different in number and quality per the compound class i.e. middle, upper, rich and very rich. Facilities in gated compounds can be only used by the compound’s residents and their guests. So, this largely reduces permeability and accessibility of neighbours’ access to the compounds’ services and facilities. Each of the above mentioned

spatial arrangements would have a unique effect on the occupant's health and well-being. Residential districts in KSA can be also classified in accordance to the social class. The facilities, finishing quality, level of furnishing and cleanliness varies from one district to another. These suffer from irregular location of the amenities such as; gardens, parks, leisure and recreation within the neighbourhoods, quarters, and districts [28]. The users of the commercial street in Al-Khobar, expressed their dissatisfaction about the public facilities in the street. They reported the absence of green areas, lack of safety, lack of entertainment facilities for children, the absence of shaded public spaces, and recreational facilities, lack of hygiene and cleanness [29]. With respect to the unhealthy built environment and individuals' habits in KSA, the following issues are noticed:

- rapid growth of Saudi cities and the absences of healthy and sustainable planning code;
- the extreme hot, dry inland and humid weather in coastal cities create environmental conditions that affect the type and timing of people's activities. Thus, Saudis tend to engage in unhealthy activities: such as irregular sleeping patterns (e.g. afternoon nap, sleeping late), evening or late night trips to local malls or sitting for long hours in coffee shops, late night's heavy meals [28]. In major cities across the KSA, it was found that the majority of Saudi adolescents spent more than 2 hours watching TV, and around half of them do not meet the daily physical activity requirements [30];
- poor living conditions add to these problems and adversely affect the health of all citizens, particularly those with diabetes. Such living conditions make it difficult for diabetics to enjoy walking around their neighbourhoods due to the extreme hot, dry and humid weather conditions and high level of air pollution within cities; and
- certain cultural issues should also be taken into consideration when exploring the relationship between diabetics and living conditions. Men are obligated to attend prayers in the local mosque in their neighbourhood/ quarter, and segregation between men and women and restricted rules regarding women clothing and their mobility.

In respect to vacant lands, the Kingdom of Saudi Arabia has over 17 million square hectares of white/ vacant lands including planned and unplanned units. The total area of used and vacant lands in the Eastern Province is 186,836 VS. 200,859 sq. ha.

4. The research methodology and objectives

The literature review above has indicated the importance of physical and religious activities to the human health. It also pointed out possible environmental and physical impediments to the exercise of these activities. With respect to this valuable contribution, this research aims at exploring the strength of relationship between the health conditions of diabetics with the proximity of mosques in the Eastern Province of the KSA, and the following objectives are pursued:

- To know how strong, the relationship is between the medical condition, physiology of the disease reported symptoms and perception of their living conditions in relation to:
 - the number, and distribution of mosques;
 - the number, distribution and sizes of vacant land lots; and
 - To find out the role that vacant lands as impediments would play in affecting the relationship between mosques and the medical conditions of patients.

Consent to carry out the study was first obtained from the University of Dammam ethics committee. The fieldwork was carried out in 2013 and drew upon a sample of diabetics who usually visit the medical clinic at the teaching hospital of the University of Dammam, Al-Khobar. This list of patients includes T1DM and T2DM male and female adults, age 15-80 years and resident in the metropolitan area of Al-Khobar, Al Dammam and Al Dhahran cities in the Eastern province of KSA. 76 diabetic patients participated in the study. They completed a questionnaire requesting information on their living conditions, home and neighbourhood and lifestyle activity since the onset of the disease. The medical staff then conducted a physical examination of the participants to test their blood pressure and Body Mass Index (BMI). These tests also recorded their

Fasting Blood Glucose (FBG), levels of HBA1C (i.e. Glycated Haemoglobin in blood), Micro albumin urea, Lipid HDL (i.e. High-density Lipoprotein or good cholesterol), Lipid LDL level (i.e. Low-density Lipoprotein or bad cholesterol), and Lipid TG (i.e. Triglyceride).

The postal addresses of the patients' homes were obtained from the patient's completed questionnaires and medical files. During 2014, hot diabetes spots map was created using ARCGIS 10.2.1 software available at the University of West of England, UK. The following layers were added to the map:

- A Mosques layer that comprises 132 mosques;
- A Vacant land layer was added and this comprises 1556 lots; and
- A Saudi household average size layer i.e. number of family members in the household which was obtained from online ArcGIS layers.

Google Earth and Saudi locator (http://www.locator.com.sa/locator/Default_E.aspx) were used to identify the mosques and vacant lands nearby the diabetic patients' homes (see figure 1). Mosques and vacant lands were modelled in ArcGIS map within a walking distance of 1200 m of the patient's home. Service area was calculated from the diabetic patients (i.e. centroid postal code). This was done on 400, 800 and 1200 m intervals (see figure 2). The distances between patients' homes to the nearest mosque and vacant lands within 1200 m were calculated using OD Cost Matrix Analysis (see figure 1, 2 and 3 as an example). The areas of the vacant lands were also calculated. The ARGIS results then were exported to a SPSS file that comprises information of the physical examination of the diabetic patients, questionnaire survey results and the visual survey on mosques and vacant lands outcome.

The data analysis calculated the mean and percentages. ANOVA and Regression tests were used to examine possible significant correlations. Thus, the clinical assessment of the patients' physiological health, the patients' own self-evaluations of their homes and neighbourhoods living condition, and the mosques and vacant lands information were correlated. SEM examines the effect of an independent variable on a dependent variable and this is through a number of co-variables. For ANOVA and Regression tests, only relationships

having a significance value (i.e. $P < 0.05$) are reported on. For SEM only networks that have a continuous significant path between independent, co-variables and dependent variables are reported. The levels of significance considered are as follows: $P < 0.05$ as the common that two or more variables change in the same direction and in the same proportion, and vice versa. Level: $P < 0.01$ as the moderate level and $P < 0.001$ as the high level. Any positive correlation means that two or more variables change in the same direction and in the same proportion, and vice versa.

5. The results

5.1 Physical, social and emotional health

This survey found that 88% of the participants have diabetic HBA1C levels above 6.5, 32% of the diabetics have a positive level of micro albumin urea and 66% of them are overweight or obese.

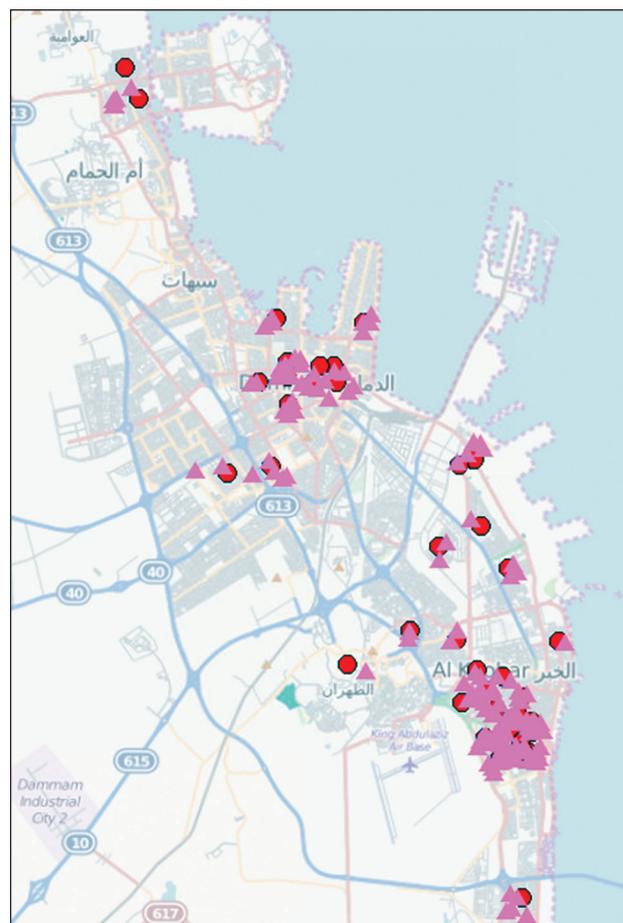


Figure 1. The location of mosques and within 1200 m from the patients' homes (represented by red dots)

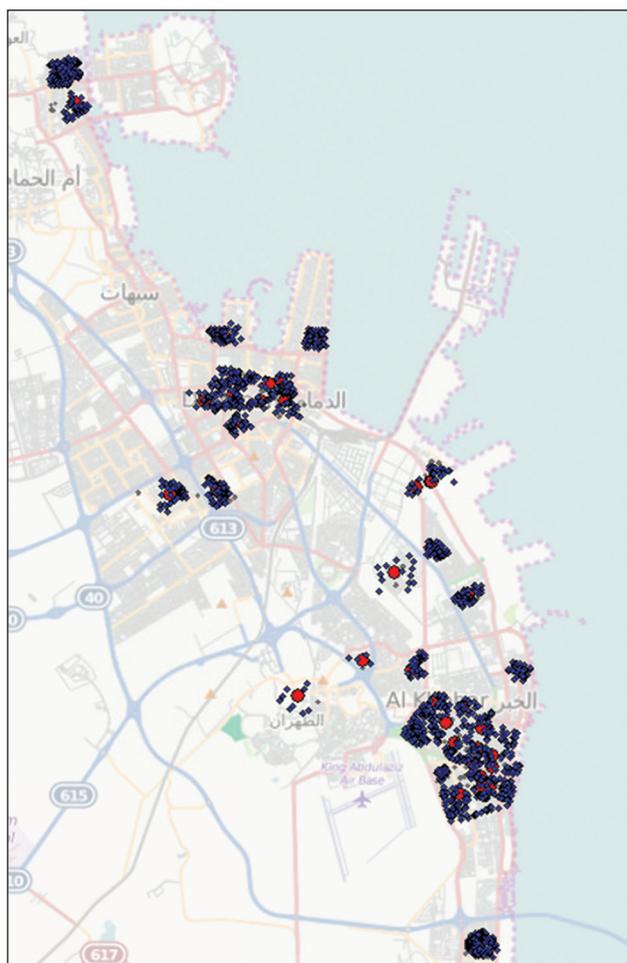


Figure 2. The location of vacant lands within 1200 m from the patients' homes (represented by red dots)

It also found 17% have a FBG level of above 200 mmol and 47% of the patients have borderline or high risk HDL. The most frequent diabetes manifestations experienced are: extreme fatigue and related tiredness, tension and stress, and blurred vision, and inability to control their nervous system. Whereas the least experienced symptoms are: loss of sensation, cardiac problems, loneliness and isolation; and blood pressure problems.



Figure 3. The calculation of service area from the diabetic patient's homes on 400, 800 and 1200 m intervals

Living conditions

In terms of diet: 48% - 59% rarely or never drink fizzy drinks or eat junk food meals. Approximately 77% said that they often or always eat fruits and vegetables. When asked about their home and social lives, more than half of them (57%) said they never or rarely engage in morning exercises. Approximately 25% rarely or never walk for more than 30 minutes a day and only 48% said they walk for 30 minutes. As much as 67% said that they frequently participate in religious activities and 59% said they frequently get involved in social activity vs 41% who rarely or never involved in social activities. 72% of the respondents said that they often or always watch TV or work in the office.

Home and neighbourhood conditions

Patients were asked about their indoor and outdoor conditions. Half of the patients said they frequently suffered from a lack of sunlight in the house. More than a third said they frequently suf-

ferred from unpleasant outside views, and low level of ventilation in the house. Nearly a quarter said they frequently suffered from: lack of hygiene in the neighbourhood, traffic noise, noise from neighbours, and difficulty of wandering around in the neighbourhood. Around 20% said that they frequently experienced uncomfortable temperatures and poor air quality in the house, poor finishing of the house, the house organization and size, and disgusting doors in the neighbourhood.

The proximity of mosques and vacant lands

61% of patients have mosques within 400 m from home, 31% have mosques within 800 m from home and 8% have mosques that are more than 800 m from home. With regards to vacant lands, 75% of patients have vacant land lots are within 800 m from their homes, 64% of patients have vacant lands within less than 400 m from their homes. 82% of patients have vacant land lots with 2400 sq. and. m within 1200 m from their homes. 18% of the patients have 1-20 vacant land lots within 1200 m from their homes and nearly half of the patients (i.e. 57%) have more than 20 vacant land lots within 1200 m from their homes.

The visual survey results

Fourteen mosques and ten vacant lands in lower class, middle and upper middle class residential and mixed use areas (i.e. commercial and residential) neighbourhoods were visually surveyed. Mosques in gated neighbourhoods (i.e. residential compounds), were also surveyed. In respect to the mosques, the survey indicates the following points:

- In a number of neighbourhoods, mosques are very near to each other. Islamic scholars emphasized having one mosque in the neighbourhood rather several mosques unless there is a very strong need to do so. These scholars indicated the preference of extending existing mosques horizontally and vertically rather than having more than one mosque in the neighbourhood. The reason is to maintain the Muslims unity and eliminate any cause of disperse;
- Some of the mosques (i.e. 4 out of 14), the quality of construction materials used is below the acceptable standard. Also, the maintenance level of the site in 7 mosques

is poor. Most of the mosques have low level of cleanness and hygiene for toilets and ablution facilities. The level of cleanness of surrounding streets in 11 cases is also poor;

- There is a public garden adjacent to five mosques only. In two cases, these gardens are separated from the mosque by a street without safe crossing;
- For five cases, there is vacant land lots adjacent to the mosque;
- In respect to the attractiveness and creation of pleasant impression, six mosques have poor visual appearance;
- 8 out of 14 mosques are surrounded by 3-4 streets and 12 out of 14 mosques have no safe crossings and four mosques only have designated car parks;
- All mosques do not have facilities to accommodate the needs of Muslims of all ages
- 10 mosques out of 14 do not have shaded areas on site;
- Mosques in gated compounds can be only used by the compound's residents and their guests. So, they are inaccessible to the neighbours due to the fact the entry to these compound needs special permission;
- Several mosques (i.e. 9 out of 14) are very close to the street and have no buffer zone to reduce traffic noise; and
- Consequently, there is no attractive green, shaded (apart of casted shadows from the buildings) thermally comfortable, and safe street corridors that lead to these mosques.

The vacant lands surveyed were found to be highly polluted which are used for dumping rubbish, construction waste and wrecked or decommissioned vehicles. They are occupied by illegally parked cars and lorries. Some have temporary car parking canopies belonging to the nearby houses, and portable trailers that are occupied by low income foreign labour.

5.2 The relationship between the mosques and vacant lands with diabetics' activities

The Regression test showed significant relationships between physical and religious activities and proximity of mosques and vacant lands (Table

1). For example, when the distance between the mosque and home increases, diabetics spend more time watching TV or working in the office. They also, reported the difficulty of wandering around in the neighbourhood. The shorter distance, larger areas and numbers of vacant lands negatively affected religious and social activities of the diabetics as well as their fitness activities. Also, they are linked with diabetics spending more time watching TV or working in the office (Table 1).

5.3 The role of personal and neighbourhoods' attributes in controlling the relationship between mosques with diabetes' tests, symptoms and environmental conditions

Using the same data categories stated above, the ANOVA test showed that for males, when the distance from home to the mosque increases, patients spend more time at home to watch TV or do office work. For females, the longer distance to the mosque is associated with a higher pulse level and decreasing ability to control nervous system (table 2).

Patients aged less than 20 years' experience higher levels of anxiety when the mosque is distant. Patients aged 20 to 40 years old, have higher levels of lipid LDL when the mosque is distant. Also, more patients complained about uncomfortable house temperature when the mosque is distant (Table 2).

Patients who finished their high school, have higher pulse and cholesterol levels which is associated with longer distance to mosque. They also experience frequent paranaesthesia when the mosque is away. Patients living in medium density

area, frequently feel uncomfortable temperature in the house when the mosque is away. Patients living in villas frequently experienced paranaesthesia when the mosque is away (Table 2).

Patients living in dwellings with area 101-200 m² experienced frequent feeling of anxiety and inability to relax when the mosque is away. Patients living in urban areas, have higher levels of Pulse, cholesterol and Lipid LDL levels when the mosque is away. Patients living in low density areas, have higher levels of BP Systolic, pulse, Fasting Blood Glucose

FBG) when the mosque is away (table 2).

5.4 The impact of mosques proximity via vacant land on medical condition of diabetics

SEM was used to test clinical assessment tests, self-reported home and neighbourhood's environmental conditions with the mosques and vacant lands information. For each SEM diagram (see Figure 1, 2, 3& 4 appendix A as an example), the study investigated the effect of mosque distance (as an independent variable) on the medical condition of the patient and self-reporting of diabetes symptoms (as a dependent variable). The mediating variables are self-reported home conditions, neighbourhood conditions, and vacant lands information.

Only significant results (i.e. $P < 0.05$) are reported below (table 3). In respect to the clinical assessment tests, the SEM results showed that when the distance to the mosque decreases, the number of vacant lots within 1200 m increases, and this is associated higher Systolic, Microalbuminuria, FBG and HBA1C levels.

Table 1. The relationship between mosques and vacant lands proximity with the diabetics' activities (Significance level <0.05, sample size=76)

Independent	Dependent variable	Estimate	Sig.
The distance between home and mosque	Watching TV or working in the office	-0.388	0.027
	Difficulty of wandering around in the neighbourhood	-0.345	0.044
The distance between home and vacant land	Religious activities	0.292	0.020
	Social activities	0.474	0.000
Vacant land area within 1200 m from home	Watching TV or working in the office	0.278	0.001
Number of vacant lands within 1200 m	Doing Morning exercises	-0.515	0.003
	Walking for 30 minutes	-0.421	0.011
	Watching TV or working in the office	0.439	0.005
	Difficulty of wandering around in the neighbourhood	0.432	0.004

Table 2. Optimal Categorical Regression test showing the level of importance of each home, work and neighbourhood variable for each of the respondents' groups

Category	Independent	Dependent variable	Mean Square	F	Sig.
Personal attributes					
Gender = female	Home distance from mosque	Pulse	0.430	12.895	0.000
		Inability to control nerves	5.931	4.473	0.011
Age less than 20	=	Constant anxiety	12.033	30.943	0.011
Age = 20 to 40	=	Lipid LDL level	1.195	8.534	0.002
Age = 41 to 60	=	Uncomfortable temperature of house	1.538	9.609	0.019
The level of Education = Intermediate and secondary	=	Pulse	.482	8.441	0.004
		Cholesterol	1.536	7.084	0.004
		Paraesthesia	5.242	5.672	0.010
Neighbourhood attributes					
Density of the neighbourhood = Medium density	=	Uncomfortable temperature in the house	1.515	7.653	0.01
Neighbourhood type = Urban	=	Pulse	0.438	4.101	0.02
		Cholesterol	1.167	6.599	0.00
		Lipid LDL level	1.064	3.554	0.02
Density of the neighbourhood = low density	=	BP Systolic	1.201	3.938	0.03
		Pulse	0.391	3.81	0.04
		Fasting Blood Glucose (FBG)	4.68	2.617	0.09
The property's attributes					
House type = Villa	=	Paraesthesia	4.539	4.904	0.02
Area of the house = 101-200 m ²		Constant anxiety	7.008	5.345	0.06
		Inability to relax	5.633	8.741	0.03

With regards to reported diabetes symptoms, SEM showed that when the distance to the mosque decreases, the number of vacant lots within 1200 m increases which is associated with frequent feeling of paraesthesia, blurred vision and poor memory and inability to concentrate. When the distance to the mosque decreases, the number of vacant lots within 1200 m increases, and this is associated with frequent inability to control nervous system, constant anxiety, loneliness and isolation, feeling miserable, inability to relax and feeling overloaded. In respect to the neighbourhood results showed that patients having more difficulty in wandering around in urban areas which causes issues associated with higher blood pressure.

6. Discussion: identifying possible detrimental to diabetics' health

The visual survey on mosques showed residents in the metropolitan area of Dammam, Khobar and

Dhahran have sufficient number of mosques but in some neighborhoods, these mosques are not well located in accordance to the reasonable and comfortable walking distance that enable people including diabetics to attend prayers. Mosques however are not well connected in terms of smooth access, safety crossings, and shaded urban corridors, suffer from low maintenance and cleanness levels. They also do not have facilities on site or adjacent to, that would accommodate the needs of different age groups. Furthermore, mosques in gated compounds are inaccessible to their neighbors. On the other hand; there is overwhelming number of vacant lands in urban and suburban areas and these polluted sites have negative environmental impact on the neighborhoods.

The present study found a positive impact of mosque proximity on diabetics' physical and social activities. The positive relationship between mosques and diabetics activities is further found concerning gender (i.e. male) and age (i.e. less than 20).

KSA has harsh and polluted environmental conditions, and the literature review showed neighbourhoods and districts have lack of amenities and poor street conditions. Also, there is the segregation between facilities such as mosques and residences, and the gated compounds that isolate its' residents, and break the homogeneity of the urban fabric in terms of social equity. The Saudi culture to a certain limitation- encourages females to stay at home and males to practise outdoor religious, social and sport activities. These conditions would enforce citizens to practise unhealthy lifestyles. The research findings should be interpreted with respect of the above facts.

The study found that most of the patients have alarming level of diabetic HbA1C and two thirds of them are obese. The most frequent diabetes symptoms are stress, tiredness, blurred vision and inability to control their nervous system. Around

half of them frequently drink fizzy drinks, eat junk food and rarely engage in physical activity. More than one third of them rarely participate in social activities. Around a quarter of them rarely walk for more 30 minutes.

On the other hand, vacant lands proximity, area and number have negative impact on these activities. Thus, when there are larger vacant lands near patients' homes, more patients watch TV. When there are more vacant lands lots, patients feel high levels of micro albumin urea and HBA1C level and reported lipid problem. The results showed that the [Age] groups are sensitive to the existence of vacant land near their homes in different ways. For instance, the younger group complained from disgusting odours in the neighbourhood whereas the older group have higher level of lipid HDL when vacant lands are nearer. The shorter distance to the vacant land also negatively affects the pa-

Table 3. SEM links between variables showing the positive and negative regression weights (Significance level <0.05, sample size=76)

Independent (A)	Mediating variable (B)	Dependent (C)	Estimate1 (A Vs. B)	Estimate2 (B Vs. C)	Overall Estimate (A, B and C)	Sig. (A Vs. B)	Sig. (B Vs. C)
Clinical assessment tests							
The distance between home and mosque	Number of vacant lands within 1200m	Systolic	-0.485	0.177	-0.308	000	0.039
		Microalbuminuria	-0.485	0.118	-0.367	000	000
		FBG	-0.471	0.756	0.285	000	0.002
		HBA1C	-0.471	0.301	-0.17	000	000
Diabetes symptoms							
The distance between home and mosque	Number of vacant land lots within 1200m	Paraesthesia	-0.460	0.384	-0.076	000	0.038
		Blurred vision	-0.460	0.508	0.048	000	0.007
		Poor memory and inability to concentrate	-0.460	0.463	0.003	000	0.006
		Inability to control nerves	-0.470	0.448	-0.022	000	0.020
		Constant anxiety	-0.470	.499	0.029	000	0.009
		Loneliness and isolation	-0.470	.396	-0.074	000	0.014
		Feeling miserable	-.470	0.416	-0.054	000	0.010
		Inability to relax	-.470	0.411	-0.059	000	0.034
		Feeling overloaded	-0.470	0.473	0.003	000	0.011
Neighbourhood conditions							
Neighbourhood type (i.e. urban, suburban)	Difficulty of wandering in the neighbourhood	Blood pressure problems	-0.616	0.251	-0.365	0.041	0.040

tients' religious activity such as trips to the nearby mosque to perform five daily prayers.

The research found links between mosques' proximity and diabetes and this is in respect to certain personal and neighbourhood attributes. For instance, higher levels of reported diabetic symptoms such as anxiety and risky levels of lipid LDL are found in patients aged less than 40 years old. Patients living in smaller properties reported frequent feeling of anxiety and inability to relax when the mosque is away. The area characteristics i.e. urban and low density areas with longer distance to the mosque have negative impact on patients in terms of higher levels of Pulse, cholesterol and Lipid LDL, BP Systolic, pulse, and Fasting Blood Glucose (FBG).

The SEM results that vacant lands play negative role in controlling the relationship between mosques and diabetics status in terms of medical tests and reported diabetes symptoms. So, even when the mosque is nearer, the existence of vacant lands hampers the positive impact of the mosque on patients and it is believed that it worsens the patient's conditions. The area type i.e. the urban area also seems to discourage patients from wandering to attend the mosque for daily congregational prayers. The lack of walkability and physical activity is linked with reported blood pressure problems.

7. Concluding remarks: What (must) be done and how

This study presented the positive impact of physical and spiritual activities have on diabetic patient's health status. The study found strong links between the proximity of mosque and the medical status of diabetics. Shorter distances of mosques to patients' homes are associated with frequent physical and religious activities and better feeling of wellness and vice versa.

The above relationship however is hampered by the unhealthy outdoor living conditions that patients living. The large number and size and proximity of vacant lands to patients' homes have adversely impacted the relationship between mosques and patients' activities.

The relationship between mosques and Muslims is not limited to worship as. As stated above, Muslims go to the mosque to socialize,, obtain

social and spiritual advice, support from the congregational prayers' leader (i.e. imam) and their fellow Muslims. Vulnerable groups of the society as diabetics are in an emergence need for the community care and attention. So, to trigger the positive social, spiritual, psychological and health-wise role of mosques, the following actions are recommended on the following levels:

Architectural level: Level of design, construction, maintenance and cleanness of mosques should be per robust building standards. Visual appearance of the mosque and neighboring blocks, and site safety in use are important issues to consider as well. The provision of facilities on site is vital to activate the mosque role

Neighborhoods and urban levels: the Saudi standards of design of mosques should be reviewed considering number, distribution in high and low density areas and types of users such as elderly people and diabetics and the hot harsh weather of the KSA. So, mosques should be, within a walking distance from homes which can be easily accessed by shaded, well ventilated and safe urban corridors.

Municipalities should use assessment tools such as Health Impact Assessment (HIA) to assess from a health point of view the existing and new mosques conditions, their relationship with the neighborhoods and the effect of vacant lands on neighborhoods.

Local communities in urban and suburban areas should be involved in decision making concerning the design and planning of community centers that comprise integrated services as mosque, gym, nursery, community hall, public library, public garden, etc. So, these would effectively respond to the needs of all group users including vulnerable groups with chronic diseases as diabetics.

In respect to vacant lands, higher taxes on vacant lands should be applied in relation to the location of the land lots and owners should be granted planning permission valid for a set period. Authorities should not permit the transfer of ownership within the planning period as this would be used by the owners to avoid tax.

In the KSA, there are several urban contexts such as residential compounds, academic campuses, shopping malls, residential neighbourhoods, mixed type (i.e. commercial and residential or industrial and residential) neighbourhoods, road ser-

vice stations etc. Future research should examine the unique relationship between the proximity and functions of mosques with their urban contexts and how the proximity of other community services to the residences and mosques would help initiating the healthy lifestyles of citizens.

Acknowledgements

The author is grateful for the support that they received from University of Dammam, and medical staff at the Teaching Hospital of the University Dammam, KSA and the technical support by the staff and technicians at University of West of England, UK.

References

1. Raymond A. Cairo's Area and Population in the Early Fifteenth Century. In *Muqarnas II: An Annual on Islamic Art and Architecture*, 1984.
2. AURIAHC A report on historical districts in Cairo, Egypt, prepared by Architectural and Urban Studies and Revival of Islamic Architectural Heritage Centre (AURIAHC). Cairo, Egypt, 1990.
3. Mosque development committee, Abu Dhabi Mosque Development Regulations: guidebook number one. Abu Dhabi, UAE. 2014.
4. Yusof A, Kamaruddin R. Travel Behaviour Kamaruddin and Land use Planning: The Planning of Mosque in Shah Alam, Selangor. *Procedia - Social and Behavioral Sciences*, 2013; 105: 723-733, doi: 10.1016/j.sbspro.2013.11.075
5. Kahera A, Abdulmalik L, Anz C. *Design Criteria for Mosques and Islamic Centers: Art, Architecture, and Worship*. Routledge, UK. 2009.
6. Ministry of Municipal and Rural Affairs (MOMRA). *The residential quarters and neighbourhoods Planning Guide*. AL Riyadh: KSA, 2005.
7. Aazam, Z. *The social logic of the mosque: a study in the relationships between building typology and urban morphology*. Paper 59, pp 1-12, Proceedings, 6th International Space Syntax Symposium, İstanbul, 2007.
8. International Diabetes federation. *IDF DIABETES ATLAS*, 2012. http://www.idf.org/sites/default/files/5E_IDFAtlasPoster_2012_EN.pdf [Accessed December 2013]
9. Bray R, Vakil C, Elliott D. *A report on public health and urban sprawl in Ontario: a review of the pertinent literature*. Environmental health committee, Ontario College of Family Physicians, 2005. Retrieved from <http://www.ocfp.on.ca/docs/publications/urbansprawl.pdf> [Accessed June 2014]
10. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *The Lancet*, 2002; 360 (9331): 473-482, dx.doi.org/10.1016/S0140-6736(02)09678-2 [accessed 13 April 2012].
11. Eckel RH, York DA, Rössner S, et al. Obesity, a Worldwide Epidemic Related to Heart Disease and Stroke: Executive Summary, AHA Conference Proceedings Prevention Conference VII. *Circulation*, 2004; 110: 2968-2975.
12. Malhotra A, Noakes T, Phinney S. It is time to bust the myth of physical inactivity and obesity: you cannot outrun a bad diet (Editorial). *Br. J. Sports Med.*, 2015. <http://dx.doi.org/10.1136/bjsports-2015->
13. Kelishadi R, Mirghaffari N, Poursafa P, Gidding S S. Lifestyle and environmental factors associated with inflammation, oxidative stress and insulin resistance in children. *Atherosclerosis*, 2009; 203: 311-9. dx.doi.org/10.1016/j.atherosclerosis.2008.06.022
14. Jeppesen P, Bek T. The occurrence and causes of registered blindness in diabetes patients in Arhus County, Denmark, *Acta Ophthalmol. Scand*, 2004; 82(5): 526-530.
15. Chaturvedi N, Stevens L K, Fuller J H, Lee E T, Lu M. Risk factors, ethnic differences and mortality associated with lower-extremity gangrene and amputation in diabetes: The WHO Multinational Study of Vascular Disease in Diabetes, *Diabetologia*, 2001; 44: 65-71.
16. Martinez ML, Devenport J, Saussy J. @ Drug Associated Heat Stroke, *Southern Medical Journal*, 2002; 95(8): 799-803.
17. WMO. *Heat waves and health: guidance on warning system development*, 2010.
18. www.wmo.int/pages/prog/wcp/ccl/opags/documents/HeatWavesandHealthGuidance_26July2010.pdf [Accessed October 2012]
19. Koenig H G, Al Zaben F, Khalifa D A. Religion, spirituality and mental health in the West and the Middle East. *Journal of Asian psychiatry*, 2012; 5(2): 180-182, DOI: <http://dx.doi.org/10.1016/j>

ajp.2012.04.00

20. Ferraro K F, Kim S. Health benefits of religion among Black and White older adults? Race, religiosity, and C-reactive protein. *Soc Sci Med.*, 2014; 120: 92-9. doi: 10.1016/j.socscimed.2014.08.030.
21. Hamidia F, Bagherzadehb Z, Gafarzadeh S. The Role of Islamic Education in Mental Health. *Procedia - Social and Behavioral Sciences*, 2010; Vol. 5: 1991–1996.
22. Hadianfard H. Subjective mental well-being and religious activities in a group of Muslims, *Iranian Journal of Psychiatry and Clinical Psychology (thoughts and behavior)*, 2005; 11: 224-232.
23. Clayden A, Mckoy K, Wild A. Improving residential liveability in the UK: Home zones and alternative approaches. *Journal of Urban Design*, 2006; 11: 55-71.
24. Manadeli K N. Public spaces in Jeddah, Saudi Arabia. In Ali Madanipour (ed.) *Whose Public Space?: International Case Studies in Urban Design and Development*, Routledge, UK, 2010; 148-171.
25. Barton H, Grant M. Urban planning for healthy cities: A review of the progress of the European Healthy Cities Programme, *Journal of Urban Health, Bulletin of the New York Academy of Medicine*, 2011. <http://dx.doi.org/10.1007/s11524-011-9649-3>
26. Handy S. Does the Built Environment Influence Physical Activity? Examining the Evidence. *Critical Assessment of the Literature of the Relationships among Transportation, Land Use and Physical Activity*, Paper prepared for the Transportation Research Board and the Institute of Medicine Committee on Physical Activity, Health, Transportation, and Land Use. Transportation Research Board. Special Report 282, 2005.
27. Pikora T, Giles-Corti B, Knuiaman M. et al. Neighbourhood environmental factors correlated with walking near home: using SPACES, *Medicine and Science in Sports and Exercise*, 2005; 38(4): 708-714.
28. Garvin E, Branas C, Keddem S, Sellman J, Cannuscio C. More than just an eyesore: local insights and solutions on vacant land and urban health. *J Urban Health*, 2013; 90(3): 412-26. doi: 10.1007/s11524-012-9782-7
29. Choguill CL. Developing Sustainable neighbourhoods, *Habitat International*, 2008; 32: 41–48.
30. Alshuaibi MM. Retrieving of the city centres: A case study of the Prince Bander Bin Abdullazziz Street, Alkhuber (Alsuwaikit). M.Sc. thesis. University of Dammam. KSA. 2012.
31. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. *International Journal of Behavioral Nutrition and Physical Activity*, 2011; 8: 140. <http://dx.doi.org/10.1186/1479-5868-8-140>

Corresponding Author

Bhzad Sidawi,

College of Architecture and Planning,

Imam Abdulrahman Bin Faisal University,

Dammam,

Kingdom of Saudi Arabia

E-mail: bsidawi@uod.edu.sa

Appendix A

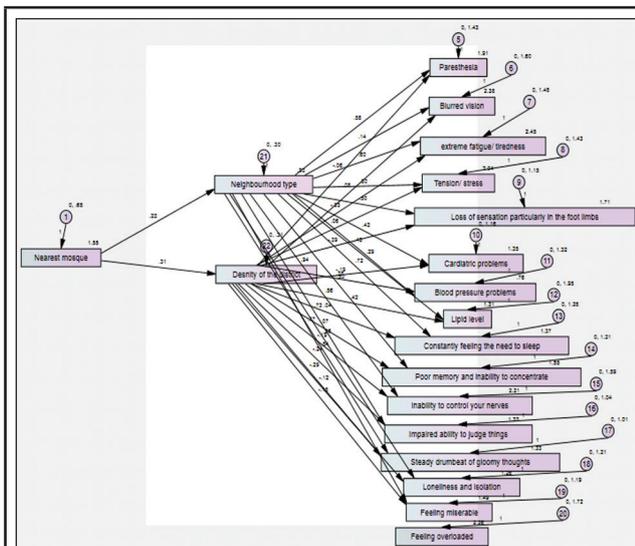


Figure 1: the SEM diagram showing the relationship between the independent variable Proximity of the mosque and the dependent variables diabetes symptoms mediated by the neighbourhood conditions from neighbours on Watching TV or working in the office. (note: the diagram shows the standardized regression weights)

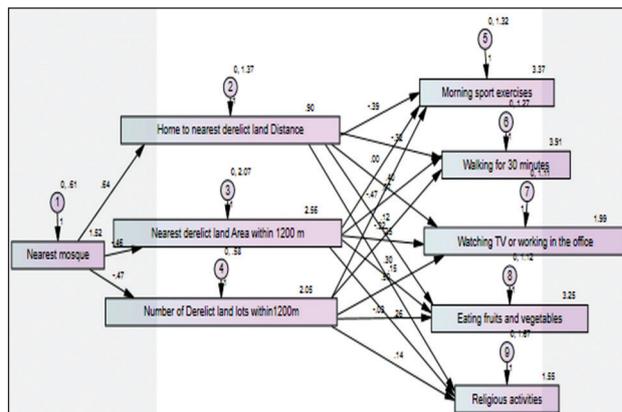


Figure 2: the SEM diagram showing the relationship between the independent variable Proximity of the mosque and the dependent variables Physical, religious activities mediated by the vacant lands. (note: the diagram shows the standardized regression weights)

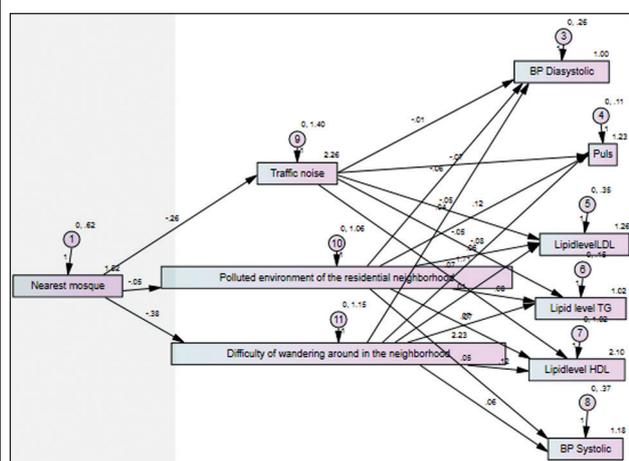


Figure 3: the SEM diagram showing the relationship between the independent variable The mosque proximity and the dependent variables clinical assessment tests. A number of outdoor conditions act as mediating variables (note: the diagram shows the standardized regression weights)

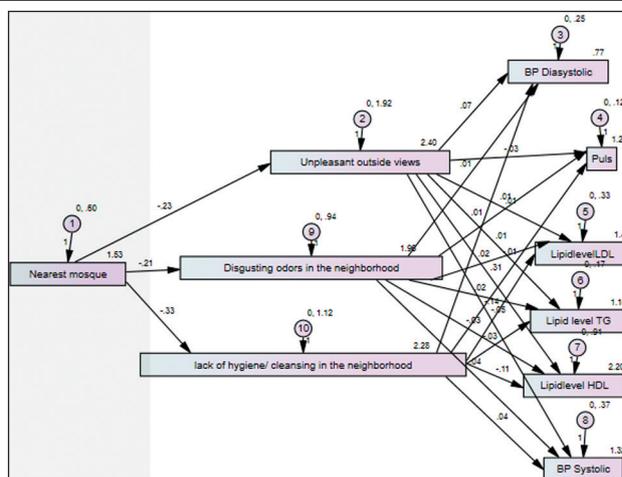


Figure 4: the SEM diagram showing the relationship between the independent variable the mosque proximity and the dependent variables clinical assessment tests. A number of outdoor conditions act as mediating variables (note: the diagram shows the standardized regression weights)

Techno - economic analysis of reverse engineering usage in design applications

Sladjan Lovric, Alan Topcic, Edin Cerjakovic, Muhamed Heric

Faculty of Mechanical Engineering, University of Tuzla, Bosnia and Herzegovina.

Abstract

Today, manufacturing companies are more and more forced to find and implement new production methods and systems in the order to respond to the market demands according to set deadlines and appropriate qualitative characteristics of its products. One of possible solutions that is increasingly becoming interesting to those companies is the application of systems for Reversible Engineering (RE) in various areas of industrial production. Thanks to its characteristics, the RE process found a wide range of practical application in numerous industrial branches, and one of them is automotive industry. In this paper is presented techno-economic analysis of implementation of RE in creation of technical documentation of submitted automotive interior part with the aim to redesign it according to specifications. A special place in the paper is dedicated to the methodology of the pre-processing of three-dimensional (3D) digitalised data with special reference to the innovative method of data processing based on the application of artificial neural networks, which are used to flattening of data without reducing the number of 3D digitized data. By this way the processed raw cloud of 3D digitized data better describes the real object of digitalisation without reduction of number of its points.

Key words: Traditional approach, modern-day approach, pre-processing, CAD model, sets of data.

1. Introduction

Modern production systems are characterized by continuous efforts for increasing of efficiency through optimization of production processes. Today it can be notice the obvious trend of dynamic development of innovative production systems and processes in order to fulfil the requirements of the market. In fact, the aim of these efforts is to reduce so-called time-to-market (of time that passes between getting ideas about the product

and bringing that finished product to the market), reducing the cost of products, increasing of product quality, and so on. One potential approach to achievement of these objectives is application of the RE system sin daily practice. From the point of specific application area re can be seen in the narrow and broad sense. In the narrow sense, RE implied duplication of geometrical characteristics of existing component, assembly or product in cad software without the aid of technical documentation or existing cad model. In a broader sense, RE can be seen as a systematic approach for analyzing of existing device or system, and it can be applied to the study of the design process of specific parts / systems, as well as, an initial step in the process of redesigning of existing product.

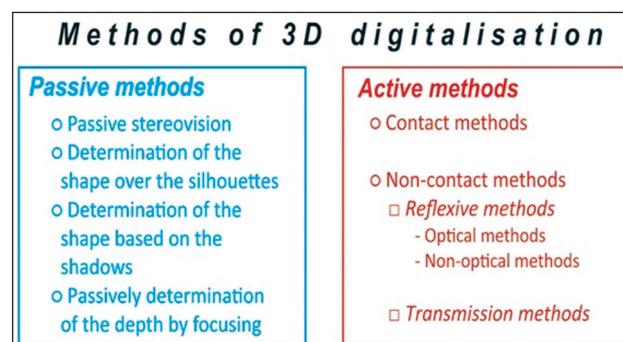


Figure 1. Review of methods of 3D digitalisation

In this context, RE can be applied to study the internal, as well as, all other parts of the cars with the aim of comparing the existing part with the results of some analysis in order to obtain suggestions for potential improvement or customization of parts [1].

Usage of RE in the automotive industry creates preconditions for reducing the time-to-market, improving the quality of products and lowering the cost of product development. In principle re is based on 3D digitalisation i.e. On gathering of information about the coordinates of the points from the surface of the physical object in 3d space and

their translation into digital format which generates the raw cloud of points which in virtual space describes/represents object of digitalisation. During the time a series of methods and approaches for 3D digitalisation i.e. Gathering of required geometrical information are developed, (figure 1). Gathered information that virtual describes object of digitalisation has certain deviation in comparison to real object. These deviations are result of many influences that occurred during realisation of process itself (the presence of noise, i.e. Measurement errors and peaks, a large number of “unnecessary” points, disorganized and incomplete data [1]). In order to reduce above mentioned errors to a certain acceptable value pre-processing of the raw cloud of points is implemented, with following sub-phases: elimination of impulse errors, flattening of data and reduction of the number of points, (Figure 2). Often, first two sub-phases i.e. Elimination of impulse errors and flattening of data are covered by the term of filtering data - points.

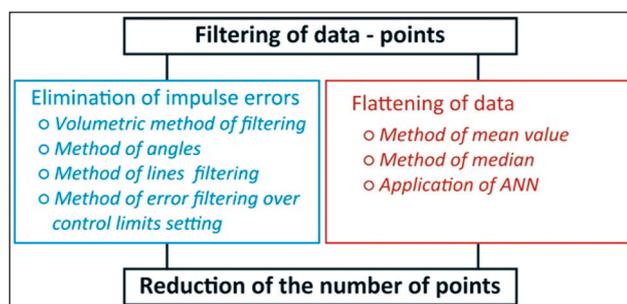


Figure 2. Phases and methods of pre-processing of 3D digitalised data

In various literature sources, depending on the type, purpose and specific requirements of RE systems, there are some additional or modified sub-phases: analysis of straightness, regression analysis and recovery of data-points [1, 2, 3], then flattening of data - points [4] as well as, sub-phases of extraction of data by cross sections and generating of transverse and contour curves, which are specific to the systems based on the methodology of cross-sections [5, 6, 7]. On the other hand, with polygonal approach to a RE process, there are certain specific sub-phases such as: selection of group of triangles for triangulation, selection of edges – entities and *Delaunay's* triangulation [7, 8]. It should be noted that there is the problem of different comprehension of pre-processing phase, both in terms of lim-

its, as well as in term of inclusion of sub-phases. In some cases, some of individual above mentioned sub-phases can be found outside of pre-processing phase, and some other like segmentation [1, 9] can be included in. Because of that there are some differences in terms of the interpretation of the concept itself, i.e. some of authors [3, 9] perceive this phase as processing phase, without a prefix “pre”. However roughly it can be taken that pre-processing phase begins with the completion of 3D digitalisation and ends with the beginning of the generation / creation of surface CAD model. In the present-day literature that addresses this issue is given a set of methods used in pre-processing of raw cloud of points with the aim to provide a useful set of data that most adequately describes the object of 3D digitalisation. The problem of too many points is reflected in the fact that during the 3D digitalisation of physical objects, large amounts of data – points are collected. This is especially typical for non-contact methods of 3D digitalisation. However, the fact is that the more complex surface of physical object requires a greater number of points for satisfactory interpretation of digitalised object in virtual CAD space (process known as a term reconstruction). At the same time, this large amounts of data can negatively affect the data processing by slowing of processing, by requirement for powerful hardware and in extreme cases can make all processing impossible for realisation. In other words, available CAD systems in general, due to the limited memory and processor resources, are not able to process the vast amount of points obtained directly by 3D digitalisation of scanned surfaces of the physical object [9]. In addition to the problems associated with manual 3D digitalisation of parts with complex geometry, the problems associated with the necessity of processing of large volumes of scanned data are important obstacles for automation of RE process. Accordingly, it is necessary to reduced amount of obtained 3D digitalised data before being sent to some of the software for the reconstruction of the surfaces. At the same time level of reduction needs to ensure the preservation of the quality of the reconstructed surface, because every wrong reduced point can lead to increase of errors at CAD model [9].

Upon completion of the pre-processing of raw cloud of points, 3D CAD model of the object of digitization is generated. According to some stud-

ies [10], a lot of time ca. 85% of the total time during realisation of RE process is spent on the phase of generation of surface model. Because of that, partial or complete automation of this phase would significantly contribute to increasing of productivity of RE process. One of the possible approaches for a partial automation of a process of creation of a surface CAD model is implementation of artificial neural networks at the second stage of pre-processing of “raw” set of data with unreduced number of digitalised points. By applying of the described approach the raw cloud of points will be in the second stage of pre-processing flattened in the shape similar to the generated surface CAD model.

In other words, the time necessary for generation of surface CAD model will be reduced while quality - accuracy of the CAD model will be better because the cloud of points was generated without mutual overlapping of digitalised data.

2. Object of digitalisation

In the daily business activities are frequently encountered requirements for re-design and correction of existing components that for certain reasons there is no technical documentation. These requirements are especially present in so-called “after-market parts” for the needs of the automotive industry. One of such specific requests was used as an object of research, which are presented in this paper. In particular, it is the re-design and creation of technical documentation of submitted automotive interior part of the world famous car manufacturer (Figure 3. a). The aim was creation of “after-market” part in accordance to specific requests. The concept of reverse engineering was used because there was not available the original technical documentation.



Figure 3. a) Submitted sample - object of digitalisation, b) 3D digitalisation by laser scanner Next Engine 3D Scanner HD

In order to perform comparative techno-economic analysis, technical documentation is made in the traditional approach, as well as by application of RE approach. The term traditional approach refers to development of technical documentation based on the usage of conventional methods for defining of geometrical characteristics of physical parts. In this particular case, on both implemented approaches the analysed parameters are: overall costs of creation of technical documentation and total geometric deviation of obtained parts from the original part (assessment performed by

CAD inspection). Implementation of all activities in the Laboratory for Rapid Prototyping and Reverse Engineering on the Faculty of Mechanical Engineering in Tuzla was realised. Upon completion of the procedure of 3D digitalisation (Figure 3. b) obtained “raw” cloud of point (Figure 4. a) is pre-processed.

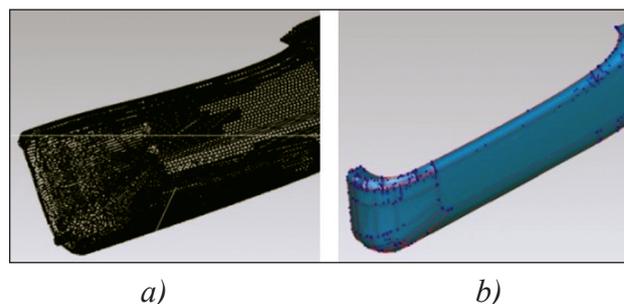


Figure 4. a) Raw, non-pre-processed cloud of points, b) Reconstructed 3D polygonal model of digitalised object

In the first phase of pre-processing, so called reconstruction of the collected data is performed. It basically presents a merge of multiple sampled segments of scans of a certain object in a single entity.

The scans are a set of information about the interrelated points which form a net of polygons, and contain information (points, surfaces) on certain projections of sampled object. By overlapping of scans, 3D CAD polygonal model that is basic digital copy of object of digitization is generated (Figure 4. b).

In this process, part of the information is unique and cannot be obtained from a net of polygons or any other projections, while part of information is redundant i.e. there is overlapping with other nets.

In the second phase of pre-processing, on the basis of appropriate alignment algorithm, joining of redundant network is performed. The joining

process is repeated until the set requirements are not met (e.g., joining with the minimum error) or until a certain number of iterations is completed.

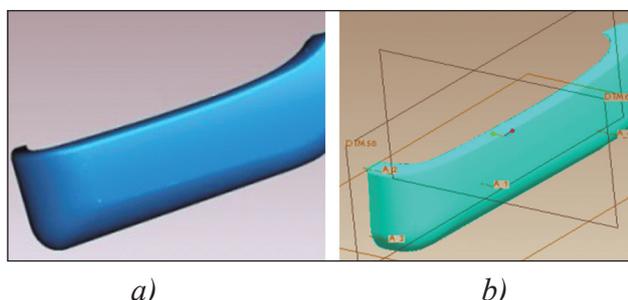


Figure 5. Obtained 3D CAD model: a) RE approach, b) traditional approach

The result of this alignment process is usable 3D CAD model of raw clouds of points. The resulting CAD model is processed by different methods (Figure 2), which finally enables creation of the final 3D CAD model of object of digitalisation, (Figure 5.a.).

For the purposes of the pre-processing of raw clouds of data obtained by 3D digitalisation, in addition to existing methods, a new method based on artificial neural networks (ANN) on observed case is developed and applied.

With the aim to pointing out of the qualitative improvement of geometric information about object of digitalisation, CAD inspection of not pre-processed set of data and pre-processed set of data by new method is made (Figure 6, Table 1).

Table 1. 3D comparison of: digitalised row cloud of points, versus, obtained RE 3D CAD model pre-processed by ANN method

Reference model	Obtained CAD model
Test model	Real non pre-processed set of data
Total number of points	223294
Number of deviating poi	662
	3D deviations [mm]
Maximal critical	0,248
Maximal nominal	0,062
Minimal nominal	-0,062
Minimal critical	-0,248
	Deviation [mm]
Maximum Upper	0,123
Maximum Lower	-0,137
Central	0,002/-0,002
Standard	0,003

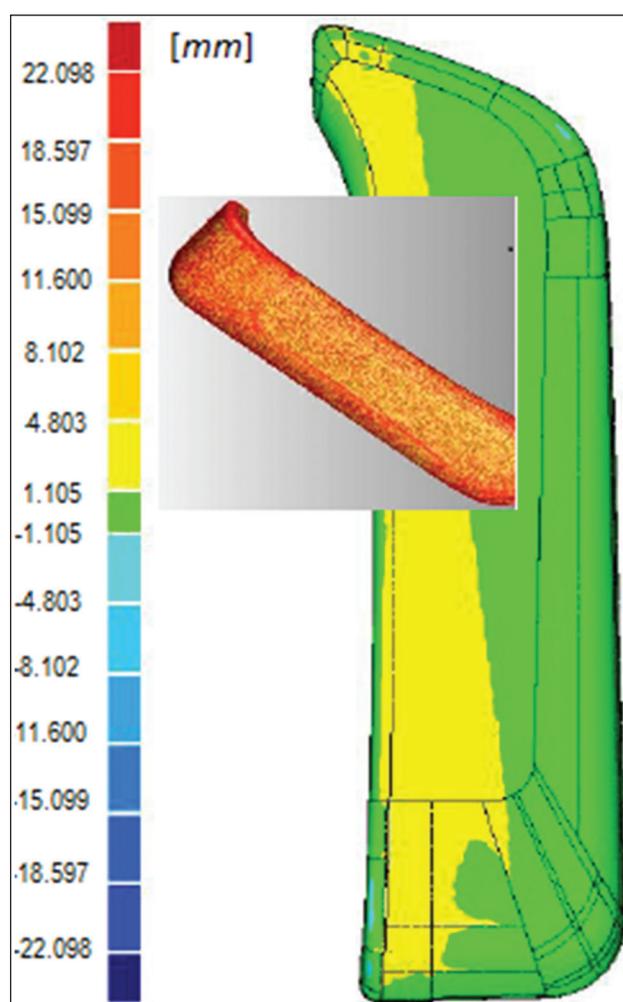


Figure 6. Results of CAD inspection, overlapping of row cloud of points (red dots) and obtained RE 3D CAD model pre-processed by ANN method (yellow solid)

The results of the CAD inspection indicates a satisfactory quality of geometric data pre-processed by applying adequately structured and trained ANN. Creation of appropriate 3D CAD model using of traditional approach begins with the reception of the technical documentation or sample (if there is no technical documentation) of product which need to be produced. Upon receipt of corresponding input parameters (technical documentation or sample) expert services within the factory (technical services, design office, department for logistics, etc.) perform an analysis of received parameters in order to obtain technical documentation and in accordance with the analysis conclusions next activities are carried out. In the case when an input parameter in the production process is sample of physical part who

require certain adjustments according to specification, following steps include many measurements technique by devices to obtain geometrical characteristics of sample and after that creation of 3D CAD model and corresponding technical documentation of submitted sample can be carried out. In this case as an input parameter in the production process was the submitted sample (Figure 3a). Using the traditional method presented above, on the basis of the measured geometrical values from the submitted sample, corresponding 3D CAD model shown in the (Figure 5.b) has been created. In order to point out the differences in accuracy between the resulting 3D CAD models created by usage of traditional and modern-day (RE & ANN) approach, on the basis of the obtained samples on the (Figure 7) and the table 2 is presented overview of completed CAD inspection. Corresponding results obtained by CAD inspection indicates that the total number of deviating points (points that do not overlap) is 32534 points, which is much more deviating points in comparison to CAD inspection presented on the (Figure 6). Also it can be seen that the maximum upper and lower deviations of the observed 3D CAD models 6.232 [mm] in absolute values. Although at this comparison there is no so called initial “zero” CAD model, according to presented results it can be concluded that there is a difference between the created 3D CAD models obtained by the traditional approach and by the RE & ANN approach.

The results of the CAD inspection are presented in the table 2.

Table 2. 3D comparison of observed CAD models (CAD model created by traditional approach, versus, CAD-model created by RE & ANN approach)

Reference model	CAD model, traditional approach
Test model	CAD model, RE & ANN approach
Total number of points	196763
Number of deviating points	32534
3D deviations [mm]	
Maximal critical	6,232
Maximal nominal	2,074
Minimal nominal	-2,074
Minimal critical	-6,232
Deviations [mm]	
Maximum Upper	6,232
Maximum Lower	-6,232
Central	0,008/-0,002
Standard	0,458

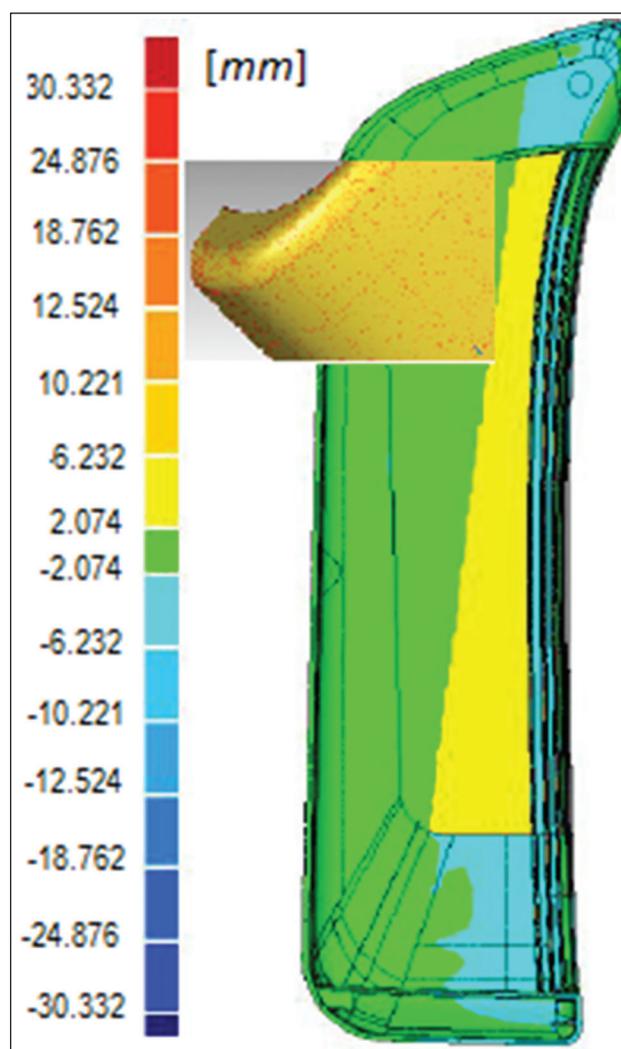


Figure 7. Overlapped 3D CAD models (CAD model created by traditional approach – RED DOTS, versus, CAD model created by RE & ANN approach – YELLOW SOLID)

For the purpose of comparison of the implementation costs of two presented approaches for creation of 3D CAD models from the same starting part to the same output (3D CAD models with corresponding geometrical characteristics), cost analysis of all activities is made. It is important to emphasize that both of used approaches, according to their characteristics, have a different implementation steps, as well as because of universal perception of result of costs analysis, the cost are represented by a neutral monetary units i.e. [MU]. The results of the cost analysis are presented in the table 3.

Comparative display of results obtained by cost analysis, are presented at the (Figure 8). For practical reasons, it was assumed that the qualitative geometric characteristics of both created 3D CAD models is the same, and therefore the absolute value equal to one is assigned to them. Above mentioned assumption comes from the fact that when is used traditional approach, in contrast to RE & ANN approach, there is no initial “zero” CAD model which can be used for comparisons and detect deviations of the obtained 3D CAD model from the initial “zero” model. Furthermore,

during implementation of traditional approach for measurement of the geometrical characteristics of the sample more measurement instruments are used, therefore the quality of the obtained 3D CAD model depends on the accuracy of the instruments and the skills of operator, etc. However, for assume is that because of the ways of obtaining of the 3D CAD model with RE & ANN approach it can be expected significantly better qualitative geometric characteristics of model compared to the model obtained by traditional approach. Regardless of the all the above mentioned, because of the difficulty in quantifying of qualitative geometrical characteristics between obtained the 3D CAD models, in this paper it is assumed that the geometrical qualitative characteristics identical in both cases.

Table 3. Overview of costs

Traditional approach to creation of technical documentation			
Obtaining of technical documentation - phases	Req. time [h]	Costs per hour [MU]	Total costs [MU]
Analysis of the initial sample	3	50,00	150,00
Measurement of sample	10	50,00	500,00
3D modelling of sample	20	50,00	1.000,00
Creation of 2D drawing	8	50,00	400,00
In total [h]	41	Direct costs in total [MU]	2.050,00
Additional costs [MU]			300,00
OVERALL COSTS [MU]			2.350,00
RE & ANN approach to creation of technical documentation			
Obtaining of technical documentation - phases	Req. time [h]	Costs per hour [MU]	Total costs [MU]
3D digitization of sample	0,6	50,00	30,00
Pre-processing of digitized 3D data	4	50,00	200,00
Creation of 2D drawing	8	50,00	400,00
In total [h]	12,6	Direct costs in total [MU]	630,00
Additional costs [MU]			300,00
OVERALL COSTS [MU]			930,00
<i>Note: All activities are implemented by an engineer</i>			

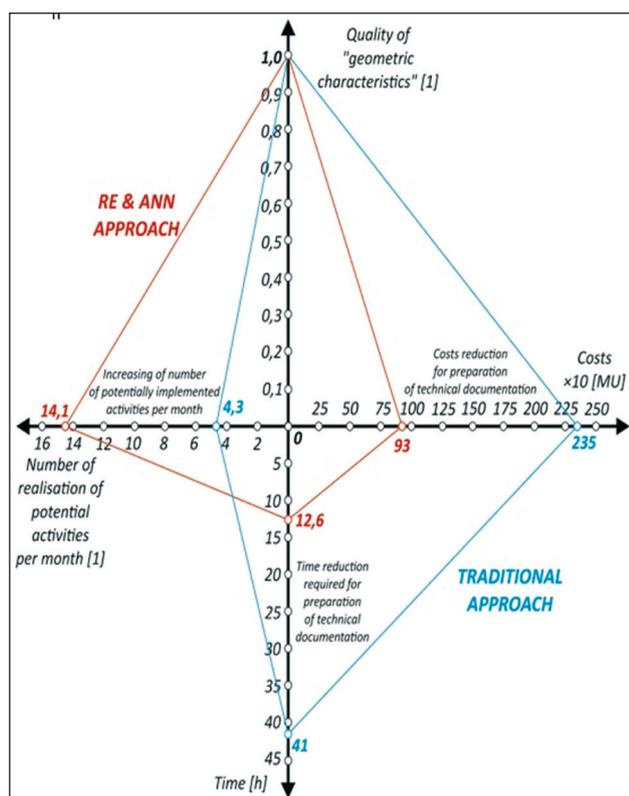


Figure 8. Comparative presentation of the results of the cost analysis

3. Conclusion

The application of modern methods, approaches and techniques in everyday industrial practice is inevitability, which adequately implemented enables improvement of the competitiveness of the process, and ultimately the production system in its entirety. With the aim of emphasizing the specific advantages of usage of the modern (RE) additional innovated (ANN data pre-processing) approach, compared to the traditional approach to creating of 3D CAD models based on the existing sample (Figure 3.a) a comparative analysis of the quality of "geometric characteristics" as well as economic aspects of the application of observed approaches was performed and presented. A special aspect of the presented analysis is devoted to the pre-processing of the collected data - the "raw" cloud of point, where is pointed out the influence of this phase on the "geometric" quality of the finished 3D CAD models. Within this, it is presented a new approach to the pre-processing of raw data by usage of appropriately structured and trained ANN, and the results of application the above mentioned approach are presented on

the (Figure 6) and on the Table 1. These results indicate the importance of adequate pre-processing of "raw" data from the aspect of obtaining a satisfactory geometrical quality of the resulting 3D CAD model, i.e. the preservation of a sufficient number of quality information on the geometrical characteristics of the object of digitalisation. In particular, by application of approach based on pre-processing of the "raw" digital data by ANN, at 0.296% points occurs deviation from the "raw" set of points without application of pre-processing with a maximum deviation of 0.062 [mm] between points. These points that deviate, in essence, represents a loss of geometrical information of the resulting 3D CAD model. In relation to the starting "raw" cloud of digitalised points. According to the results of a comparative analysis of the quality of "geometrical characteristics" of the resulting 3D CAD models (Figure 7, Table 2), the certain differences between the obtained models can be seen such as the mutual deviation of large number of points (deviation was recorded in 16.3% of collected points), where is large maximum deviation 2.074 [mm] noted. It is obvious that the application of two different approaches for the generation of 3D CAD models on the basis of the same sample obtained geometric information are varying in quality, where it can be assume with great certainty that the RE-ANN approach results in higher quality of geometrical information of obtained 3D CAD model. Of course for a fuller understanding of the mutual relations between the two analyzed approaches some other factors (time and cost of implementation, available equipment and expertise, the required quality of geometrical information, the geometric complexity of the sample, etc.) should be considered too. Only then, on the basis of a comprehensive multi criterial analysis of the specific case it is possible to make the right choice of implementation of one or the second approach. At the same time, comparative analysis of the economic aspects of the application of two observed approaches (Table 3) indicates on certain benefits provided by the application of RE-ANN approach which are primarily related to the time and cost of obtaining of 3D CAD model. In this particular case the time of generating of 3D CAD model based on the known sample is approx. 70% less, while the direct costs of approx. 60% lower by applying RE-

ANN approach in comparison with the traditional approach. Despite these advantages, it is necessary to be aware of the fact that the use of RE-ANN approach has some limitations that should be taken into account. The limitations are related to investment in equipment (hardware and software), and the necessary professional knowledge of the operator that are required in order to take advantage of resources that the aforementioned approach allows. Finally, taking in to account all aspects (cost, time, quality of “geometric characteristics” and number of activities) of carried out and presented technical and economic comparative analysis of traditional vs. RE-ANN approach to generating of 3D CAD models based on known sample (Figure 8) it is clear that the application of modern approach is justified, and its profitability will be significantly increased with increasing of geometric complexity of the part whose 3D CAD model need to be developed.

References

1. Wang GJ, Wang C, Chuang SHF. *Reverse Engineering of Sculptured Surfaces by Four-Axis Non-Contacting Scanning*, *International Journal of Advanced-Manufacturing Technology* 15:800-809, Springer - Verlag London Limited, 1999.
2. Fischer A, Manor A. *Utilizing Image Processing Techniques for 3D Reconstruction of Laser-Scanned Data*, *Annals of the CIRP*. 1999; 48(1).
3. Kneisl G. *3D-Digitizing and Surface Reconstruction*, *Institute for Applied and Technical Physics, Vienna University of Technology, Vienna*, 2000.
4. Lee KH, Woo H, Suk T. *Data Reduction Methods for Reverse Engineering*, *The International Journal of Advanced Manufacturing Technology*, Springer-Verlag London Limited, 2001; vol. 17: 735-743.
5. Hur SM, Kim HC, Lee SH. *STL File Generation with Data Reduction by the Delaunay Triangulation Method in Reverse Engineering*, *The International Journal of Advanced Manufacturing Technology*, 2002; 19(9): 669-678.
6. Yau HT. *Reverse Engineering of Engine Intake Ports by Digitization and Surface Approximation*, *Int. J. Mach. Tools Manufact.*, 1997; 37(6): 855-871.
7. Topcic A, Tufekcic Dz, Cerjakovic E, Fajic A, Lovric S. *Rapid prototyping and reverse engineering as tools for reengineering of manufacturing processes “Proceedings” Improvement of production by applying reengineering in order to strengthen the competitiveness of enterprises “*, University of Mostar; Faculty of Mechanical Engineering and Computing Mostar, format B5, 2015; p. 93-117. CIP 658.5.011 (063) (082), ISBN 978-9958-9263-4-1, COBISS.BH-ID 21989894.
8. Lovric S, Tufekcic Dz, Topcic A, Mustafic A. *Comparative analysis of contact versus contactless methods of three-dimensional digitization of objects*, *The 1st International Virtual Conference on Advanced Scientific Results (SCIECONF-2013)*. Slovakia, Zilina, June 10. - 14., 2013; Section : ID-147-19.
9. Chang DY, Chang YM. *A Freeform Surface Modeling System Based on Laser Scan Data for Reverse Engineering*, *The International Journal of Advanced-Manufacturing Technology Springer-Verlag London Limited*, 2002; 20: 9-19.
10. Lee SH. *Application of Reverse Engineering for Automotive Parts*, Pusan - Kyungnam Automotive Techno Center; 2002. <http://pkatec.pusan.ac.kr>

Bibliography

1. Lovric S. *Development of the methodology for the optimization of the parameters of the 3D digitization process of complex geometric forms* “University “Džemal Bijedić” in Mostar, Faculty of Mechanical Engineering Mostar, Doctoral dissertation, 2015.
2. Lee K H, Woo H. *Use of Reverse Engineering Method for Rapid Product Development, Computers Industrial Engineering, Elsevier Science Ltd., 1998; 35, Nos 1-2, 21-24.*
3. *Public Policy in the Information Age: Digitization and Competition, Computer Systems Policy Project, USA, 2002. <http://www.cspp.org/reports/digicomp.html>*
4. Curless BL. *New Methods for Surface Reconstruction from Range Images, Doctoral Dissertation, Stanford University, USA, 1997.*
5. Huang M C, Tai C C. *The Pre-Processing of Data Points for Curve Fitting in Reverse Engineering, The International Journal of Advanced Manufacturing-Technology Springer-Verlag London Limited, 2000; 16: 635-642.*
6. Lee KH, Woo H, Suk T. *Point Data Reduction Using 3D Grids, The International Journal of Advanced Manufacturing Technology, Springer - Verlag London Limited, 2001, 18(3): 201-210.*
7. Woo H, Kang E, Semyung W, Kwan H L. *A new segmentation method for point cloud data, The International Journal of Machine Tools & Manufacture, 2002; 42: 167-178.*

Corresponding Author

Sladjan Lovric,
Faculty of Mechanical Engineering,
University of Tuzla,
Bosnia and Herzegovina,
E-mail: sladjanlovric070@gmail.com

Instructions for the authors

All papers need to be sent to email: ttem_bih@yahoo.com,

Every sent magazine gets its number, and author(s) will be notified if their paper is accepted and what is the number of paper. Every correspondence will use that number. The paper has to be typed on a standard size paper (format A4), leaving left margins to be at least 3 cm. All materials, including tables and references, have to be typed double-spaced, so one page has no more than 2000 alphanumeric characters (30 lines). Sent paper needs to be in the form of triplicate, considering that original one enclosure of the material can be photocopied. Presenting paper depends on its content, but usually it consists of a page title, summary, text references, legends for pictures and pictures. Type your paper in MS Word and send it on a diskette or a CD-ROM.

TITLE PAGE

Every article has to have a title page with a title of no more than 10 words: name (s), last and first of the author (s), name of the institution the authors (s) belongs to, abstract with maximum of 45 letters (including space), footnote with acknowledgments, name of the first author or another person with whom correspondence will be maintained.

ABSTRACT

Second page needs to contain paper summary, 200 words at the most. Summary needs to hold all essential facts of the work-purpose of work, used methods (with specific data, if possible) and basic facts. Summaries must have review of underlined data, ideas and conclusions from text. Summary has no quoted references. For key words, at the most, need to be placed below the text.

CENTRAL PART OF THE ARTICLE

Authentic papers contain these parts: introduction, goal, methods, results, discussion and conclusion. Introduction is brief and clear review of problem. Methods are shown so that interested a reader is able to repeat described research. Known methods don't need to be identified, it is cited (referenced). Results need to be shown clearly and logically, and their significance proven by statistical analysis. In discussion, results are interpreted and compared to existing, previously published findings in the same field. Conclusions have to give an answer to author's goal.

REFERENCES

Quoting references must be in a scale in which they are really used. Quoting most recent literature is recom-

mended. Only published articles (or articles accepted for publishing) can be used as references. Not-published observations and personal notifications need to be in text in brackets. Showing references is as how they appear in text. References cited in tables or pictures are also numbered according to quoting order. Citing paper with six or less authors must have cited names of all authors; if seven or more authors' wrote the paper, the name of the first three authors are cited with a note "et al". If the author is unknown, at the beginning of papers reference, the article is named as "unknown". Titles of the publications are abbreviated in accordance to Index Medicus, but if not listed in the index, whole title of the journal has to be written.

Footnote-comments, explanations, etc., cannot be used in the paper.

STATISTICAL ANALYSIS

Tests used for statistical analysis need to be shown in text and in tables or pictures containing statistical analysis.

TABLES AND PICTURES

Tables have to be numbered and shown by their order, so they can be understood without having to read the paper. Every column needs to have title, every measuring unit (SI) has to be clearly marked, preferably in footnotes below the table, in Arabian numbers or symbols. Pictures also have to be numbered as they appear in text. Drawings need to be enclosed on a white paper or tracing paper, while black and white photo have to be printed on a radiant paper. Legends next to pictures and photos have to be written on a separate A4 format paper. All illustrations (pictures, drawings, diagrams) have to be original and on their backs contain illustration number, first author last name, abbreviated title of the paper and picture top. It is appreciated if author marks the place for table or picture. Preferable the pictures format is TIF, quality 300 DPI.

USE OF ABBREVIATIONS

Use of abbreviations has to be reduced to minimum. Conventional units can be used without their definitions.