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Business, Value, Model

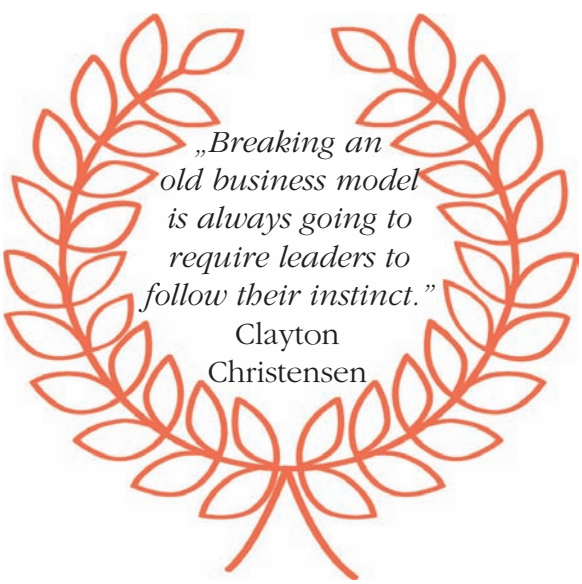
As simple, the concept of Business Model seems, as much confusion it generates. Any experiment or attempt of surveying the opinions of quite well-educated people (business school students – for example) gets mixed results: a sizable range from simple financial calculations of the profit to complex business plans. Where then the truth lies?

The failure to correctly define, understand, design and/or decipher business models leads to serious communication errors as well as significant business consequences; actually, it really means the difference between business success and bankruptcy.

The major obstacle in the way the business models are defined is the variety of the model types themselves. The model's typology largely varies from iconic ones (yet almost impossible to build for abstract concepts as a business) to explanatory, descriptive models and, ultimately, to symbolic models (graphical and mathematical models among them). As the business people are practical people by definition, and entrepreneurs are not necessarily the highest educated, the graphical representations have priority over mathematical models. We found – as result of decades of business education teaching as well as business consulting experience – that extremely concentrated symbolic models (such as linguistic metaphorical constructions) have a particular value for business education and even research.

A prestigious reference – the Oxford Dictionary of Economics namely, edited by the respected Emeritus Professor John Black – inclines in favour of the mathematical models of the economic-financial side of the business as it defines an [economic] model as „a simplified system used to simulate some aspects of the real economy". However, it admits that „the real world is so large and complicated that it cannot be fully described infinite time or space". Therefore, „a good model concentrates on the point it is studying and leaves out anything not essential to this" and, consequently, „models vary between the very simple … and large econometric models with thousands of equations".

Business models, as economic models by definition, observe the above definition (and favour the quantitative advantages of equations). In this respect, the equation defining the break-even-point is a good example of such a simplified (but limited) business model.



On the other side, the business models (as real phenomena of elevated complexity) have to be descriptive. Yet a certain degree of formalism is required. A largely accepted descriptive still standardized business model is the business canvas. The canvas of the business model is built of nine blocks – namely: key partners, key activities, key resources, value propositions, customer relationship, customer segments, [customer distribution] channels, cost structure, revenue streams – as described by Alexander Osterwalder.

For practical reasons, case by case, mixes (combinations) of types of models are suitable for properly describing businesses. And here is room for innovativeness – because each type of business is unique in its own way; in addition, even similar businesses, of similar size, active in the same industry (even the copycats) get and may report different result – understandable at least for one reason: they have different people as decision makers (business owners and managers).

In terms of innovativeness, in spite of explosive development of new technologies (information technology, communication technology and social networks, new materials and forms of renewable energy, biotechnologies etc.), it is neatly recommended to avoid the risky confusion to consider a certain innovative technology as having an innovative business model just because technology is innovative. In other words: a business based on a certain innovative technology does not necessarily have an associated innovative business model.

„Unless commitment is made, there are only promises and hopes; but no plans."
Peter F. Drucker

One more word about the business plan: why it is not a business model. At max, it may be accepted that a business plan is developed based on its corresponding business model. The supporting argument has, roundly, the same source of business knowledge: the Oxford Dictionary of Business states that a business plan is „a detailed plan setting out the objectives of a business over a stated period, often three, five, or ten years".

Cezar Scarlat
Senior Editor

Business Models in Online Industry

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Abstract

Entrepreneurship is currently one of the core aspects of the global economy. The current study analyses how online business models are classified by specialists and also identifies the particularities of each online business model presented. Starting from the online entrepreneur's characteristics and the Internet penetration rate all over the world we discovered that there are many ways to group similar business types. Our results have identified that online business topics, such as virtual reality, artificial intelligence marketplace, online advertising, cloud, financial technology, are actually used to discuss about businesses and also to observe how the public attention evolved in the last 5 years and last 12 months buy interrogating the Google public databases and extracting the relevant results.

Keywords: business model, online industry, online entrepreneur, development of online business, online business models

Introduction

In the past decade, online business models have been developing constantly and are characterized by complexity, dynamism and the use of technology. The purpose of the research is exploratory because it aims to identify information about online entrepreneurs and the current trends of the online business models.

The research theme analyzed includes a qualitative research of online business models trends, due to the need of identifying the key factors involved in the existent trends of the online industry. At the same time, the research theme proposed

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was analyzed by using qualitative research method in order to demonstrate the added value brought and also the contribution of identifying the current trends in the online world.

Online Entrepreneur's Characteristics

Online also known as digital entrepreneurship generally refers to the pursuit of opportunities based on the use of digital media and other information technologies (IT).

Moreover, an online or digital entrepreneur uses technology in order to develop and improve his/her business because it raises a higher level of efficiency and helps to promote services or products because, in the online environment the competition is fierce. Still an uncommon characteristic of digital entrepreneurs is the perception that their business can create in the minds of customers. A company based in an apartment can have a similar website as a company that produces millions of dollars. Some of the most famous tech entrepreneurs, like Steve Jobs or Mark Zuckerberg, are the most relevant examples of entrepreneurs who started their businesses in a garage or in a dorm room.

In recent years, the emergence and expansion of ICT is focusing on entrepreneurial characteristics such as individuality, innovative ideas, flexibility and speed. Easy and quick access to information create new opportunities arising for online entrepreneurs, for small firms and decrease the entry barriers in markets. As information barriers and transaction costs fall, there are new opportunities for small firms to grow as well as increasing pressure for existing companies (OECD, 2001).

It is necessary to define the online entrepreneur as a person who establishes and conducts a venture on the Internet. An online entrepreneur encompasses activities of a regular entrepreneur, but the mode of operation and the processes are more technologically based. Online entrepreneurship has particular characteristics that lead to different and complex problems faced by online entrepreneurs. For example, the security issue within an online transaction is very different form a regular brick-to-mortar retail operation (Prakash, 2009). When it comes to online entrepreneurs, they're typology is different from the brick-to-mortar entrepreneurs. A conceptual framework for analyzing online entrepreneurs has yet to be developed formally in the field of online entrepreneurship. An online entrepreneur needs to take more security aspects into consideration, given the fact than an online business deals with sensitive data such as personal information and credit card information. Moreover, the concept of „test drive" of a product might me completely absent when dealing with an online website, unless the website is a „demo" version of a certain software that can be easily tested (Prakash, 2009).

The characteristics of a regular entrepreneur have been extremely studied in

traditional entrepreneurship literature. These characteristics typically apply to a regular entrepreneur, a „brick-to-mortar" entrepreneur, defined as the individual who starts a business in the real world, as opposed to an entrepreneur who starts a business in the online world.

For an online business, an entrepreneur needs to possess specific skills. The skill of being a team player, may not be relevant for a one-man-based online business that is selling items on eBay, for example. Other characteristics, such as previous work experience, age, risk taking may not be relevant for an online entrepreneur (Daniel & Anwar, 2014). A good knowledge of the basics in HTML, CSS, PHP, JavaScript or any other web programming language, or even electronic payment, or shopping cart software are of use for an entrepreneur who has an online venture. Some of the technical knowledge mentioned above may not be so relevant nowadays considering an entrepreneur could simply buy the software solutions. The desire to use technology can be an important variable that influences the success of an online business.

The behavior and processes for online entrepreneurs and brick-to-mortar entrepreneurs have common aspects but some of the key process are different. Summarizing Gartner's steps for traditional or brick-to-mortar entrepreneurs, he identified six common behaviors: deciding on a location, accumulation of resources, production activities, setting up an organization, marketing and products, responding to the government and society (Gartner, 1985). Many of the behaviors and process are applicable for online entrepreneurs as well, more exactly (accumulation of resources, marketing, organizing and responding to external environment). However, online entrepreneurs have developed new behavior, different and unique from the regular and traditional behaviors, such as: protecting user's privacy, search engine optimization for their online business, because search engines are an important source for potential clients, protecting online assets (Prakash, 2009). The processes and behaviors of online entrepreneurship are closely linked to software and hardware used in the venture because these tools are key components for improving and maintaining an online business.

Online Industry

By June 2018, the number of Internet users reached 4,208,571,287 worldwide (Table 1). The penetration rate has exceeded 55% worldwide (Miniwatts Marketing Group, 2018), compared to last year's penetration rate of 51.5%, which has enabled the rapid development of online business models due to the rapid development of technology.

Table 1 – *World Internet usage and population statistics*

World Regions	Population (2018 Est.)	Population % of World	Internet Users 30 June 2018	Penetration Rate (% Pop.)	Growth 2000-2018	Internet Users %
Africa	**1,287,914,329**	16.9%	**464,923,169**	36.1%	10,119%	11.0%
Asia	**4,207,588,157**	55.1%	**2,062,197,366**	49.0%	1,704%	49.0%
Europe	**827,650,849**	10.8%	**705,064,923**	85.2%	570%	16.8%
Latin America/ Caribbean	**652,047,996**	8.5%	**438,248,446**	67.2%	2,325%	10.4%
Middle East	**254,438,981**	3.3%	**164,037,259**	64.5%	4,894%	3.9%
North America	**363,844,662**	4.8%	**345,660,847**	95.0%	219%	8.2%
Oceania/ Australia	**41,273,454**	0.6%	**28,439,277**	68.9%	273%	0.7%
WORLD TOTAL	**7,634,758,428**	100%	**4,208,571,287**	55.1%	1,006%	100%

Source: Miniwatts Marketing Group, 2018

The result of fast Internet adoption in the first decade of the 20th century has facilitated the development of online business models. For example, new e-commerce business models have derived from classic business models using new marketing models and exploiting new distribution channels. These channels have helped many businesses to access new markets (Nambisan, 2016).These features have attracted customers and investors around the world, simulating growth in national economies and leading the way to a single world market, a phenomenon that continues to grow at an accelerated pace. Additionally, these changes have led to the transformation of the local distribution chain into a global distribution chain. This has created a value chain that includes procurement processes, manufacturing processes and logistics activities involving companies, customers and logistics providers. All of them provide specific added value that customers in their purchased products and services, all of which are embedded in the eCommerce online business model. This model was preferred to a local value chain because the global economy offers the opportunity to better capitalize assets (Sheriff, 2018, p. 76).

In the digital economy, Information Technology (IT) and new media have become sources of innovation in business processes and models. Bits of information rather than material goods are processed (Davidson & Vaast, 2010).

The business model is the methods by which the company generates revenue to support itself and how it is positioned in the value chain. In the development of e-commerce, new online business models will emerge and will reinvent themselves in the online environment (Rappa, 2010). A comprehensive and persuasive taxonomy of business models on the web was developed by Michael Rappa. The identified core categories can fit business models into: brokerage, advertising, information, marketing, production, affiliation, community, subscription, utility. These models are very varied, moreover, a company can

combine several business models as part of the Internet business strategy. For example, it is not uncommon for a business to combine subscription services with advertising delivery. Online business models now attach great importance to any form of intellectual property that can be protected by a patent (Rappa, 2010).

Simon Kingsnorth believes that the business model must match the desired strategy. For example, making an aggressive e-commerce strategy does not match a suitable B2B relationship. It is also the case of using aggressive Social Media content which is not a suitable strategy for a retailer and it is very likely that it will not success in selling the desired products. It is vital that the strategy chosen matches the existing online business model (Kingsnorth, 2016). An efficient use of the suitable online business model enables companies to increase their profits by reducing the cost of doing business. In many ways, an online business model is the most important catalyst for making international business effective and generating effective added value (Sheriff, 2018).

At the beginning of the development of online business models, the term of digital economy also emerged. The term was enunciated by Don Tapscott in 1995 and it was among the first researches that considered that the Internet will change the way business is done. It defines the digital economy through a network that connects individuals and organizations that transport dominant structures to networks. The concept of collective intelligence is used to change innovation, production, procurement and communication in a profound way (Tapscott, 1997).

According to Thomas L. Merseburg, there are three main components of the digital economy that can be identified: e-business infrastructure (hardware, software, telecom services, networks, human capital) e-business processes (processes the organization conducts over computer mediated networks) and e-commerce (transfer of goods via the Internet) (Mesenbourg, 2001).

Applegate introduces the 6 e-business models: distributor focus, portals and manufacturers, infrastructure distributors, infrastructure portals, and infrastructure

manufacturers (Applegate, 2001). The main dimensions for classifying an online business model: the role of the user, the interaction, the nature of the offer, the pricing system, the level of personalization and the economic control (Dubosson, Pigneur, & Osterwalder, 2002). All these approaches have the common aim of describing and organizing businesses around excess typologies and taxonomies of new business archetypes, mostly available through Internet-based technologies (Zott, Amit & Massa, 2011).

The term of online business or e-business can be used to define any type of business that performs a commercial transaction which includes the transfer of information via Internet. E-commerce or any other business in the digital environment includes the use of information technology to facilitate external activities to individuals, groups or other businesses via the Internet (Beynon-Davis, 2012).

The term of e-business was first proposed by the IBM marketing and Internet team in 1996 (Gerstner, 2003). In ordered to be able to define the online business model, firstly we need to identify how the business generates value and how it generates revenue. Thus, the definition of the revenue model, which is in fact a structure that helps to identify the source of income. The revenue generation model tracks the value offered, how it can be valued and who pays for value (Afuah, 2004). This revenue model is a key component of the business model (Wagner, 2013). Eric Wagner identified 5 important components that can drive the evolution of the online entrepreneur presented in the table below (Table 2).

Table 2 – *Five components for the development of an online business*

Component	Description
Revenue Model	This is the component that generates income. To whom we want to sell the product, what is the actual message and how can be the customer convinced to purchase the product or service
Gross Margin Model	It is an estimate of the probability of each sale, it is important to know what percentage goes to the company after each sale, whether is a high or low value
Operating Model	The operating model must be known to make the right decisions about maintaining and developing the business
Working Capital Model	Depending on the business typology, it must be known whether the capital is financial or production equipment is required
Investment Model	Because many entrepreneurs complain of capital shortages, it is necessary to know the company's needs and how to obtain the investments it needs to grow

Source: Adapted after Wagner, 2013

There are several ways to begin designing an online business model which implies identifying more revenue generating models and how these models can make direct or indirect contribution to an online business. Direct beneficiaries are those who use the value directly from the available resources or example, using articles, interacting with digital and online content or accessing web applications. The funding model based on the direct beneficiaries assumes that they will be willing

to pay for the resources made available. Indirect beneficiaries are those who generate added value through indirect ways, such as sponsors and advertisers using advertainments directly to user, founders or donors (Maron, 2015). Furthermore, the two groups of beneficiaries that pay directly or indirectly for online products or services are the following: direct beneficiaries who pay for subscriptions or each time they use the service, publishing or hosting and indirect beneficiaries who pay for advertiser, content licensing.

Another approach was defined by Raym Crow, who mentions the value-for-value framework for online businesses as similar to classical business framework, plus some new items. This framework is organized as an answer to various question such as: How does the business create value and in which ways it will be valuable, namely for who. Every online business has some potential sources of added value and the content and tools used to develop a valuable source, the audience and devoted users are linked to each other (Crow, 2009). Refocusing this value questions and systematically re-evaluating assets in all ways, online business owners can more easily identify areas they have not considered in the past.

All of these definitions and classifications of online business models denote the difficulty of defining exactly what a business is in an online environment, and especially what is the threshold in which a business uses technology or becomes a digital or online business. At this time, a lot of businesses embed technology into one or more key tasks, starting from the touchscreen phone and color screen, and reaching systems that use artificial intelligence and augmented reality algorithms. Current times require increasing productivity, faster information flow, and automation of processes to withstand the market economy.

Given that an exact and generally valid definition cannot be given, it will be attempted to identify a specific definition, geared to the functions of each type of online business, so that more functional business types can be identified with common or at least close objectives. If on the basis of the criteria stated in the following research, it is desired to analyses an online business model and allocate it to the appropriate category, it should be noted that from the outset that each online business is unique and the categories may not fit perfectly, an online business type can be classified into several categories. For example, the Amazon brand can be considered a renowned marketplace, but also a cloud company. The same can apply for Airbnb, which can be considered an online booking system or a market for tourist offers.

Michael Rappa identified in 2010 categories of online business models divided into the categories to be presented. This categories are the following: online businesses based on brokerage, online businesses based on advertising, online businesses based on an info-mediator model, online manufacturer model, ecommerce model, online business based on the affiliate model, online community businesses, subscription based online businesses and utility based online businesses. In Table 3 each online business model is shortly described, in order to understand the business model and implications.

Table 3 – *Online business models*

Online business model	Description
Brokerage	It can be divided in the following specific types: marketplace exchange (Orbitz, ChemConnect), auction brokers (Cars Direct, Respond.com), transaction brokers (PayPal, Escorw.com), virtual marketplace, distributor, aggregation systems (Priceline.com)
Advertising	It can be divided in the following: portal, search-based advertising (Google Ads), targeted advertising (Retargeting.biz), behavioral marketing, Remarketing (Google Remarketing), classic advertising (Monster.com)
Infomediary	The activity of this category of online business takes place in advertising networks, use audience measurement services (Nielsen/Netratings), loyalty marketing for customers by offering them loyalty points.
Online manufacturer	The online manufacturer model can be subdivided in the following: the direct seller, rental, licensing, Integrated branding content
Ecommerce	This business model can be both B2B, B2C and can also be divided in some subcategories: e-retailer which conducts the business solely on the web (Amazon), click and mortar which has both a physical store and an online store (Barnes&Noble), Bit vendor strictly deals with digital products and services (Apple iTunes).
Affiliate	The affiliate online business model can be categorized in: banners exchange (makes banner exchange across the affiliate network), pay-per-click (pay to receive user clicks), sharing revenue (offers a percentage of commission-based sales from the purchases of users who click on the link and then make a purchase)
Online community	Online community business model can be subcategorized in the following: open source (software developed in collaboration by a global community of programmers who distribute their source code to each other), open content (content developed in collaboration with a global community with volunteer contributors. Like Wikipedia), social media services (provide people with the opportunity to connect with others for common interests and can provide opportunities for contextual advertising or subscription to premium services)
Subscription	The subscription online business model can be divided into the following: content services (provides text, audio, or video content to subscribed users for access, for example, Listen.com and Netflix), networking services, Internet service providers
Utility	The utility model can be divided into two directions: measured usage (keeps track of and charge the user for use of the service) and measured subscription (allows users to buy access for an exact number of users)

Source: Adapted after Rappa, 2010

Trending Business Models

Given the development of online business models, the emergence of new opportunities and the evolution of technology, at this stage of the research we will conduct more case studies of expanding business models and which have been successfully validated from an economic point of view. For this analysis an exploratory research will be carried out with the main objective of identifying the key elements that define the competitive advantage of these new businesses that have been developed.

In this research, we will identify key elements that have underpinned the success of these business models, including positioning the business in the context of the global economy, technology used to become leaders in their market segment, a promotional model used to attract new customers, type of sales approach used, automation used to be competitive, and even artificial intelligence models, where appropriate. All of these elements will look at how the business produces value and how it is translated to the customer for revenue.

Another aspect that will be pursued will be the fact that each company charges its customers to earn revenue. The particularities analyzed through the exploratory research will be needed in order to identify the change of paradigm generated by new technologies and the way in which new businesses undertake disruptive innovation, sometimes replacing classical business models. The fields of activity in which these exploratory researches will be conducted will be relatively varied but interconnected in an information ecosystem system as follows:

Cloud Technology – is the area of activity where software and hardware are being put up for sale, often combined to provide B2B customers with the information infrastructure needed to develop a particular type of business. Cloud technology may include one or more elements, including servers, software licenses, interconnected networks with Internet access, artificial intelligence systems, and the advice / guidance needed to use these systems.

Online advertising – the online advertising segment includes software solutions that a most often use cloud infrastructure to bring together potential users, product and service providers. Cloud technology is often used to facilitate the processing of a large amount of data. The more refined customer data, the more information systems can deliver a better delivery of promotional messages and a better success rate of online advertising campaigns.

Marketplace – Marketplace combines product and service offerings from multiple vendors, supported by both infrastructure and advertising systems, such as affiliation, social network advertising, search engine advertising, or visual advertising. These marketplace systems are likely to be the first to turn classic online commerce into mass, facilitating the movement of physical assets and even their virtualization, as in the case of Amazon that is truly successful in selling books in electronic format.

Transport – Transport is an essential component of any economy, which facilitates the movement of goods and people. Digitalizing this segment is an important step in reducing costs or achieving profits. With the emergence of cost/route optimization systems and introducing the concept

of sharing a race, transport is currently being enhanced by technology and the availability of geolocation systems for almost everyone.

Tourism – Tourism has also been radically improved, being supported by cloud technology, promotion systems, market place and transport systems. Thanks to these systems, booking a hotel room becomes very easy and increases the user's confidence in the room they are going to reserve. Reservation/rental systems maintain and develop their business on the basis of their reputation and guarantees.

Fintech – It is a new industry, based on technological progress. The term „finance" is jointed to the term „technology". Improving these two terms creates added value for a quick cash flow and sometimes it is safer. In the fintech segment we find online payment processors, auction systems for shares, and newer virtual currency payment systems.

Augmented Reality and Artificial Intelligence – Probably the newest segment in which technology-based businesses are developing. Although many devices and experiments have been carried out over the years, this field is still in its early stages and a huge growth is expected. All technology companies consistently invest in these types of devices and software, with already launched applications.

Evolution of Business Models

After identifying the business types which are mentioned in the literature review, we have analyzed which are the most trending ones. Our research was based on the Google Trends Database, tool which can be used for identifying the evolution of a topic, a keyword or a phrase.

Google Trends adjusts data in order to compare the search terms used in the queries more easily. The search results of Google Trends are proportionate to the time and location of a query by using the following process: each data is divided by the total searches of the geography and time range it represents to compare relative popularity. Otherwise, places with the most search volume would always be ranked highest, the resulting numbers are then scaled on a range of 0 to 100 based on a topic's proportion to all searches on all topics, different regions that show the same search interest for a term don't always have the same total search volumes (Google LLC, 2018).

Google Trends data is an unbiased sample of Google search data. Only a percentage of searches are used to compile Trends

data. The 2 types of Google Trends data are: real-time data which is a random sample of search queries from the last 7 days and non-real-time data in a random sample of Google search data that can be retrieved from as far back as 2004 and up to 36 hours before the search. After search data is collected, it is categorized, connected to the topic and all the personal information is removed. Some of the data is excluded, such as searches made by very few people (Google trends eliminates repeated searches from the same person over a short period of time), duplicate searched (Google Trends eliminates repeated searches from the same person over a short period of time) and special characters (Google Trends filter out queries with apostrophes and other special characters).

For having a relevant result, we used for the first searches in the database the name we used in the current research and follow the recommendation to search for the whole topic. Because of someone categories of researched business models are new, searched topics with less than 10 points from 100 points popularity, were analyzed separately.

Cloud, marketplace, virtual reality and artificial intelligence topics are the most popular by the popularity score, we can observe how the trends evolved in the last 5 years in figure 1.

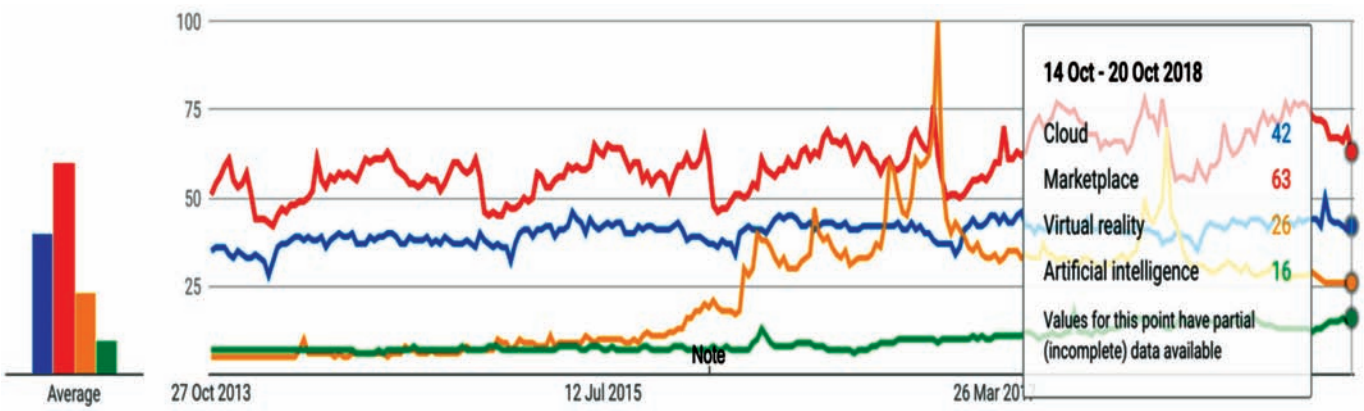

Figure 1 – *Evolution of cloud, marketplace, virtual reality and artificial intelligence topics in the last 5 years*
(Source: Google Trends, 2018)

In the last 12 months, we analyzed just the less popular topics in Google trends, like Carpool, Online advertising, online hotel reservation and financial technology. In the next figure we can observe the evolution of keyword searches related to our topics and also that the popularity and evolution is not linear from month to month.

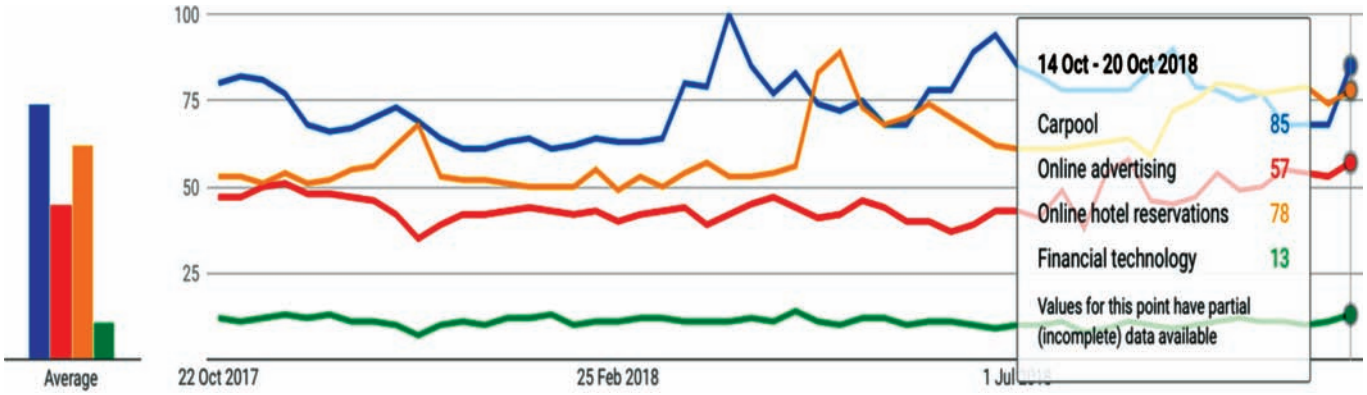

Figure 2 – *Evolution of carpool, online advertising, online hotel reservations and financial technology in the past 12 months*
(Source: Google Trends, 2018)

For determining the evolution of every searched topic, we used a formula which can indicate the trending level of a topic in the past 5 years, compared to last 12 months. In this case, the first formula determined how much the topic evolved in the last year compared with the previous four years.

$$\text{Trend evolution} = \left(\frac{\text{Avg. interest in last 12 months}}{\frac{\text{Avg. interest in last 5 years} * 5 - \text{Avg. interest in last 12 months}}{4}} - 1 \right) / 100$$

Table 4 – *Trending categories for online business models*

Identified business model	General topic for this activity	Average popularity in last 5 years	Average popularity in last year	Trend evolution
Artificial intelligence	Artificial intelligence	10	19	675%
Augmented reality	Virtual reality	23	42	130.13%
Tourism	Online hotel reservation	2	3	71,42%
Marketplace	Marketplace	60	87	63.38%
Cloud technology	Cloud	40	54	47%
Online advertising	Online advertising	2	2	0%
Fintech	Financial technology	1	1	0%
Transport	Carpool	5	3	–54.54%

Data source: Google Trends, 2018

Discussion And Conclusions

To conclude, online entrepreneurs play a pivotal role in having a successful online business model because they seek business opportunities in order to further develop their business. Given the fact that the research is based on analyzing exclusively online business models, the Google Trends analysis demonstrated that the topics are shifting toward online business models.

The theoretical aspects presented in the first part of the research define the online entrepreneurs as a person who presents the same traits as a brick-to-mortar entrepreneurs, but he/she conducts a venture solely on the internet and therefore he/she has different needs and they have to take in consideration different problems, such as protecting user's privacy, search engine optimization and so on. The processes and behaviors of entrepreneurs are closely linked to software and hardware because these are the tools that maintain their online business.

Given the extent of the Internet penetration rate nowadays, more exactly 55% compared to 51.5% in 2017. The growth of the Internet penetration provides online entrepreneurs with a favorable environment for developing their online business models and finding new trends.

After obtaining the results we discovered that the most trending topic is Artificial intelligence, which also Google includes as field of study. Probably the evolution obtained of 675% is influenced by the researchers and specialist from various domains. On the second place, the most important topic is about virtual reality, which increased the popularity with 130.13% in the last year, compared to the average from 2013-2017.

Online hotel reservation, marketplace and cloud we consider that have a good trend evolution, in the range of 47-71%. For online advertising and financial technology, we obtained irrelevant results, probably because the Google database has not enough information. Carpool topic is not trending anymore, it's the only topic which has a decrease. In online industry and the entrepreneur communities things are moving fast, because the increase of Internet penetration and business competition for gaining loyal customers. The current research is made to identify trends of new business but every business model can include more than one trending technology, depending of the creativity and innovation of every entrepreneurs. There are many factors which help a business model to be successful and probably one of them is to follow a trend when it's starting. Successful entrepreneurs are moving fast and also identify the trends from the beginning to be prepared for making a change in theirs's niche.

As for the limitations of the research, the qualitative analysis is an analysis of perception and by being a perceptual analysis is not as accurate compared to a quantitative research. The research was used because the main focus was identifying the current online business models trends from the Google trends point of view, such as visibility and key interest factors.

Further research should focus more on the online entrepreneurs characteristics as well on the online business model trends and how this trends can improve the processes and technologies of online business models.

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Trends in Shale Energy Production

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Abstract

Unconventional Shale Energy resources have become an increasingly significant source of oil and natural gas in the United States, Canada and China over the last decade. This rapid growth could not be achieved without research and development activities in this field. Moreover, revolution in unconventional hydrocarbon industries has triggered many research questions from highly engineering aspects to highly political issues in this area. In the current paper, we have attempted to shed a light on the frontier research of this growing knowledge domain. A number of 2489 papers were collected from Science Citation Index-Expanded (SCI-E) and the Social Sciences Citation Index (SSCI) databases. We applied bibliometric methods on collected publications and with the help of CiteSpace III software; co-citation networks of publications were mapped which revealed valuable information on research trends and knowledge gaps existing in this field. Three clusters of intellectual structure identified and analysed and future research opportunities recommended.

Keywords: unconventional energies, bibliometrics, emerging technologies, characterizing knowledge domain, citespace

Introduction

The Unconventional hydrocarbon energies, more prominently shale gas and oil, have been getting extracted in United States for decades. Continues advancement in essential related technologies, such as hydraulic fracturing (fracking), horizontal drilling, and 3D seismic exploration has made these resources supplied more efficient and cost effective manner. The trend of shale gas and oil development continued until these resources became economically competitive in the energy market, early 21st century. In the year 2012, averaged of

„Good fortune is what happens when opportunity meets with planning."
Thomas Edison

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25.7 billion cubic feet per day (Bcf/d) of shale gas were producing in the U.S., which was about 39% of total natural gas production in United States. Rapid growth in unconventional hydrocarbon energy in the United States, not only have reduced dependency of that country on its oil imports, but also can make United States a major liquefied natural gas (LNG) exporter in the global energy market (EIA 2013).

Due to widespread existence of proven shale gas and oil reserves throughout the earth, it is not far-fetched to predict these resources will be developing in many energy importing countries in the coming decades. However, shale gas and oil technologies are evolving and maturing fast, but currently only in United States, Canada, and China, shale gas and oil resources are extracted at commercial scale, and Brazil, and Estonia produces shale oil as well while these resources are abundant in many other countries as well (EIA 2015).

Advancement in unconventional hydrocarbon technologies owes a great depth to extensive U.S. federal funding on research and developing activities and disseminating the results into the unconventional hydrocarbon related industries.

Along of rapid development of unconventional gas and oil industry over the last decade, research activities have also been drastically growing in the related aspects of these technologies over the last five years. Figure 1 presents growth of publications in unconventional shale gas and oil research field, in ISI Web of Science. Due to the importance of these technologies for energy importing countries, and on the other side, controversial environmental impacts of unconventional shale energies extraction which can have destructive to the communities and environment, many multidisciplinary research questions has been raised with various focuses such as engineering, geological, public policy, and environmental aspects of these technologies (Yuan *et al.* 2014).

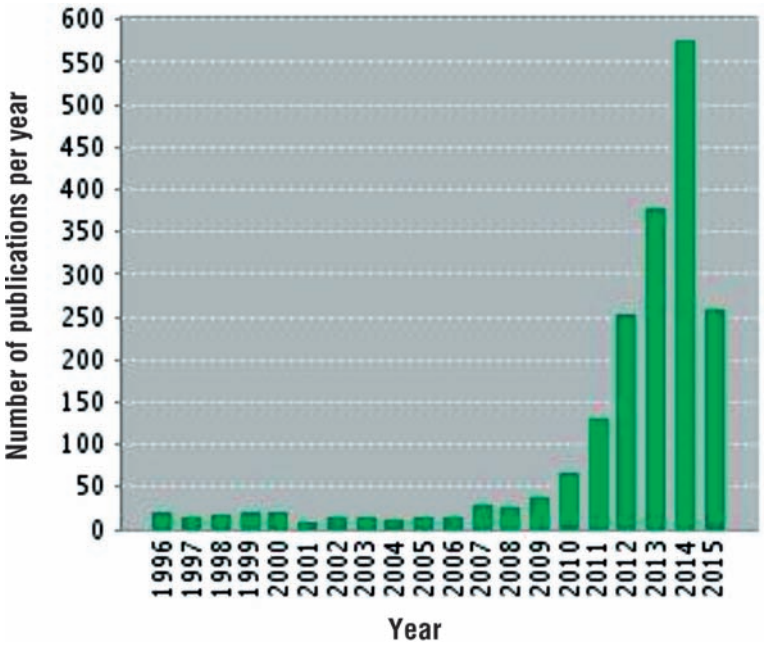

Figure 1 – *Growth of publications*

Aside from shale gas and oil, unconventional hydrocarbon energies consist of tight sands, clathrates (gas hydrates), and coal bed methane (CBM). However, due to rapid growth in shale gas and oil extraction, and their abundant proven reserves, in the current paper we have attempted to analyze the growing research domain of unconventional shale gas and oil through bibliometric methods. Bibliometric methods are known as a set of quantitative methods for analyzing and characterizing research domains (Keiser, Utzinger, 2002). Bibliometrics studies are highly valuable when they are conducted on growing research domains, since it can interpret research trends, hot topics, main research areas and much other useful information which can provide a comprehensive perspective of the targeted field for enhancing efficiency of later research activities on that research domain. Moreover, analyzing the footprints of research activities in other nations can reveal capability of future development of unconventional energies in those countries.

Publishing the results of a research is a critical part of any scientific activity. Considering the fact that publications of a research domain can shape its related body of knowledge, in bibliometric studies, a large group of publications which are representing a specific knowledge domain are being collected and analyzed. In this study, we collected 2489 refereed publications in unconventional hydrocarbon energies research field (more specifically shale gas and shale oil) from Science Citation Index-Expanded (SCI-E) and the Social Sciences Citation Index (SSCI) databases which are the most credible databases developed by the Institute for Scientific Information (ISI).

Bibliometric methods have been widely applied in many disciplines as well as energy related knowledge domains. Since reading a map is much more informative for researchers than words or data, providing visualized networks of references in bibliometric studies can help, in depth analysis of a research domain (Feng *et al.*, 2015). Kiriyama and Kajikawa, analyzed the status and research trends in energy security topic using citation analysis (Kiriyama, E. & Kajikawa, 2014). Xu and Boeing mapped bio fuel field using bibliometric research (Yaoyang, Boeing, 2013). Li *et al.* proposed a framework for integrating bibliometric method with technology roadmapping to plan future development of a new solar technology-based industries in China (Li *et al.*, 2014).

However, It should be mentioned there has not been any bibliometric conducted on shale gas and oil research domain. In this paper, we have mapped network of references in order to illustrate a comprehensive perspective on the intellectual structure of sale gas and oil research field using a visual mapping software called Citespace III. Three clusters of research trends identified and analysed and future research opportunities were analysed based on the existing gaps and intellectual structure of the field.

Research Methodology

Bibliometrics methods were initially introduced in 1969 through application of statistical and mathematical methods to bibliographical data of books, articles, or other publications (Wei, 2014).

Citation analysis is one of the most widely used bibliometric techniques. Initial citation analysis technique was based on the rationale that the more cited papers are the ones which have more likely influenced their knowledge domain and contain core literature. However, citation analysis individually cannot offer a transparent perspective of a field and it can be argued that there may exist some papers that have not highly cited but has high influence on the literature, especially the ones which have been published recently (Leong, 1989).

Co-citation analysis is defined as the frequency with which two or more earlier documents are cited simultaneously by the later documents (Small, H.). Co-citation analysis is based on the rationale that, the more a pair of papers cited simultaneously by a later paper(s), the more semantic relation exist between them which represent an indicator of subject similarity between co-cited publications (Raghuram, Tuertscher, Garud, 2010). Thus, analysis of co-citation networks of a knowledge domain can reveal intellectual connection within the field.

In the present study, we examined intellectual structure of unconventional shale energies research domain by adopting co-citation analysis through visualized procedures. Mapping knowledge domain can be defined as the visualization of the topology of relationships between science components of a disciplines, fields, or specialties (Cozzens *et al.*, 1988).

Corresponding to the increasing recognition of the Citespace software as a practical tool for co-citation analysis, we used Citespace III for our co-citation analysis and mapping citation networks. Citespace is a java-based software that can visually show relationships among most frequently cited authors, institutes, keywords and many other bibliographical information. It can explain evolutionary trends of certain research fields using co-citation analysis (Zhang *et al.*, 2015).

Bibliometric studies are conducted by analysis of academic publications related to the targeted knowledge domain which has been published through a period of time. Those publications are actually the input data for bibliometrics studies and all later assessments will be conducted on the established dataset of publications. Thus, data collection is the initial step and the most critical part of bibliometric studies while there is no common way to deal with it. In the present study, we searched on ISI Web of Science, particularly Science Citation Index-Expanded (SCI-E) and the Social Sciences Citation Index (SSCI) databases, which provides high quality peer reviewed publications and commonly used as the database for variety of bibliometric studies due to its credibility (Wei, 2014).

Needless to say searching on databases should be done through specific queries which lead to the comprehensive publications of the targeted research field. We searched on the related queries such as „shale gas", „shale oil", and „fracking" on the TOPIC field tag which includes title, abstract and keywords of each publications. Specifically here is our search query: TS = („shale gas" OR „shale oil" OR „fracking" OR „unconventional hydrocarbon energ*") OR TS = ([„hydraulic fracturing" OR „unconventional energ*"] AND shale) OR TS = („horizontal drilling" AND Shale) OR TS = („3D seismic exploration" AND shale). This search was conducted on May 15th 2015 without any restriction on the publishing time of results. We collected 2489 publications, among which 1,827 were articles, 200 meeting abstract, 150 editorial material, 128 review, 113 news item, 91 proceeding papers and 77 other types of publications. We downloaded full record information of all 2489 collected publications and processed with the Citespace III software. In the following session we discuss on the results.

Research Results

Analysis of countrie. Unconventional hydrocarbon energies have changed the landscape of energy in United States. Due the promising advancement in related industries, many developing and developed countries started research activities in order to assess these resources for their future energy demands. Among those, China is projecting ambitious plans for dramatic increase of its shale gas productions.

Affiliations of authors in each publication can show the country in which that research have took place. Altogether, 72 countries were recognized while the top 10 countries have conducted more than 73% of researches on this area. With the help of Citespace III, we could map the relationship between research focus and collaborations in shale gas and shale oil research domain. Figure 2 presents a map of collaboration relationship between researchers in unconventional shale energies research domain in 1996-2014-time interval.

Looking at the Figure 2, we can intuitively see the United States as the core of collaborations in this research domain. The bigger the node is, the country is more productive. United States is the most productive country in unconventional hydrocarbon research domain with 1090 publications followed by China (351 publications), Canada (130 publications), Austria (96 publications), and England (92 publications).

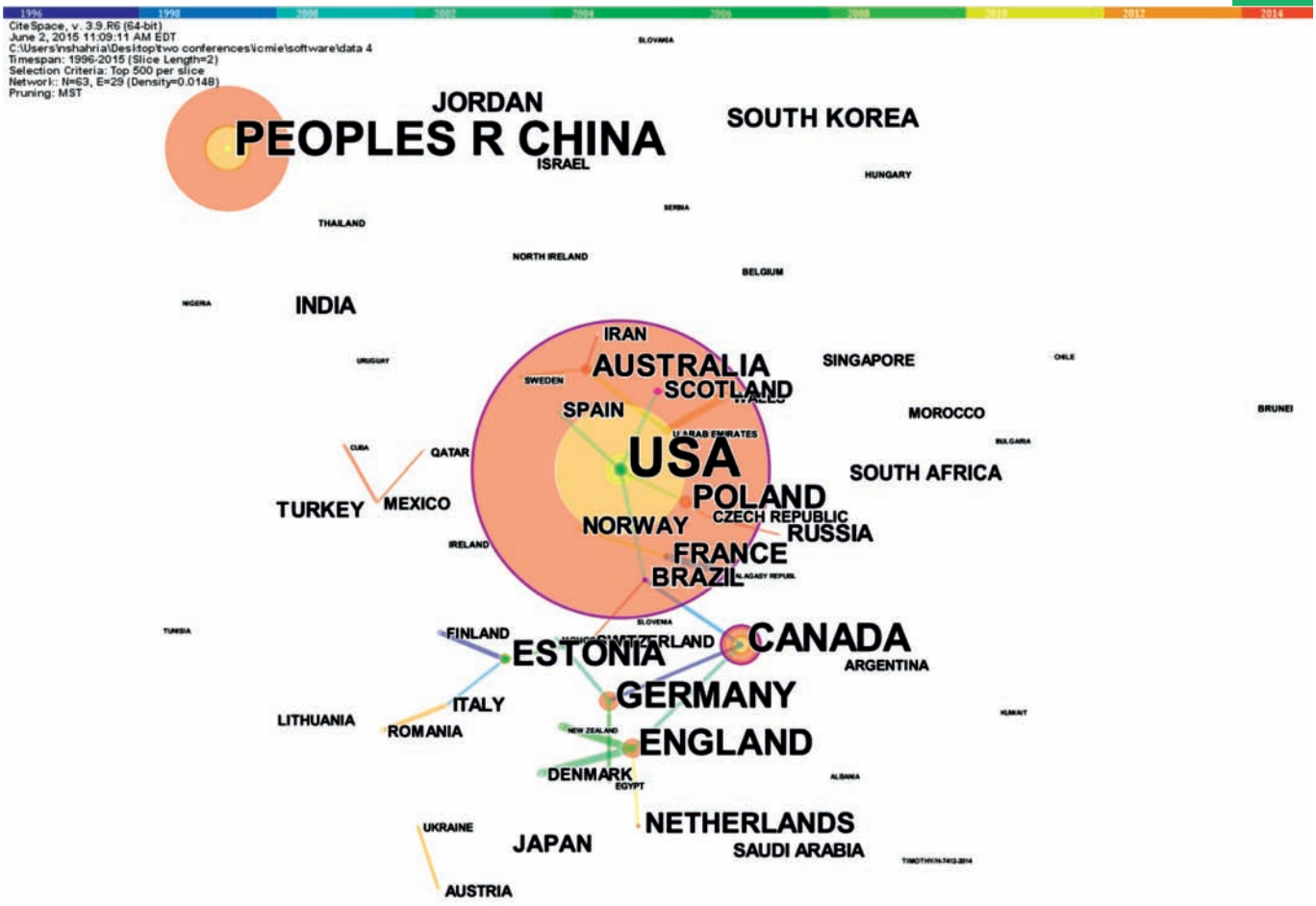

Figure 2 – *Map of collaboration*

Centrality is a concept defined in Citespace as an indicator for measuring the ability of each node to link with other nodes. The Freeman's (1979) betweenness centrality metric which is a graph-theoretical property is used and illustrated by purple ring around each node in Citespace III (Chen, 2006). As it is depicted in Figure 2, United States and Canada has much higher centrality which represents collaborations compare to China. It doesn't mean that there has not been any collaboration among Chinese research institutes and American ones in this field, but calculating the Freeman's betweenness centrality have located China in topologically distinguished position in the map.

Although currently China is producing six times smaller amount of shale gas compare to the United States, it is planning to develop its shale gas production dramatically, while China is dealing with inadequate access to technology, water and land.

The U.S. National Science Foundation (NSF) and Department of Energy (DoE) are the two main organizations provided funding resources on shale gas and shale oil research domain within United States. University of Texas Austin has the most productive research group in this field with 73 publications, followed by Penn State University (44 publications), Colorado School of Mines (36 publications), Carnegie Mellon University (35 publications), University of Pittsburgh (35 publications), Stanford University (32 publications), and Texas A&M University (30 publications). The universities located in Texas State of United Sates have the most prominent research groups among other productive schools in the world which can be seen as the result of considerable production of unconventional hydrocarbon energies in that state.

While research in shale gas and oil in U.S. is widespread among more than 50 universities and research institute, in China this area is highly focused in a few universities. China University of Petroleum is the most productive university in China as well as the entire world with 81 publications in unconventional shale gas and oil research domain, followed by China Academy of Science (42 publications), China University of Geoscience (41 publications), and Southwest Petroleum University (35 publications). However, it should be mentioned that China Academy of Science (CAS) is a national academy for the natural science in China, working with 124 research institutes and universities in that country (CAS, 2015).

As it is depicted in the map of Figure 2, among European countries, England with 92 publications, Germany with 87 publications, and Estonia with 69 publications are the most productive ones. Due to more environmental conservative policies among European countries compare to the U.S., these resources has not get high attentions

among research institutes. Tallinn University of Technology in Estonia is the most productive university in Europe with 44 publications in shale gas and shale oil research field in Europe while in England and Germany this topic is being addressed by different universities. It is should be mentioned that Estonia is the first country in the world that has met all of its power needs from shale resources and even exports shale oil (Energy overview, 2015).

Intellectual structure of the unconventional shale energies research domain. According the ISI Web of Science classifications, more than 90 research areas has covered by the 2489 collected publications. Among those, the top five classifications cover more than 82% of collected publications while each publication can be categorized in more than one research area. The engineering (1187 publications), energy fuels (916 publications), chemistry (435 publications), geology (372 publications), and environmental science (352 publications) are considered as the main research areas. However, this analysis is not practical since these classifications are defined too general and have overlaps. For instance, energy fuel category covers publications related to all aspects of development, production, use, application, conversion, and management of all sources of energies except nuclear technologies (SCIE, 2015). In other words, any publication which talks about any energy source can be classified in this topic except nuclear energy.

In order to gain a better understanding of the intellectual structure of unconventional shale energies research domain, we have mapped co-citation network of references with the help of Citespace III software.

CiteSpace III uses a time-slicing mechanism in order to maps synthesized panoramic networks across consecutive years. The duration of time intervals for each slice is defined two years in this study. Nodes represent the publications and links represent co-citation relationship between publications. We can understand the recent or old co-citation relationships through the colour of links which are represented in the bar above each map produced by Citespace III. The initial publications related to shale gas and shale oil in ISI Web of Science started from 1996 (while references can be older), the trend of publishing on these topics poorly continued until the year 2009, and boomed dramatically from the year 2010 (Figure 1).

Considering the large number of references, we selected the top 200 higher cited papers in each time unit for analysis in this study. Altogether 1732 references got connected through 1817 co-citation links as it is depicted in Figure 3 where it is presented co-citation network of references cited in 1996–2014 time interval in unconventional shale energies research domain.

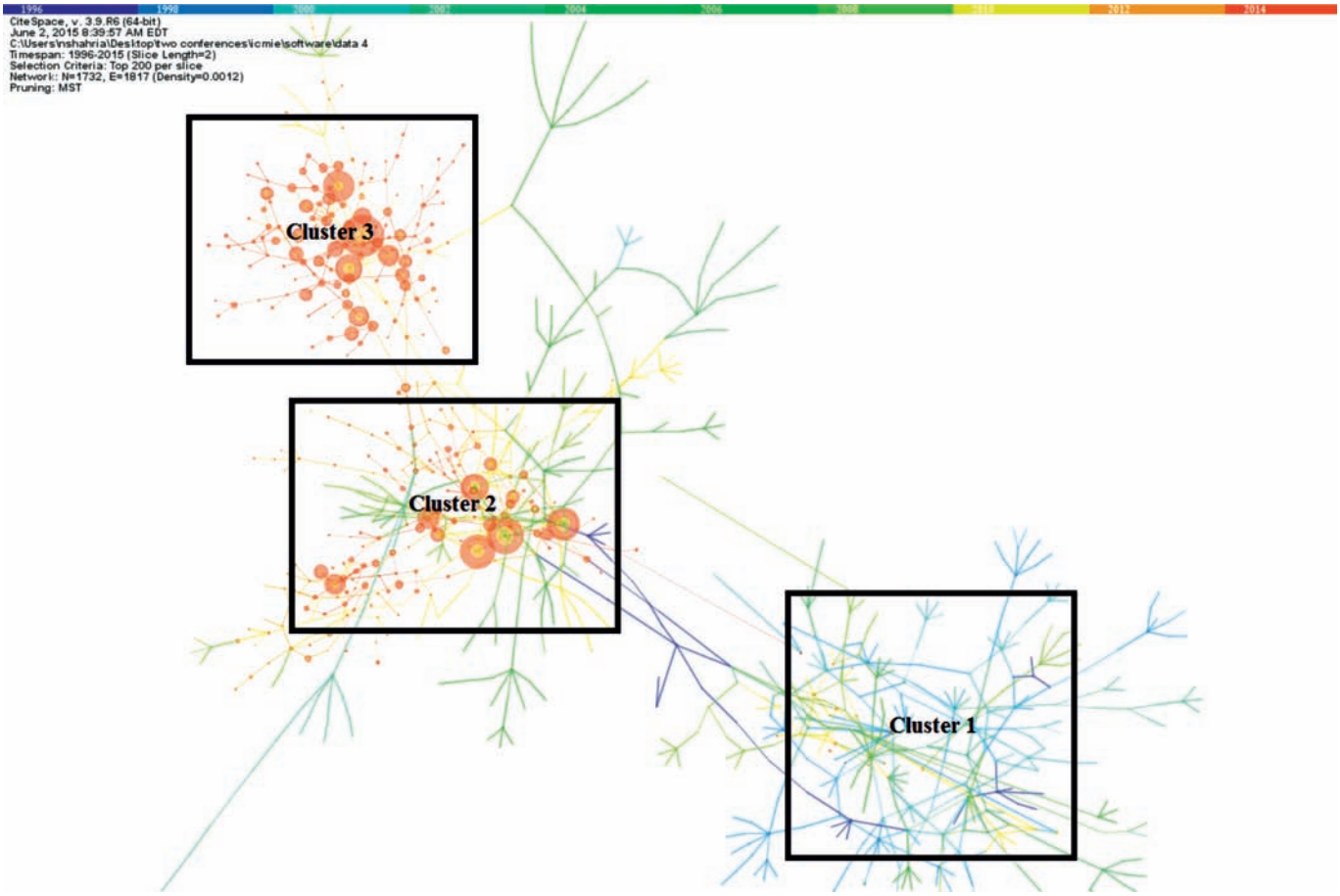

Figure 3 – *Co-citation network of references*

At a glimpse on the co-citation map of references, we can intuitively classify this network into three topologically distinguished clusters. As the co-citation networks represent semantic relationship between references, it can be perceived the intellectual structure of unconventional shale energies research field has three poles.

The first cluster has widespread structure with dominancy of purple and blue colours. This cluster in consist of smaller nodes compare the two other clusters which represent lower frequency of those references in the literature. As it is indicated in the above bar of the Figure 3, blue and purple colours represent 1996-1999 time period which were the beginning of our targeted research domain. It means this cluster contains the first intellectual basis of our targeted research domain while there has not been any recent prominent research trend moving in this cluster since we cannot see orange colour in this cluster. However, it doesn't mean there has not been any publication over the last 4 years related to content of this cluster, but it indicates that if there has been any publication related to concept of this cluster, have not coupled in co-citation relationship of older publications in this cluster. In other words, recent publications of this cluster have not got attentions of resent research trends in unconventional shale energies research field.

After the intuitive analysis of the map of Figure 4, we reviewed prominent papers

of each cluster in order to understand the content those clusters and do in depth analysis of intellectual structure for each one. Number of 16 most prominent references of first cluster was identified by Citespace III as it is depicted by the name of first author and the year in which that document was published as it is shown in Figure 4.

Reviewing the first cluster reveals the dominancy of publications addressing shale oil engineering issues. Paul T. Williams and Nasir Ahmad from University of Leeds conducted a research which published in the year 1999 in the Fuel journal. Their paper is considered as the most effective paper in this cluster. They conducted an experimental research for analyzing thermo gravimetric of oil shale in relation to heating rate and final pyrolysis temperature and reached to interesting results about weight lost in different temperature level (Williams, PT. & Ahmad, N., 1999).

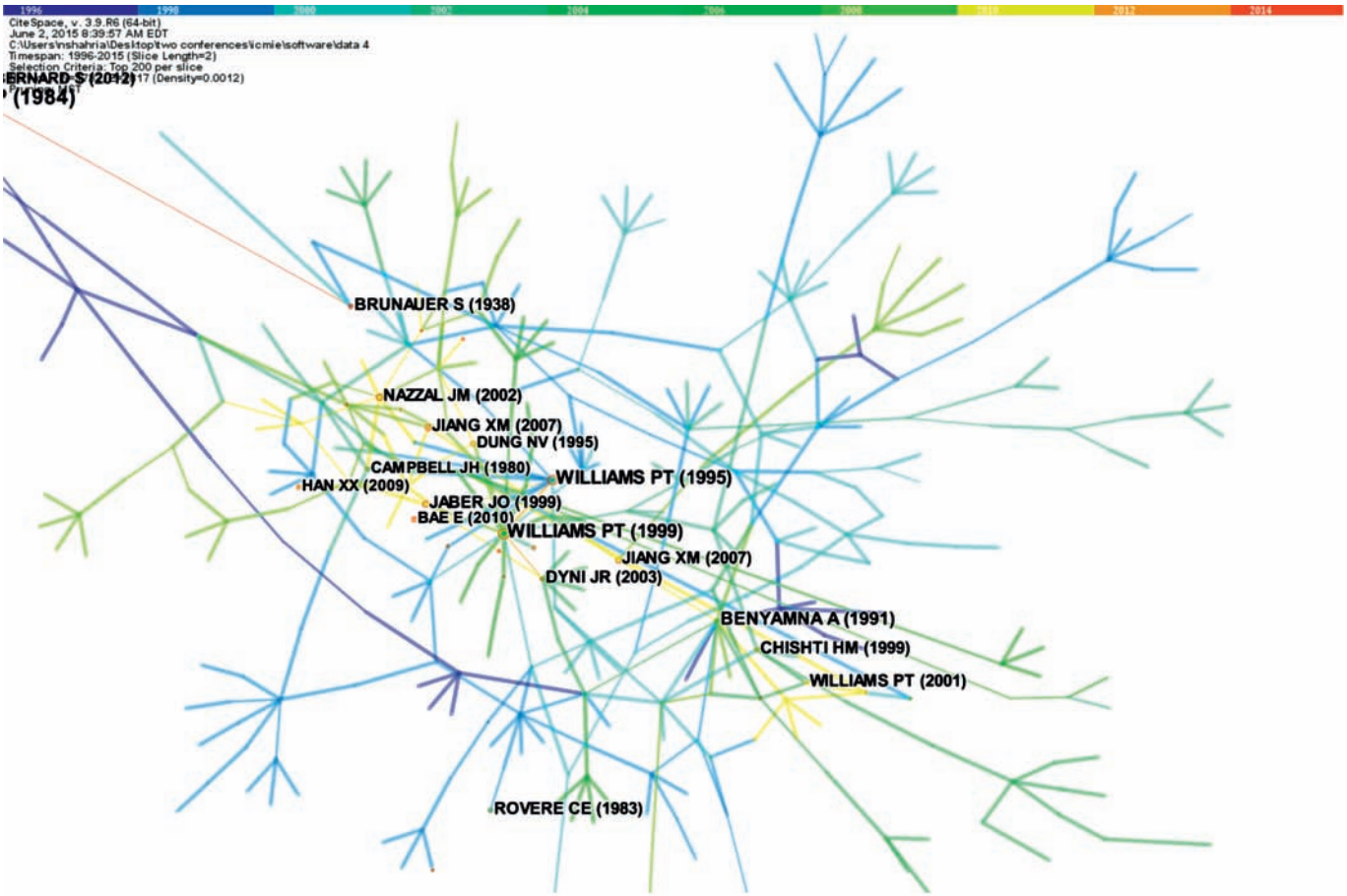

Figure 4 – *A zoomed view of the network of the first cluster*

Two of X.M. Jiang works which were published in 2007 got high attention in this cluster. In one paper he introduces these fundamental characteristics of oil shale and its industrial application in combustion. In another paper he recommended a new comprehensive utilization system for oil shale extraction (Jiang, XM., Han, XX. & Cui, ZG., 2007). Analyzing chemical characteristic of shale oil is a perdurable research trend in this cluster. Claudio E. Rovere et al. conducted a research on this topic in

1983 which resulted into identifying 600 components. About three decades later, EunJung Bae *et al.* addressed similar question with more advance technique and identified more than 30000 chemical components in the oil extracted from shale formations.

The second cluster has widespread structure as well as the first cluster, but it contains bigger nodes in the middle and smaller ones around its network. Those central bigger nodes have light and dark orange colours which represent resent time intervals of 2011-2015. It indicates the existence of a drastic growth in recent research area in that cluster which have co-citation relationships with other older references. It indicates the intellectual relations of research frontier and older research domain in the seccond cluster.

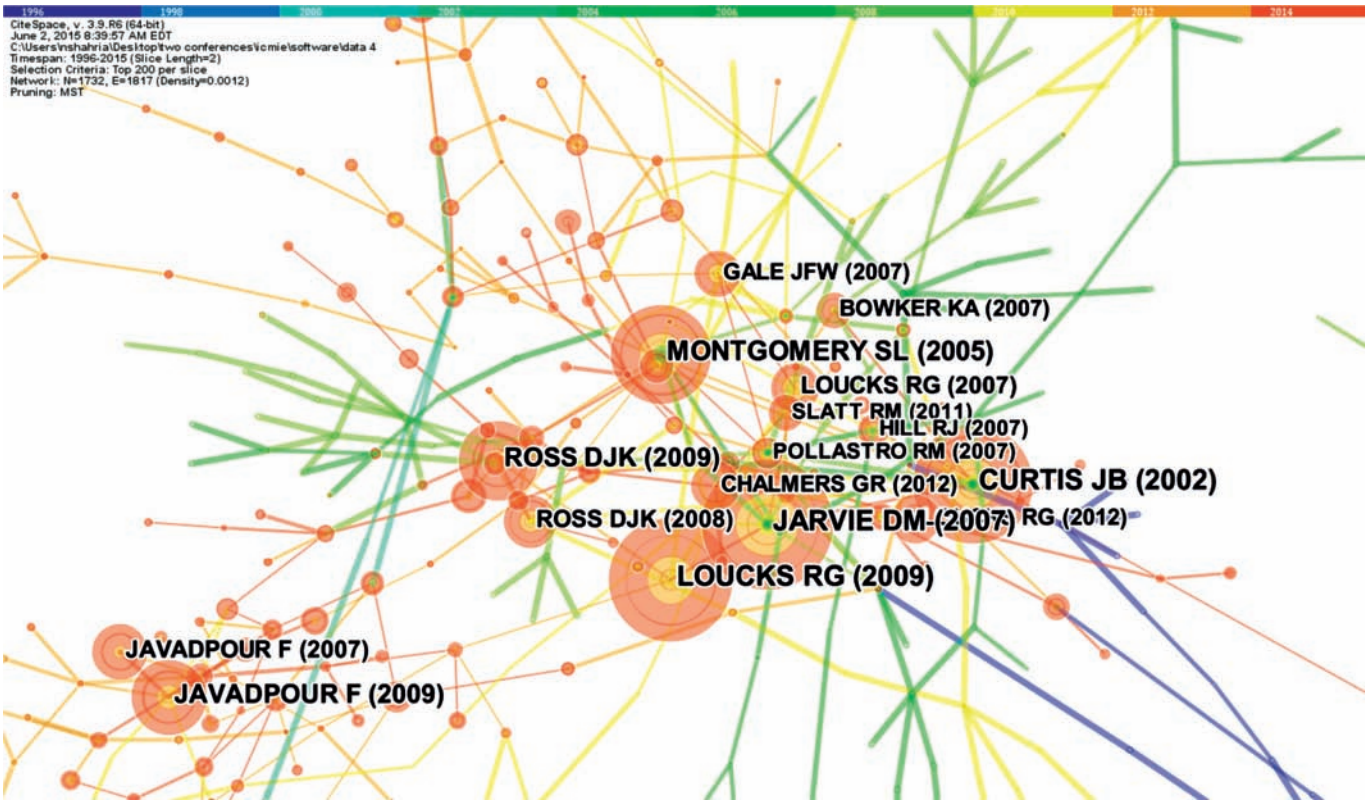

Figure 5 – *A zoomed view of the network of the second cluster*

By reviewing the prominent papers of second cluster, we can identify the dominancy of geological issues in the second cluster, mainly related to shale gas. The American Association of Petroleum Geologist (AAPG) is the most credible organization which provides publication, conference, and educational opportunities in geoscience, has been a pillar of the worldwide scientific community in shale gas geological aspects research domain. Evaluation of shale gas resources in different shale basins such as Mississippian brunet shale is a considerable research domain in this cluster which owes a great depth to geology science. Daniel J.K. Ross and R. Marc Bustin conducted a research which got published in 2009 in the journal of Marine and Petroleum Geology and has cited 200 times. In that paper, they showed the significance of shale composition and pore structure on gas storage potential of shale

reservoirs (Ross, Marc Bustin, 2009). D.M. Jarvie *et al.* estimated the total generation potential of about 609 bbl of oil equivalent for Barnett shale reserve (Jarvie *et al.*, 2007).

As it is shown in the map of Figure 5, two works of Farzan Javadpour got high attention while they have topologically located in distance from the core intellectual focus in this cluster. Farzam Javadpour, who is a geologist, has worked in shale gas porosity and permeability concepts. He used diffusive transport regime with a constant diffusion coefficient and negligible viscous effects for nanoscale gas flow in shale gas sediments which was a new approach in the field for shale gas evaluation and production optimization (Javadpour, 2013). Both of his works has been cited more than 250 times in the shale gas research field. Those papers were not his only innovative introduced approaches by applying different methods into permeability of gas in shale rocks; for instant one of his latest work published in 2015 suggest stochastic modelling approach for permeability analysing of shale gas systems. As it is depicted in the map of Figure 5, altogether 16 prominent publications of this cluster were identified by Citespace III.

Third cluster has the most focused network of unconventional shale energies research domain with the dominancy of light and dark orange colours. The drastic growth of this cluster over the last four years and low intellectual relationship to the older references, indicate that the content of this cluster is the hottest topic in the field which has emerged mainly during the last four years.

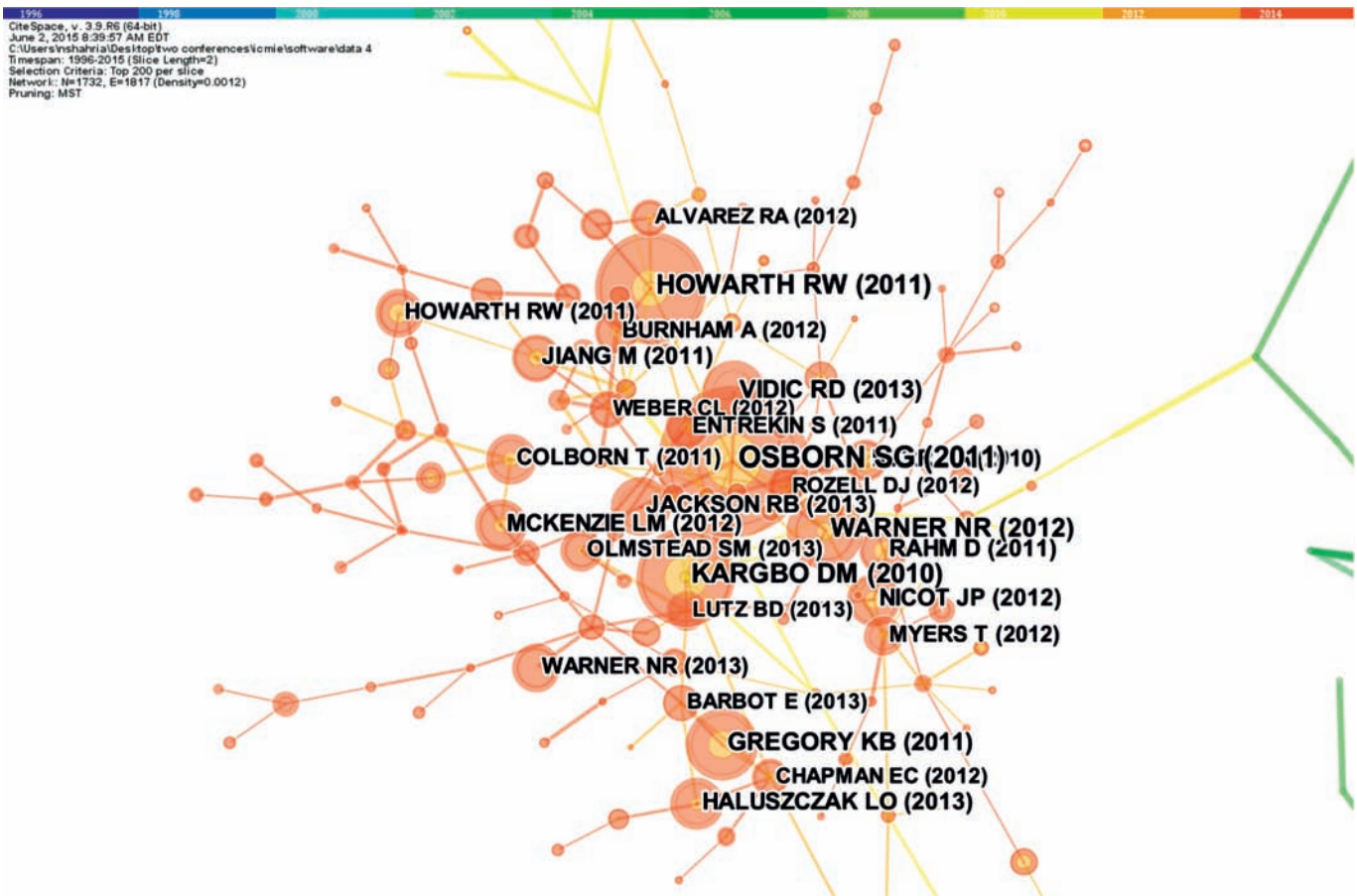

Figure 6 – *A zoomed view of the network of the third cluster*

Reviewing the papers of this cluster reveals a high relevance to the environmental aspects of unconventional shale energies; mainly the effects of hydraulic fracturing (fracking) of shale gas reserves were studied. Concepts related to the regulation, public policy and risk governance are also the most related concepts concerning environmental impacts of unconventional shale energies (mainly shale gas) development in this cluster.

Despite the rapid growth of unconventional hydrocarbon energies and their positive effects on energy independence and job creation in the United States, fracking of shale layer has been highly controversial due to its possible environmental impacts. Fugitive methane emissions, groundwater pollution, and increased seismicity are suggested as fracking potential environmental impacts (Osborn, SG.)

A very important result of our co-citation analysis of the unconventional shale energies research domain is the exposure of the low co-citation relationship between third cluster and the two others. It means low intellectual relationship between the third cluster which is aimed to address environmental impacts of unconventional shale energies, and the two other clusters which are addressing geological and engineering issues and contain the main scientific basis of this field as well.

This low co-citation relationship reveals the lack of scientific basis for assessing environmental risks of unconventional shale energies. In other words, instead of doing experimental research on the environmental impacts through scientific methods, other softer methods such as asking opinions of experts were implemented in this area while we are facing the considerable lack of data and knowledge regarding unconventional shale energies environmental impacts which means experts are not experts enough.

In this situation, not scientifically measured assumptions are highly referenced for further assessment in the literature. For example, many experts claim that although shale gas extraction may contaminants groundwater resources, from climate change perspective it is much cleaner than coal due to less carbon dioxide emission. The point which is missing in this claim is the amount of fugitive methane (which is a greenhouse gas) emission through the upper streams of shale gas production and transmission while only at combustion point it is cleaner. Anthony Ingraffea who is researcher in fracture mechanics and two of his colleagues from Coronel University conducted a research on the greenhouse gas footprint of shale gas production which got published in 2011in the Climate Change journal. They calculated the amount of greenhouse gas emission impact of shale

gas and compared it with coal (which is known as a very harmful energy resource on the climate change). Surprisingly result of their scientific approach revoked the claim that shale gas has lower greenhouse gas emission compare to the coal. They demonstrated shale gas has 20% more greenhouse gas emission impact compare to the coal and considered more harmful resource for global warming (Howarth *et al*., 2011).

Recomendations for Future Research

Existing gap between third cluster and the two other clusters has caused the two opposite discourse in the unconventional shale energies (more specifically shale gas) literature which are arguing for and against development of these resources. From one side, many environmental activist believe shale gas boom is doing more harm than positive effects on the societies, they claim this revolution was so fast compare to the maturity of technologies and our knowledge on their side effects. From the other side, many people believe shale gas is a strategic asset for oil importing countries which can pave a way for their energy independence.

However, complexities of the context of such a problem, and on the other hand lack of data and knowledge, provoke the researchers for providing more science based decision support system through bridging the existing gaps of clusters and integrating different aspects of unconventional shale energies infrastructures for regulation process.

From this point of view, we can classify our recommendations into two groups of problems at the state regulations levels and national energy policy formation. Researchers who are aimed addressing state level regulations are more recommended to bridge current environmental discourse into scientific bases through systems engineering approach as well as reviewing state of the art regulation and governance experiences. On the higher level side, researchers who are interested working on public policy aspects of these resources are recommended to see unconventional shale energies as national infrastructure, which is critical for energy security and job creation. In the higher level analysis, providing a system of systems approach toward these socioeconomic interdependent systems can provide a better framework dealing with these resources which are grappling to be resilient on current global energy market dealing with resent global oil price collapse. However, state regulations and national policy formation obviously have high interrelations which provide a range of interesting research questions to be addressed within two recommended approaches.

Conclusion

Unconventional shale energies research domain is rapidly growing on the geology, engineering, and environmental knowledge bases. However, this area of research is still not mature and dealing with lack of data and knowledge which resulted into two contradicts discourse arguing against and in favour of these controversial resources. In the current study, with the help of Citespace III software, we mapped and analyzed this growing research domain through bibliometric methods. After identifying main universities, research institutes and funding resources, we mapped network of co-citations relations for the references of 2489 publications ever published in this area. Our results indicate existence of three clusters which indicates the polar structure of unconventional shale energies research domain. The first cluster which is the oldest one refers to mainly engineering aspects of shale oil. The second cluster was mainly about geological aspects of shale gas and the third cluster was the newest and most intellectually concentrated research trend, addressing environmental impacts of these controversial resources. Main concepts, core publications, and research trends of those clusters identified and discussed in the paper. Our analyses reveal the lack of geological and engineering basis for environmental assessment of these resources. However, a range research approaches were recommended based on the identified research gaps, resulted from our bibliometric study in unconventional shale energies research domain.

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Maritime Spatial Planning in The Black Sea

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Abstract

The future implications for the implementation of the Maritime Spatial Planning (MSP) project in the Black Sea coastal area require identifying the changes and the effects. This paper aims to analyze the political, economic, social, technological, legal and ecological components, as well as the limitations of adopting a vision and the strategic objectives relevant to the Black Sea area. At present, Romania, in partnership with Bulgaria, is implementing the Black Sea Cross-border Maritime Spatial Planning (MSP) project and the authors are part of the teamwork. The aim of the project is to create a methodological framework for the development of the cross-border maritime plan. Thus, the findings of the PESTEL multi-criteria analysis will be relevant to the MSP project, on the one hand, and to all stakeholders – experts, researchers, academics and relevant Maritime Policy institutions. PESTEL, a complementary SWOT tool, extends to the analysis of the external-internal context and it is usually applied by firms for strategic diagnosis / strategic planning analysis. The idea of applying this diagnostic method to MSP will lead to identifying certain types of issues that often have an impact on the implementation of the project.

Keywords: PESTEL analysis, MSP, Black Sea

„Someone's sitting in the shade today because someone planted a tree a long time ago."
Warren Buffett

Introduction

The European Union has recognized the need for a more comprehensive approach of the maritime spatial planning and management in order to establish the sustainable development of its seas and oceans

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(Calado, 2010), which is why Directive 2014/89 / EU – establishing a framework for the development of the seas Maritime space – was adopted. In accordance with article 3(2) maritime spatial planning means „a process by which the authorities of the Member State concerned analyze and organize human activities in marine areas in order to achieve the ecological, economic and social objectives".

The Black Sea is the eastern gate of the European Union, a junction between Europe, Central Asia and the Middle East, an important transport and energy hub, an intersection of different cultures, a region with political, social and economic fragmentation, and at the same time a more threatened area in Europe due to the continental pressures and contradictory coastal and maritime activities. There are six Black Sea coastal states that include two EU Member States, namely Bulgaria and Romania and four non-member states: Georgia, the Russian Federation, Turkey and Ukraine (Petrișor, 2014). Romania has a coastal area that extends about 240 km along the north-western part of the Black Sea, an area that is affected both by natural factors and by anthropogenic factors and still possesses an exceptional potential, numerous untapped resources.

Currently, Romania and Bulgaria are implementing the MARSPLAN Black Sea project in order to make progress in supporting the implementation of the Directive and expanding the cooperation framework with all the Black Sea basin states. The Black Sea coastal area is an extremely complex social-ecological system, which varies according to the environmental, socio-economic, cultural and governance factors (Golumbeanu, 2015).

The concern for the field of maritime spatial planning in recent years is reflected in the literature by various definitions given to the concept. Thus, Marine Spatial Planning is „a process of public analysis and allocation of spatial and temporal distribution of human activities to marine areas to achieve the ecological, economic and social goals". MSP is defined as „creating and establishing a more rational organization of the use of marine space and interactions between its uses to balance development requests with the need to protect the environment and to achieve the social and economic objectives in an open and planned manner" (Douvere, 2008). At the same time, it is recognized that Maritime Spatial Planning (MSP) is an extension of land-use planning policies and instruments, first to the coastal area, defined as the land-to-sea area, for sustainable coastal management, and, currently applied to the activities taking place at sea.

PESTEL Analysis

Traditionally, the PESTEL analysis is used as a tool in the external analysis when conducting a strategic analysis or undertaking market research for businesses but

it can also be used by organizations to strategically manage different projects. PESTEL is an important tool used for market and environmental analysis and to support strategic decision-making (Narayanan, 2001).

The PESTEL framework is an analytical tool used to identify the key factors of change in the strategic environment and includes political, economic, social, technological, legal and environmental factors, but other variants include PEST, PESTLIED (including international and demographic factors), STEEPLE (including ethical factors) and STEEPLED (including educational and demographic factors) (Johnson, 2008).

PESTEL analysis has different definitions in the literature, such as PEST (Dare, 2006) and STEPE (Richardson, 2006). The initial form of PESTEL was first conceived by Aguilar as ETPS (economic, technical, political and social). It was subsequently reorganized as STEP for the Arnold Brown Life Insurance Institute to be used in the Strategic Trend Evaluation, which was later modified to address the macro analysis of the external environment or scan for environmental change and it was defined like STEPE. In the 1980s, the legal dimension was added to this approach (Richardson, 2006). In addition to a strategic analysis technique, PESTEL analysis has begun to be used in various fields (Yüksel, 2012).

PESTEL, a complementary tool for SWOT, extends the analysis of the external context, analyzing in detail certain types of issues that often have an impact on the implementation of the project/initiatives. PESTEL is an acronym for six sources/change factors/domains (Figure 1) that it takes into account: Political, Economic, Social, Technological, Ecological and Legal (UNICEF KE Toolbox).

Figure 1 – *PESTEL factors*
(Source: Professional Academy 2017)

- **P**olitical Factors: These factors determine the extent to which a government can influence the economy or a particular field of activity. Political factors include government regulations, such as environmental laws and regulations, employment, fiscal policy, trade restrictions, political stability, democracy and the level of corruption.
- **E**conomic Factors: These factors are determined by the performance of an economy that has a direct impact on society and produces long-term effects and inclusive economic growth, interest rates, inflation and exchange rates.
- **S**ocial Factors: These are factors that take into account all the events that affect the community or the area in which the project is being conducted. These factors analyze the social environment and include cultural exigencies/trends, norms, dynamics and population demographics, population health status, and so on.
- **T**echnological Factors: These factors relate to technological innovations and concern the level of automation, research and development, technological awareness, etc.
- **E**nvironmental Factors: These factors include all factors that influence or are determined by the environment, such as climate, geographical location, natural disasters, soil and subsoil characteristics, renewable energies, soil pollution, water sources, the atmosphere, global climate change, etc.
- **L**egal Factors: These factors take into account all internal and external legal issues in activity areas that affect project implementation, such as employment, taxation, resources, the environment, imports and exports, etc.

In this paper, the PESTEL framework will be used in a slightly different context, namely, the main purpose of the analysis will be to identify the factors that represent challenges or opportunities through the implementation of the Maritime Space Planning (MSP) project for the Black Sea coastal area. In order to allow the creation of a framework for the development of the Black Sea Maritime Spatial Planning Plan, which has a steering and regulatory nature, the spatial and temporal distribution of current and future activities and uses in marine waters should be taken into account. The usage necessities for the various uses of the maritime space (such as fishing, aquaculture, renewable energy, oil and gas exploration and exploitation, other energy, minerals and aggregates, ecosystems conservation and Biodiversity, raw materials extraction, maritime navigation, tourism, underwater cultural heritage, and so on) (Directive 2014/89/EU), as well as increased competition for the use of resources in accordance with development requirements must be achieved with environmental protection and in accordance with national legislation and policies.

The analysis of the PESTEL framework for the maritime spatial planning project in the Black Sea coastal area is presented in the following section.

Pestel Analysis for MSP

Therefore, the PESTEL analysis is used in this research to identify the changes and effects produced by the multitude of activities that must be harmonized at spatial and planned sea level, to maximize the benefits and opportunities and to minimize the threats for the implementation of the MARSPLAN project in the Black Sea.

PESTEL involves identifying the factors in each of the six relevant areas for the MARSPLAN Black Sea project (Table 1)

Table 1 – *PESTEL Analysis*

I. Political Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	Political and governmental stability	• Governmental involvement, consistency and continuity for the implementation of the MARSPLAN project;	• Governmental changes affect the pace of implementation of European legislation and may generate local government indecision;
2	Coherence and continuity in central and local public administration approaches concerning maritime spatial planning	• National legislation adopted specific to MSP;	
3	International and regional cooperation	• Functional strategic partnership at the Black Sea; • Cross-border cooperation between Romania and Bulgaria on maritime issues; • Government involvement in trade unions and agreements;	• Significant differences between conceptual approaches of international partners; • Different organization of the entities that coordinate the implementation of transnational projects in the partner countries;
4	Support for regional development	• Favorable regional context; • Awareness of the need for regional development; • Implemented projects on beach widening;	• There has been no updating and correlation of local development plans in line with the situation resulting from coastal rehabilitation works; • Poor local regulations concerning the land in the coastal area;
5	Central and local institutional capacity to develop and implement sustainable regional development policies	• EU requirements for regional development to be implemented by Romania; • Popularization, awareness and increasing knowledge of the benefits of implementing regional development measures;	• Lowly qualified staff in the development and implementation of strategies at a regional or national level; • Dependence on European funds for the development and implementation of major regional development projects;
6	Access to the EU structural funds or other funding sources	• The existence of specific financing programs specific to regional development financed by European funds that can be accessed by Romania; • Other European funds that funded the rehabilitation of the Black Sea coast;	• The financing of the MARSPLAN project from European funds has not been continued; • The financing of the rehabilitation project of the Black Sea coastal area was not continued on the following sections that were scheduled to start in 2016;
7	Tax policy (rates and incentives)	• The national fiscal policy is focused on maintaining macroeconomic stability;	• Tax policy (rates and incentives) is changing every year so business plans must be adjusted yearly;

II. Economic Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	State of the national and local economy	• The national economy is on an upward trend; • Constanta has developed as an economic and commercial hub between East and West; • Growth rates are positive; • Development of local transport and water supply/sewerage infrastructure through National Local Development Programs (PNDL), with immediate effects on increasing the quality of life in traditional rural areas; • Local governments/authorities benefiting from financial resources;	• The upward development trend must be matched by an update and improvement of the development policies so that the applicability of the measures in this sphere can successfully and coherently be integrated into economic development; • Local financial resources that are not directed coherently towards sustainable local development;
2	Development of port activity	• Creating jobs; • Development of transport infrastructure (motorway, airport, waterway, railway); • Allocation of governmental resources for projects in the Black Sea area;	• Shortcomings in spatial planning if they do not connect and correlate urban and environmental regulations with the level of port activity development;
3	Tourism development	• Creating jobs; • Development of transport infrastructure (motorway, airport, waterway, railway); • Development of the area through the construction of dwellings, accommodation and related activities in tourism; • Developing other support industries; • Increasing the investments developed by the foreign business environment; • Attractiveness for the national business environment;	• The hotel, as well as leisure infrastructure, is ageing; • Focus, in particular, on developing investments in accommodation and creating deficiencies in other functions (recreation, promenade, etc.) • Failure to comply with regulations for coastal tourist developments; • Lack of a regional strategy for the development of support services for tourism and fisheries; • Lack of a regional strategy for promoting national cultural heritage;
4	The potential for the food and agriculture industry	• Creating jobs; • Shared use of infrastructure designed to reduce investment costs;	• Abandoning of agriculture and using surfaces for residential, commercial, tourist construction;
5	Local taxes (monetary and fiscal policies)	• Collecting important sums to return to society by investing in infrastructure development;	• The existence of a relatively high level of local taxes;
6	The quality of the banking system and credit availability	• Quality banking system; • Credit availability is quite good;	• Credit availability is at larger costs than EU;

III. Social Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	Population trend	• Population growth rate as there are university centres in the region;	• The general trend of the ageing population; • The coastal zone has been experiencing a slow decline and the ageing process in recent years; • Excessive urbanization of some areas to the detriment of others;
2	Concerns about spending spare time and attitudes toward work, leisure, career and retirement)	• The coastal area, lake area of the region, promenade areas; • Organizing competitions, festivals, concerts, shows; • Professional activities in the service area (related to tourism, port activity);	• Sedentarism of the population quite pronounced; • Lack of sports facilities and infrastructure; • The cycle of work (the peak being the summer season);
3	Civil society and public participation	• The existence of non-governmental organizations; • Engaging the public in decision-making could help stakeholders;	• A rather shy perception of civil society involvement with its own ideas and proposals; • Lack of initiatives to propose and intervene in local development strategies in some localities;
4	University environment	• The functioning of universities with internationalization strategies adapted to the requirements of the economic actors;	• Sometimes lack community membership due to the fact that some students are not from the city of residence;
5	Business opportunities	• Developing a small business; • Employment opportunities; • Openness showed by society in the implementation of green electricity generation solutions;	• Secondary speculative issues considering the summer season and abundance of single/short-term consumers;

IV. Technological Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	Transport infrastructure	• Constanta is the largest port on the Black Sea and the fourth largest port in Europe; • International Airport, river and sea transport, rail transport, motorway;	• Lack of energy transport infrastructures produced along the Black Sea coast; • Increasing transport distances due to the lack of bridges across the Danube in the western part of Dobrogea;
2	Coastal hydro-technical constructions	• Rehabilitation works of the southern part of the Romanian coastal zone in Constanta Municipality (South Mamaia, Tomis North Zone, Tomis Center Zone, Tomis South Zone) and Eforie Nord Zone; • Extension and modernization of water supply and sewerage networks;	• Advanced coastal erosion in the southern coastal zone between Eforie and Mangalia-Vama Veche;
3	Communication / utilities infrastructure	• Extension and modernization of water supply and sewerage networks; • High-speed, low-cost Internet access;	• Lack of tourist information facilities (on-line / print); • Lack of on-line dissemination/ promotion platforms for the investments proposed or under implementation;

V. Environmental Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	Geographic position	• A privileged position, with an opening to the Black Sea, leading to opportunities for land-sea activities; • The existence of a rich natural and cultural heritage;	• An uncontrolled exploitation of the opportunities offered by this strategic positioning; • The excessive urbanization of the southern part of the coastal area;
2	Coastal erosion	• Integrated coastal zone management; • Reducing the coastal erosion of the beach and cliff areas through the rehabilitation works of the Romanian coastal zone;	• The existence of protected natural areas; • The second part of the coastal rehabilitation works was not started;
3	Urban development	• The Romanian seaside is the most exploited tourist area in Romania;	• The uncontrolled development of different tourism activities over the environment·s supportability capacity;
4	Weather and climate change	• The temperate-continental climate (with Mediterranean influences in the south) affects tourism, agriculture, the health of the population, etc.;	• The seaborne distribution of marine parameters has undergone major reconfigurations (eg, precipitations that occur violently over short and limited periods);

5	Laws regulating environment pollution	• Adopted national legislation regulating environmental pollution as well as normative acts with an environmental impact;	• Over-regulation in favor of environmental protection, without indicating efficient and adaptable mechanisms for the economic exploitation of existing resources (wind, solar, mineral);
6	Endangered species	• Protecting endangered species by the joint efforts of the local authorities and NGOs;	• Pressures on the fish stock in the Romanian economic zone;

VI. Legal Factors			
No.	**Factor**	**Opportunity**	**Barrier/Threat**
1	European documents: directives, resolutions, normative acts	• EU Maritime Spatial Directive (2014/89 / EU);	• The low applicability of certain aspects of European documents due to the specificities of the Black Sea;
2	National legislation specific to MSP	• O. G. no. 18/2016 on Maritime Spatial Planning;	• Insufficient regulations and national provisions for maritime spatial planning;
3	Sectoral national legislation with an impact on MSP	• The existence of international, European and national legal regulations in the field of water, environment, maritime transport, fisheries and aquaculture concerning the protection of subterranean cultural heritage, concerning the protection of archaeological heritage;	• Certainly insufficiently regulated issues, such as the exploitation of energy resources, the exploitation of renewable and non-renewable natural resources, pipelines and cables; • Over-regulation and lack of accountability of local authorities in attracting investments; • A long period of time to obtain building permits • Lack of land ownership documents as well as supporting documents (plans, topographical maps, cadastre) for neighbouring land areas;
4	European funding policies and programs	• Carrying out similar maritime spatial planning (MSP) projects in certain marine regions of Europe; • Opening for the cooperation of the states bordering the Black Sea;	• The non-member States of U.E. in Black Sea coastal areas (Georgia, Russian Federation, Turkey and Ukraine) have not developed Maritime Spatial Planning Plans;

Results and Discussion

Given the fact that maritime spatial planning is thought to be a cross-sectorial policy instrument that allows public authorities and stakeholders to use a coordinated, integrated and cross-border approach (Directive 2014/89/EU), the authors considered it necessary to carry out a PESTEL analysis for key factors, namely political, economic, social, technological, ecological and legal components for the MARSPLAN Black Sea project.

The maritime development process, which results in the development of a maritime spatial plan or plans, is a process that has to take into account the land-to-sea interactions (Directive 2014/89/EU). Developing the Black Sea Maritime Spatial Planning is designed to plan the use of land and coastal areas to promote the sustainable growth of maritime economies, the sustainable development of maritime areas and the sustainable use of marine resources.

PESTEL's analysis of the political, economic, social, technological, environmental, and legal components of the MARSPLAN Black Sea project identified certain types of issues that may impact on the implementation of the project. A first result of the analysis shows that there are interdependence and interaction between the analyzed domains. Combining multiple uses of the marine area should, therefore, take into account the opportunities and barriers that prevent multiple uses in different contexts. Combining marine activities should be done in such a way as to minimize local impact and contribute to reducing global human pressures on marine ecosystems.

Another identified outcome would be that users need to show responsibility for the society and the environment, and decision-makers and policymakers, coastal communities, NGOs, scientists and maritime businesses must make cost-effective efficiency improvements of the marine resources that are used.

As specified in some specialist studies, planning recommendations addressed to authorities focus on economic, social and environmental issues in an integrated approach, giving them equal priorities, in sustainable development of the area (Petrișor, 2016). Sustainability is a key factor, therefore, the sustainable development of the Black Sea coastal area must be seen as a multifaceted concept with four pillars (economic, social, environmental and cultural) and several dimensions, including a territorial one (Petrișor, 2014). Therefore, in the context of sustainable development of activities in the Black Sea and coastal areas, local authorities need to encourage investment, ensuring predictability, transparency, easy regulation and clear enforcement rules.

Identifying the changes and effects of the multiplicity of activities to be harmonized at spatial and sea level by implementing MARSPLAN for the Black Sea will contribute to the efficient management of maritime activities and the sustainable use of marine and coastal resources by creating a coherent, transparent, sustainable and evidence-based decision-making framework.

Conclusions

The first conclusion identified is that combining multiple uses of marine areas will deliver significant benefits in terms of economic, spatial and environmental efficiency.

The second conclusion is that both decision-makers and coastal investors are faced with the challenge of finding a balance between the benefit of economic growth and the mitigation of the pressure exerted by the activities developed on the coastal environment.

The findings from the PESTEL multi-criteria analysis will be relevant to the MARSPLAN project regarding the creation of the methodological framework for the elaboration of the Black Sea Maritime Spatial Planning Plan. On the other hand, the results will be useful to all stakeholders – experts, researchers, academics and institutions relevant to maritime policy. The Lessons learned as well as the actions proposed to implement any improvements identified will provide recommendations for future projector managers.

The authors intend to continue their research work through a more in-depth study of the impact of urbanization in the Romanian Black Sea coast, its results being able to respond to the way in which the sustainable development of the area must be addressed.

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Business Through the Syndicated Loan

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Abstract

The main research objective of this paper is to justify the benefits for the parties involved in syndicated loans and to clarify the competitive advantages of this type of financing. The question concerning the benefits and rewards of syndicated loans is further developed in two directions: advantages for the companies and benefits for banks participating in the distribution of financial resources. The achievement of this objective requires a thorough analysis of the factors from the point of view of demand and supply that determine the attractiveness of the choice of syndicated lending. The analysis and results of the study are addressed to the specialized academic community, practitioners, banking experts and market analysts. The publication of the results of the analysis can help to achieve practical benefits and realize the added value by reducing costs, penetration of new market segments, attracting new clientele, realizing income from the provision of additional services and portfolio diversification. The key contribution of the paper is to clarify the factors that make syndicated loans attractive. The review of the literature on the studied issues and the analysis of secondary data from the Thomson Reuters data bases provide an opportunity to outline current trends and describe the essential challenges facing their development in the post-crisis period. The analyses of the sectoral and regional profile of syndicated loans can provide valuable information that can serve as an indication or reference to rethink some imposed stereotypes on the global market of syndicated loans.

Keywords: syndicated loan, global market of syndicated loans, banks, bank loans

„A goal without a plan is just a wish."
Antoine de Saint-Exupéry

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Introduction

Unlike the traditional bilateral bank loans, a syndicated loan is provided by a group of creditors united in the so called bank syndicate and is managed by one or several banks-leaders of the syndicate. The main terms and conditions for the provision of the loan are negotiated between the borrower and the bank leader chosen by the borrower, also called a Mandated Arranger. Upon completion of the negotiations, the Bank receives a mandate to provide financial resource and invites other banks to participate in the financing. It is believed that the syndicated loans originated and developed in the London City in the 1960s by relatively few commercial banks with limited balance indicators, but serving large and important clients. In view of their limited capabilities, these banks have not been able to provide the necessary borrowing resources to the customers entirely at their own expense. However, this did not represent a significant barrier to their customer relationships as they provided the resource by attracting other banks that agreed to participate in the financing after the main parameters of the loan have already been negotiated by the bank-initiator (Fight, 2004). The provision of large leverage-buyout (LBO) loans in the mid-1980s turned the syndicated loan market into a dominant channel for companies to access banks and other institutional providers of financial resources. The reason is simple – syndicated loans are both cheaper and more efficient for administration than bilateral loans and credit lines (Miller, 2011).

The argument for the attractiveness of syndicated loans could develop in two directions – demand-side benefits (i.e. for the borrowing companies) and benefits for the participants in resource placement.

Undoubtedly syndicated loans represent *an alternative to public funding* for large corporations. They provide banks with the opportunity to compete with public debt markets in the placement of large resources to borrowers. In this respect, Coffey (2009) defines the syndicated loans as a convenient external financing tool that allows relatively quick and flexible access to resources in exchange for or complementing the traditional sources of capital – stocks and bonds. The factors that determine the attractiveness of syndicated loans and the reasons for the borrowers' preferences for them are multilayered.

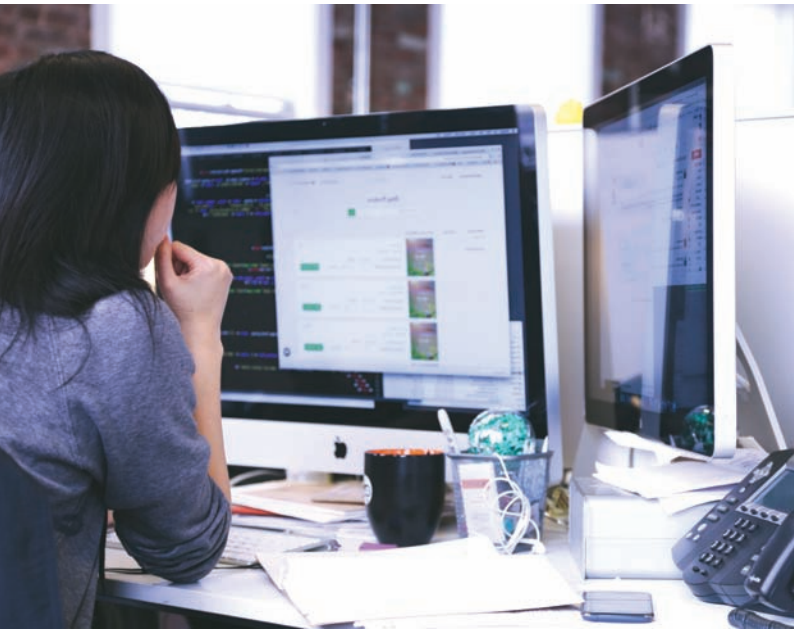
One of the possible reasons for choosing the syndicated format is related to the cross-border nature of funding, which allows to *overcome the existing restrictions* in the local financial legislation, especially in cases of concluded deals with borrowers form the third-world. The borrower's ability

to attract cross-border resources gives him an exceptionally favorable opportunity to be independent from the local market financing conditions and to attract financial resources on more favorable terms. Another legitimate reason can be rooted in *the technology of provision* and in *the servicing mechanisms* of the syndicated loans. It is well known that they are unified in terms of granting of resource and payment of loan instalments, which are usually made through a Agent bank. This *saves transaction costs* for borrowers related to servicing the instalments as compared to the option to use several bilateral loans from different banks. In addition, *operating costs reduction* is achieved because the terms and conditions of the loan are negotiated with the arranger bank and no rounds of negotiation are required with each individual participant in the financing.

From the borrower's point of view, the syndicated loan can be considered as a formal substitution of the processes of negotiation and signing of a series of separate agreements with multiple creditors. In this line of reasoning, the main advantages for the borrowers are related to *the reduction of the administrative procedures, the faster finalizing of the deal and simultaneously obtaining the total necessary resource* compared to bilateral crediting. Given the advantages of syndicated loans to the traditional for the banks bilateral loans, it can be summarized that they lead to a reduction in transaction and administrative costs due to the fact that the borrower does not have to enter into credit relationships with many banks. On the other hand, however, the borrowers have the opportunity to establish new useful contacts with individual participants in the syndicate, which could offer additional services in areas where they have competitive advantages. It seems paradoxical, but the syndicated loans simultaneously save costs from establishing relationships with a limited number of credit institutions, while at the same time the borrowers are not deprived of the opportunity to realize added value from potential new contacts and use of additional services by the syndicate members.

Discussion

The traditionally discussed and the most frequently mentioned advantage of the syndicated crediting is that it provides an opportunity for the mandated arrangers to share the risk with the other participants in the bank syndicate. Such risk sharing, however, is valuable if the banks themselves are funded by imperfect financial markets and have to use expensive external resources (Froot, Stein, 1998).



For credit institutions that can be proud with realizing deals with relatively high interest rate spreads, it can be assumed that they will not be particularly intrigued by participating in a syndicated crediting. In reality few banks find themselves in such a situation. Considerably more are those who have temporary surpluses of large resources or do not generate a sufficiently high interest spread from their core business. They would prefer the syndicated loans in order to raise their net interest income. Particularly with respect to the banks – regular participants, the syndicated loans favors the achievement of this objective also through the minimal operational costs of transaction administration normally borne by the leading banks.

The syndicated loans are an alternative to the traditional bilateral loans when the banks are targeting growth or looking for opportunities to dispose of potential surplus resources. The syndicated loans are also used to improve the return and the credit quality of the bank loan portfolio (Howcroft, Kara, Marques-Ibanez, 2014). A number of studies highlight the factors that determine the *attractiveness* of choosing syndicated loans for banks that ensure the resource placement. The results of these studies indicate that the syndicated loans can be used by the banks-leaders to alleviate the *regulatory capital constraints* (Hubbard, Kuttner, Palia, 2002). Dennis and Mullineaux (2000) view the syndicated loans as an effective tool for *portfolio diversification*.

An axiomatic assertion in the financial theory is that if a bank has a well-balanced and skillfully diversified portfolio, eventual losses caused by a separate loan transaction will affect negatively the realized profit, but will not threaten its solvency. In return for taking a relatively low risk of concentration of borrowed resources in their portfolio, the creditors will be willing to receive lower returns and will therefore be prone to provide loans at terms and conditions more advantageous to borrowers (Mitchell, 2007). Other authors also share such an argumentation, but at the same time note that this applies to a greater extent to the small banks – regular members of the bank syndicate (Sufi, 2007; Esty, Megginson, 2003; Altunbaş, Gadanecz, Kara, 2005). By participating in syndicated loans, they achieve the so much desired diversification of their loan portfolio by lending to large borrowing companies, with which ceteris paribus these banks would not otherwise have credit relationships.

In fact, the participation itself of small banks in syndicated loans facilitates the development of a new business segment, respectively for attract new customers. This would result in a lot of advantages not only from the point of view of the opportunity to penetrate into a new market, but also to offer competitive services to the newly attracted clientele that will „infuse" additional profitability from credit activity.

The individual banks have different competitive advantages such as experience and expertise in specific sectors and industries. Completely logically, the design of their portfolio should focus on exposure to those niches, which have the necessary knowledge and experience to implement effective risk management, which in turn guarantees the peace of shareholders. Such risk-averse behavior, however, excludes the possibility of the bank penetrating into fields and/or areas, in which it feels uncomfortable due to lack of expertise.

In some of these areas, however, the market conjuncture may allow for the realization of higher spreads, which are not necessarily connected to taking a higher risk. Voluntary deprivation of the opportunity for realization of a higher margin puts the bank in an unfavorable competitive position. The participation in syndicated loans, however, can successfully overcome the objective limitation of specialization in the expertise of most of the banks. They can acquire such exposures, by which to avoid the unhealthy concentration of loan portfolio in individual sectors and industries. Thus, on the one hand, the syndicated loans allow for the optimization of the realized spreads through flexible acquisitions or sales of bank assets, to optimize spreads and, on the other hand, to achieve the equilibrium by diversifying assets, which is vital for each investor. In the end, the chain effect can be described as an attempt to strike not two, but rather three extremely valuable targets: *attracting new clientele, providing additional services (resp. increase profitability) and portfolio diversification.*

The close relationships between a banker and a client are very favorable from the point of view of the efforts of the bank for risk reduction, more effective competition with the direct financial markets, value generation to borrowers and creditors and increasing the net profits. From this position syndicated loans are very different from the traditional „client-bank" relationships of the bilateral loans. However, they have better competitive advantages with regard to the direct capital raising from the financial market (Howcroft, Kara, Marques-Ibanez, 2014).

Another major advantage of syndicated loans compared to the bilateral bank loans is the possibility of *a secondary trade.*

The secondary market provides an option for banks to place syndicated loans in their portfolios or parts of them to other investors. The condition for secondary trading is the existence of a clause in the credit agreement that allows the *transfer of claims* to other creditors. The standardization of documentation is a primary factor in facilitating the secondary sale of syndicated loans. Particularly useful for improving the liquidity of this specific market are trading standards introduced by specialized professional bodies such as the Loan Market Association (for Europe) and the Asia Pacific Loan Market Association (for the USA, Asia and the Pacific region).

The syndicated loans expand borrowing by allowing institutional investors to participate directly in financing loans that banks create instead of indirectly financing the banks (Ivashina, Scharfstein, 2010). The demand by the large holders for liquid resources provides a relatively high degree of liquidity for this type of assets. Although the shares in syndicated loans held by the banks are not comparable in terms of liquidity to the treasury bills, for example, they are certainly much more liquid than standard bilateral loans. The banks are increasingly utilizing the option of secondary placement, resulting in a significant increase in the volume of secondarily traded syndicated loans during the first decade of the new century (Howcroft, Kara. Marques-Ibanez, 2014).

The analysis of the advantages and gains of banks, involved in the providing of syndicated loans, should be considered in the light of the specific roles assigned to banks in the syndicate hierarchy – bank – leaders of the syndicate and banks – regular participants or lower level managers (Gadanecz, 2004). In particular, the leading *motives* for the participation of the bank – leaders in the syndicate can be summarized as follows:

- allocation of credit and liquidity risk among a larger number of participants in the financing;
- avoid the overexposure of a borrowed resource in a separate credit transaction, in accordance with the criteria for acceptable internal or regulatory norms and limits for risk concentration;
- the realized revenues from management fees for syndicated loans contribute to increasing the profitability of the banking activities and for diversifying the sources of revenues;
- for most banks – leaders, which uphold their market-maker reputation, syndicated loan management is a matter of paramount importance for the corporate image.

The role of banks – regular participants in the syndicate composition is quite different from that of the arrangers. Their benefits are also of a different nature, given their participation primarily as resource providers. Participants from the second level in the hierarchy typically have a different regional affiliation and they comprise of smaller credit institutions with relatively modest international lending experience (Gadanecz, Kara, Molyneux, 2012). From

the point of view of the banks – regular participants, their participation in the bank syndicates is provoked by:

- their limited capabilities to expose significant resources in a single loan transaction;
- the ability to penetrate new market niches, industries or geographic regions;
- the ability to avoid or reduce operational and transaction costs;
- opportunities for increasing the profitability of additional services provided to the borrower such as cash management, investment consulting, currency trade transactions, trust management, etc.

The one-sided focusing of the analysis on the benefits of syndicated loans would be incorrect and incomplete unless some critical factors influencing their attractiveness are marked. It is widely known that large high-ranking companies usually have the „luxury" of a direct access to financial market investors and the „privilege" to receive cheap resources on the provided standard bank loans (their so called „plain-vanilla" loans). This is not the case with the so-called „Leveraged issuers" (borrowers with a relatively higher risk rating). Banks' estimates of the assumed risk are influenced by the complexity of the transaction, the current market conditions, and whether the loan is underwritten. Loans for mergers and acquisitions (M&A), recapitalization, restructuring and exit loans are probably among those with the highest risk status.

In the course of the formation of the syndicate, the mandate bank examines the market carefully, analyzes the attitudes of pre-selected investors, while at the same time tries to make a delicate, but highly accurate measurement of their „appetite" for resource supply. Based on the results of such a survey, the arranger strives to negotiate the loan with corresponding spreads

and fees, which are in a price balance with the demand and the supply on the market. However, the Russian debt crisis in 1998 imposed some changes in the conduct of the arrangers. They began to adopt a more flexible market approach, which allows them to make ongoing changes in pricing of the loan depending on the investor demand or to transfer resources between different tranches. The flexible conditions made loans look more attractive – especially with respect to changes in pricing, which are connected with market moods and investor reactions (Miller, 2011).

There are also a number of other circumstances, which require the adoption of restrictive measures on the leverage loans. For example, if the loan is unsecured, probably a restrictive measure will be imposed on the ability to provide collateral for other loans (the so called „negative pledge"). Moreover, the borrower is usually deprived of the right to change their business area or to transfer activities to their own subsidiaries that are separate legal entities without the written consent of the creditors. Different types of financial restrictions can be imposed and they can be included as covenants in the credit agreement. The covenants serve as an instrument for guaranteeing the interests of the banks.

They impose clearly defined limits, prohibitions and different types of restrictions, which the borrowers are obliged to observe until full repayment of the loan (Dass, Vikram, Wang, 2011). The financial restrictions may affect different indicators, reflecting the net value, the total indebtedness, the sum of the short-term assets and the short-term liabilities, the pre-tax profit and the dividend payments to the shareholders. A survey of the US syndicated loan market in the period 1996-2010 ascertains the presence of more than 80 different covenants in the credit agreements (Freudenberg *et al.*, 2012). Restrictions can also be envisaged with regard to the possibilities for attracting additional loan financing.

Post-Crisis Projections

The evolution of syndicated loans is marked by peaks and falls, but is generally characterized by a „mirror image" of the economic reality and the market conjuncture (Chui *et al.*, 2010). The global crisis has hit the most the export-oriented companies, which have suffered order cancellation, and their current financial status has been heavily affected by late payments for deliveries made (Malouche, 2009). Moreover, not only the reduced demand, but also the falling commodity prices, which is a common phenomenon during an economic downturn, led to significantly lower levels of necessity for cash resources for companies to finance a unit trade volume. This affected the credit demand, which in turn has led to a dramatic decline in the volume of syndicated loans that are mainly used for short-term financial needs of resources by commercial companies (Chui *et al.*, 2010). The collapse in the global trade has led to a decline in the gross capital flows, a reverse movement of capital flows between the developed and the emerging markets and a decline in the international bank lending (Cetorelli, Goldberg, 2011). In many countries, the banks sharply restricted the credit supply (Aisen, Franken, 2010). This prompted companies with credit constraints to reduce the investments (Duchin, Ozbas, Sensoy, 2010), which in turn helped spread the crisis from the financial to the real sector of the economy.

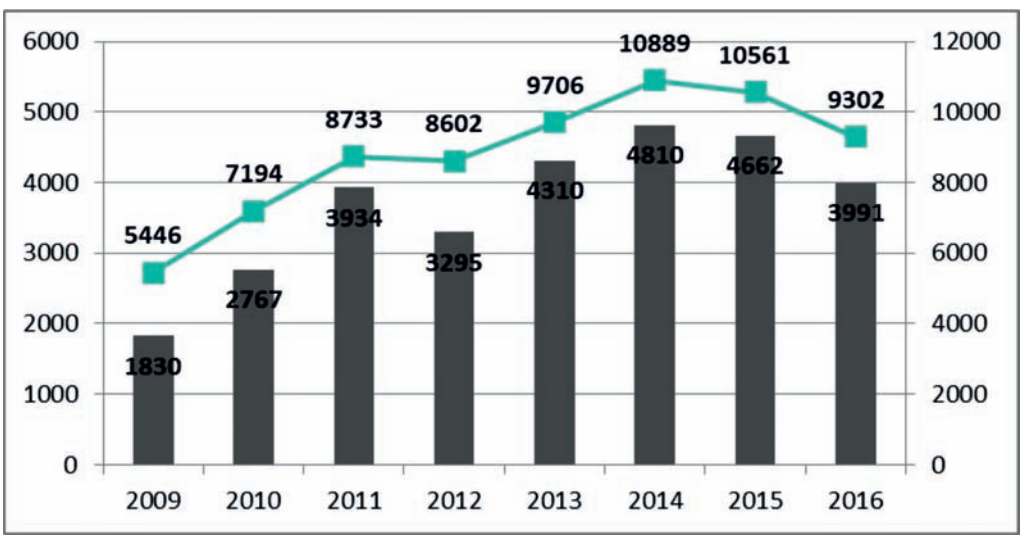


Figure 1 – *Global Syndicated Loans*
(Source: Thomson Reuters Global Syndicated Loans Review, 2009 – 2016)

The post-crisis period started with the lowest volume of syndicated loans granted registered in the past decade – a little over $ 1.8 trillion USD in 2009 (for comparison in the pre-crisis 2007 the sum reached up to $ 4.8 trillion USD – record-breaking then). The trend towards a smooth recovery was undermined by a marked decline in 2012 and a pronounced new downward tendency in both the volumes and the number of transactions concluded over the last two years of the survey period (Figure 1). In this figure primary axis is Proceeds USD billion and secondary axis is Number of Deals. At the same time, variable values of the indicator „average amount of disposed resources in a single transaction" were observed – from 336 million USD in 2009 to 441 million USD in 2015 and 365 million USD in 2016.

Analyzing the chronology of changes in the volumes of the syndicated loans granted in *a regional cross-section*, it can be clearly observed that the post-crisis recovery does not happen in the same scenario on the different markets. Although in 2009 Europe and the United States started with almost equal positions (even with slight predominance of Europe), only two years later the syndicated loans across the Atlantic doubled as a relative share of those on the Old Continent (Figure 2) (Proceeds US$ billion).

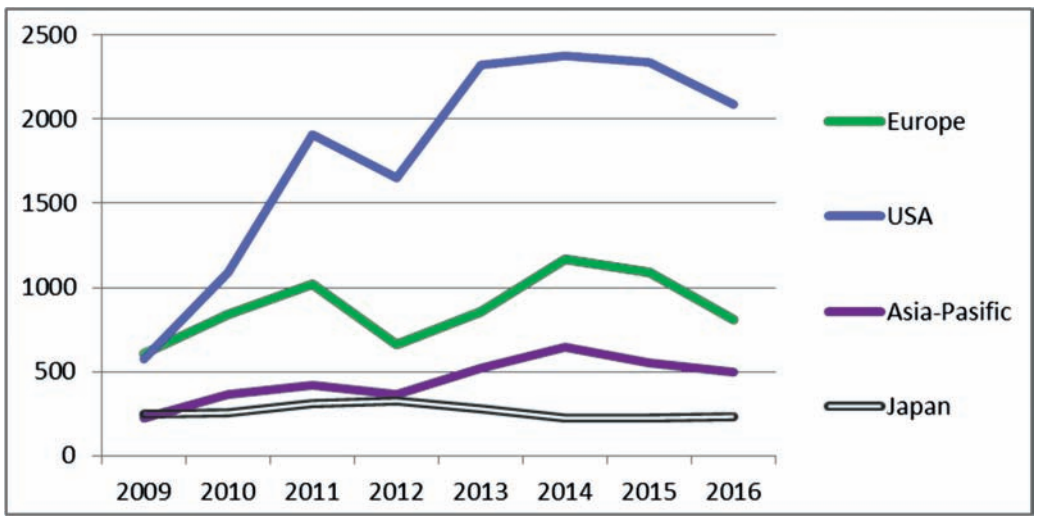


Figure 2 – *Global Syndicated Loans by Regions)*
(Source: Thomson Reuters Global Syndicated Loans Review, 2009–2016)

Table 1 presents current data on the regional profile of the global syndicated crediting in 2016 by number of concluded transactions, volume of resources provided and market share of regions and individual countries. This data shows that the America, and the USA in particular, play the role of a hegemon with the largest market share of deals concluded and resources provided. Europe ranks second in market share in 2016, but falls significantly behind both in the number of deals concluded and in the volume of resources provided to the global leader – the USA. The resource attraction in the Eastern European countries can be estimated as very weak. The registered differences in the indicator „average amount of resource sold in a single credit transaction" (in the last column of Table 1) are impressive.

Results with considerable amplitudes between regions are observed, while the average value of this indicator for the global syndicated loans amounts to 441 million USA. There is more than a 6.8-fold difference between the lowest and the highest value of this indicator. The average amount of the transactions in the region of Africa, Eastern and Central Asia is the largest, while the lowest amount of resources provided are the syndicated loans in Japan with an average value of 117 million USD. At the same time, however, the activity of a given market can be judged by the indicator „number of concluded deals", according to which Japan is ahead of Europe.

Table 1 – *Regional Comparative Profile of the Global Syndicated Loans in 2016*

Region/Country	N of Deals	Volume (US$bn)	Market Share (%)	Average Amount of Disposed Resources in a Single Transaction (US$mln)
North America	4075	2284	57,2	560
USA	3630	2091	52,3	576
Europe	1484	812	20,3	547
Western Europe	1361	745	18,7	547
Eastern Europe	123	67	1,7	545
Africa, Eastern and Central Asia	154	123	3,1	799
Asia – Pacific	1471	498	12,5	339
Japan	2020	236	5,9	117

Source: Author's calculations based on Thomson Reuters, Global Syndicated Loans Review, 2016

The data on the intended purpose of the syndicated loans and their sector profile can provide valuable information for the analysis of the post-crisis projections on the European syndicated loan market. Table 2 show Syndicated Loans by Use of Proceeds and by Industries in Europe, Middle East and Africa (EMEA Region). The syndicated loans are provided not only for investments in real assets but also for highly cyclical restructuring activities such as leverage buyouts, merger and acquisitions and stock repurchases. The demand for such type of loans is weaker during financial crises. Less cyclical loans are considered those that are designated for investment in real assets – for example, for general corporate purposes or working capital (Giannetti, Laeven, 2011).

Table 2 – *Syndicated Loans in EMEA Region*

	2014		2015		2016	
	Volume (US$bn)	%	Volume (US$bn)	%	Volume (US$bn)	%
Use of Proceeds						
Refinance Bank Debt	257.5	22	55.9	4		
General Corporate Purposes	411.6	35	586.1	47	457.8	49
Refinancing	123.7	10	72.2	6		
Project Finance	50.2	4	70.2	6	85.8	9
Acquisition Financing	156.8	13	267.9	21	208.5	22
Industries						
Energy and Power	202.8	17	242.1	19	182.1	20
Industrials	225.3	19	206.5	17	126.3	14
Financials	126.7	11	138.0	11	106.7	12
Materials	137.1	11	131.4	10	162.6	18
Consumer Staples	108.4	9	138.5	11	74.3	8
Healthcare	66.1	5	76.6	6	47.2	5
Real Estate	63.3	5	69.9	6		
Consumer Products and Services	56.3	5	49.4	4	44.8	5
Media and Entertainment	68.2	6	58.5	5		
Telecommunications	57.5	5	59.1	5		
High Technology	44.9	4	34.4	3		

Source: Thomson Reuters, Global Syndicated Loans Reviews, 2014-2016

A comparison of the sectoral profile of the syndicated loans between Europe and the significantly more dynamic American market shows that there are some differences. On the American market in 2016, the loans in the fields of „Healthcare" and „High Technology" have significantly higher relative shares than those in Europe – 8% and 11%, respectively. The loans for „Materials" and „Consumer Staples", which in Europe together make up 26% of the volume in 2016, in North America are twice smaller a relative share – only 13%. Such differences in the relative shares of the funded industries are indicative of the greater progress in the providing of resources to priority and high-technology sectors over the Atlantic.

Conclusions

The syndicated loan market is considered an important component of the integration of the financial markets. Over the last decade, the multinational banks used syndicated loans as a tool for expanding their international business. This has turned the global syndicated loans into an important factor for stimulating the economic activity and the global economic development. The syndicated loans differ from traditional bank loans with atypical „lender-borrower" relationships. The syndicated loans provide a number of advantages for both the users and the banks, providing the financial resource. The companies-borrowers consider the syndicated loans as a

good opportunity to secure favorable financing as an alternative to public financing. The attractiveness of the syndicated loans to the borrowers is complemented by such key factors as reducing the administrative and the transaction costs, greater operational efficiency and overcoming of possible financial restrictions at national level. The benefits for the participants in the bank syndicate can be systematized as follows: risk sharing, overcoming regulatory capital restrictions, an ability to penetrate new market niches and segments, better structured and diversified loan portfolio and an opportunity to realize additional returns. At the same time, it should be noted that, especially in the case of leveraged loans, the banks are striving to compensate the increased risk status by applying different types of restrictive measures and covenants in the loan agreements.

The analysis of the volume of the granted syndicated loans in a regional cross-section ascertains that the post-crisis recovery does not follow the same scenario on the different markets. It was found that in the period 2009-2016 the syndicated loans across the Atlantic were considerably higher than the relative share of those on the Old Continent. The results of the analysis of the target profile of the syndicated loans and the sectoral affiliation of the borrowers reveal the relative share of the loans designated for financing of pro-cyclical activities and the share of those used to finance industries and activities with less pronounced cyclicality of the demand. The sectoral analysis of the syndicated loans in Europe showed that there are differences in the relative shares of the loans for the different industries compared to those on the American continent, where more resources are provided to priority and technological sectors than to pro-cyclical areas. It could be summed up that the post-crisis projections of the syndicated loan market outline symptoms, which do not renounce the possibility that the global financial system enters a new spiral of recession.

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Healthcare Satisfaction in Catastrophic Conditions

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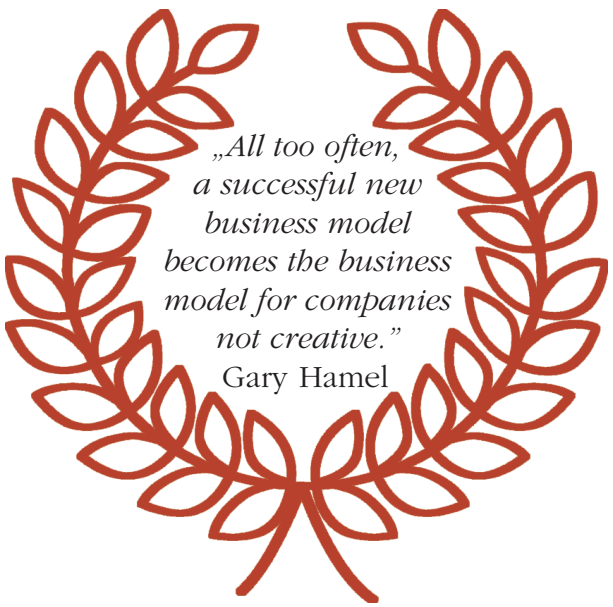
Abstract

Optimization is the fact of enhancing a running system without the need to interrupt the real-system. Improvement of a concurrent complex industrial system such as healthcare should be highly considered in order to increase the satisfaction of three factors: patient, management and resource. A new reward system is defined in this work as part of optimization. Using simulation, a close optimal solution can be achieved. The reward system is generic and can be applied to any industrial system with queueing theory. A new optimization algorithm, MRA, is also proposed for the first time in order to define best resource allocation.

Keywords: disaster events, healthcare, optimization, reward system, satisfaction factors.

Introduction

Satisfaction in healthcare is an important measure but hard to be defined. Xesfingi and Vozikis defined satisfaction to be the provider's success at meeting clients' expectations (Xesfingi, Vozikis, 2016). In any industry, customer's satisfaction is related to the quality assessment and delivery of service. Customers tend to express intentions in positive ways such as praising and preferring the company over others (Zeithaml and Bitner, 2000). For example, in healthcare systems, patient satisfaction is fundamental for enhancing hospital's image, which in turn translates into increased service use and market share (Andaleeb, 1988) and therefore leads to management satisfaction. Another dimension can be considered an important level of satisfaction, employee satisfaction. Well treating customers and delivering the service with the expected



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level of care leads to customer's satisfaction. System overall satisfaction can be achieved only if the employee is also highly satisfied (Naidu, 2009).

Optimization is the fact of enhancing a running system without the need to interrupt the real-system (Cabrera *et al.*, 2012). In this work, the improvement of complex industrial systems is based on the satisfaction of three factors: customer, management and staff. A new generic maximum reward system, $\Re$, is defined in this paper in order to improve any industrial workflow with a queueing system such as banks, theatres, etc., including healthcare during disaster events. All equations are original and defined for the first time.

The reward system is defined by

$$\Re = \sum_{i=1}^{3} W_i F_i \quad \textbf{(1)}$$

Where, $\sum_{i=1}^{3} F_i = F_1 + F_2 + F_3$

- F_1 = customer satisfaction factor
- F_2 = management satisfaction factor
- F_3 = staff satisfaction factor

$$\sum_{i=1}^{3} W_i = W_1 + W_2 + W_3 = 1$$

- W_1 = the weight of importance of customer
- W_2 = the weight of importance of management
- W_3 = the weight of importance of staff

The weight of importance reflects which satisfaction factor is mostly affecting the reward system defined. The factor with the highest weight is the one of high priority and should be first considered while enhancing the system. The percentage of satisfaction can be improved by changing, re-allocating or adding resources. Resources are referred to as the employees serving customers. The system number out should be also increased in order to increase revenue and thus increase management satisfaction. Usually, customer satisfaction is a factor of total waiting time or Length of Stay (LoS) and the level of care received. The less the average waiting time the customer spends in the system, and the higher the level of care received, the higher F_1 can be. As for management satisfaction, F_2, it is a factor of profit/revenue. Employee satisfaction, F_3, is a factor of utilization rates and workload. Weights can be assumed or predicted from observations and site visits and exact values can be calculated based on management decisions. The weight of factors is based on the company's preferences.

This work is organized as follows: In Section 1, the reward system is defined. In Section 2, related work is presented. Customer, management and employee satisfaction are illustrated in Sections 3, 4 and 5 respectively. The application of this reward system to healthcare is illustrated in Section 6. Workflow optimization algorithm is presented in Section 7. Finally, conclusion and future work are presented in Section 8.

Related Work

Emergency Departments (ED) being complex and 24/7 busy units invade the literature with the need for simulation in order to study its flow of operations. Nevertheless, previous studies include normal flow and few only covered the disaster conditions. ED simulations during catastrophe events are very limited. Xiao presented a workflow optimization during a disaster event (Xiao, *et al*., 2012). Another study was presented during a terrorism case where different arrivals to the ED were analyzed using DES modelling (Joshi, Rys, 2008). Patvivatsiri studied the patient flow and resource utilization rates during a bioterrorist attack; an appropriate resource allocation was determined accordingly (Patvivatsiri, 2006). Another study focused on examining the advantages and efficiency of suggesting different scenarios during the triage stage and evaluating their effects on saving lives during an earthquake disaster case (Cao, Huang, 2012). The study of the ED operations during catastrophe conditions was also modeled using different other scenarios (Al-Kattan, 2009). Gul and Guneri showed in their work the importance of simulation for disaster preparedness of EDs (Gul, Guneri, 2015). From these bunch of studied performed earlier in the literature, simulation modeling was the best way to improve the ED performance during unexpected and disaster cases. Therefore, the new contribution of this paper is presented in the coming sections where simulation is used to prove the efficiency and effectiveness of the work.

Customer Satisfaction

The customer satisfaction, F_1, as defined earlier, is a factor of the average waiting time in the system from the time a customer arrives until the customer exits the system along with the level of care received. Customer satisfaction is represented by:

$$F_1 = \eta_1 e^{-x} + \eta_2 F_3 \quad \textbf{(2)}$$

Where,

- x = the average level of customer's LoS in the system
- $x = \dfrac{(\text{actual LoS} - \text{expected LoS})}{\text{expected LoS}}$
- $\eta_1 + \eta_2 = 1$
- $\eta_1 = 1 - \eta_2$
- η_2 = customer-employee medical relationship
- η_2 is affected by the culture and utilization rate of employees. In some cultures, employees treat customers in a very good way regardless of their utilization rates; other employees are negatively affected by their high workload and therefore badly affect the way they treat customers
- Actual LoS is the current LoS customers experience in the real system
- Expected LoS is the maximum length of stay a customer spends in a normal system flow

Management Satisfaction

The management satisfaction, F_2, represents how much revenue is the company making out of this business. Increasing management satisfaction means an increase in the net profit. It is depicted in the equation below:

$$F_2 = \frac{\text{Profit}}{\text{Revenue}} \quad (3)$$

Where,

- Revenue is system gain from each customer regardless of the cost paid
- Revenue = k * Payment
- Payment = money the customer spends in the system
- k = number of customers arriving at the system
- Profit is the net profit the system achieved after paying all expenses for human resources, equipment, material, etc.
- Profit = Revenue – Total Expenses
- Total Expenses = salaries, material, equipment maintenance/replacement

In order to reveal these values, meetings with management are necessary where exact figures can be deducted. Thus, the proposed model under study can be applied by decision makers in case the net profit is attractive and simulation outputs can be relied on for enhancement of the real-life functioning system.

Employee Satisfaction

Employee satisfaction reflects how much employees are happy with their daily jobs. This includes the pay and workload. In order to increase employee satisfaction, utilization rate should be decreased, and wage should be increased. Employee satisfaction, F_3, is represented by the equation below:

$$F_3 = \sum_{n=1}^{m} f_n / m = (f_1 + f_2 + f_3 + \ldots\ldots + f_m)/m \quad (4)$$

Where m = a number of different categories of employees

Each industrial system has different categories of employees in order to deliver a certain service (such as receptionist, actual workers, transporters, etc.). The satisfaction of each category is defined by f_n, where f_n is defined by:

$$f_n = \left(\sum_{i=1}^{k} X_i(\Delta_n) \right) / k$$

Where,

- Δ_n = a certain category of employees
- k = number of employees in the same category Δ
- X = *the* balance between pay and workload for an employee belonging to the same category Δ
- X_i = (W_1 * pay) – (W_2 * workload)

- $W_1 + W_2 = 1$
- *pay* = (actual pay) / (maximum pay)
- Workload = (actual workload) / (maximum workload)

Since each category of employees can include several workers responsible for the same role then,

$$f_1 = (X_1(\Delta_1) + X_2(\Delta_1) + X_3(\Delta_1) + \ldots\ldots X_k(\Delta_1))/k$$
$$f_2 = (X_1(\Delta_2) + X_2(\Delta_2) + X_3(\Delta_2) + \ldots\ldots X_k(\Delta_2))/k$$
$$\vdots$$
$$f_n = (X_1(\Delta_n) + X_2(\Delta_n) + X_3(\Delta_n) + \ldots\ldots X_k(\Delta_n))/k$$

Application to Healthcare

In healthcare, systems are very complex and suffer from high bottleneck especially the emergency department (Liu, Z. *et al.*, 2015). This bottleneck imposes the need to review ED operations and try to find a way to improve the flow without the need to interrupt the real system. As per literature on EDs, resource re-allocation/scheduling and adding extra resources is one way to alleviate the bottleneck, improve the system and optimize the workflow (Yang, K.K. *et al.*, 2016). Applying the reward system, $\Re$, suggested in previous sections, will lead to a study of three important factors in order to measure the level of satisfaction in the ED: Patient satisfaction, Management satisfaction and Medical human resource satisfaction.

For this studied ED there are different types of human resources operating in the system and serving patients. The non-human resources referred to as „facilities" are implicitly taken into consideration when changing the level of resources available. For example, suggesting an addition of doctors in the ED in order to improve the flow indirectly means increasing the number of „facilities" used by these doctors needed to deliver the task. The resource type „facilities" is everything needed to deliver care to an arriving patient such as beds with all its accessories, medication, medical devices, cotton, syringe, etc. Human resources fall under eight different categories: Doctor, Registered Nurse (RN), Nurse, Transporter, Receptionist, Technician, Accountant, and Physician. As per table 1, each category type includes a different number of resources allocated.

This reward system is applied to an emergency department in Lebanon during catastrophe events. The hospital is a medical legacy based on more than half a century of experience and is considered a non-profit health institution recognized as a public utility foundation since 1952. It contains almost 200 beds, distributed in different units and covers most of the medical and surgical specialities. Its emergency department is open 24 hours a day and serves more than 40,000 patients a year. Arrivals are modeled with an average arrival rate estimated based on a database of 48 weeks from August 2015 to August 2016. Catastrophe events are disaster conditions such as an earthquake, an epidemic season, a terrorist attack, etc. It is defined from equation (1) by:

$$\Re_c = W_{1c} * F_{1c} + W_{2c} * F_{2c} + W_{3c} * F_{3c}$$

Table 1 – *Maximum resource capacity*

Maximum Resource Capacity	
Resource Type	**Maximum Capacity/ER**
Doctor	10
RN	10
Nurse	10
Transporter	10
Physician	1
Accountant	8
Technician	3
Receptionist	1

From interviews with management, the weight W_{ic} of each F_{ic} during catastrophe events is found to be:

$$W_{1c} = 0.85 \quad W_{2c} = 0.12 \quad W_{3c} = 0.03$$

This means that the main priority in catastrophe cases is to save as many lives as possible and make sure patients exit the system in order to leave the room for other victims. Thus, the weight of patient satisfaction factor, W_{1c}, is 85%. Still, management satisfaction should be considered otherwise decision makers will not be interested in enhancing their systems in order to coop with such disaster events. Thus, the weight of management satisfaction factor, W_{2c}, is 12%. Which leads to 3% for the weight of resource satisfaction, W_{3c}, since $W_{1c} + W_{2c} + + W_{3c} = 1$. The utilization rate of medical resources is definitely very high during such conditions due to the high patient surge and decreasing their workload is not a priority here.

Patient Satisfaction Factor: F_{1c} is a factor of system number out. Therefore, the system number out must be maximized in order to guarantee that the maximum number of patients is staying alive and exiting the system. The proposed equation for F_{1c} is:

F_{1c} = the rate of departure/rate of arrival

Where,

- the rate of departure = number of patients leaving/interval of time
- the rate of arrival = number of arriving patients/interval of time
- number of patients leaving = system number out
- number of arriving patients = system number in

Using the outputs resulted from Arena simulation of this studied ED during catastrophe events (refer to table 2), patient satisfaction factor is found to be: F_{1c} = 2.43%. This is a disaster measure and needs high consideration during optimization. The high surge of patients during catastrophe events explain this low satisfaction factor.

Table 2 – *Arena simulation outputs before optimization*

Arena Simulation Outputs before Optimization	
Metric	**Results**
System Number In	20,097
System Number Out	489

Management Satisfaction Factor: To calculate management satisfaction, total expenses and revenue should be calculated:

- Total Expenses = Salary Expenses + Facility Expenses (refer to table 6)
- Revenue = consultation fee * number of system out
- The value of η varies from a hospital to another. The more medical resources are appointed for a service, the more facilities are needed to accomplish a certain task; thus, the correlation between the Expenses (resulting from human resources) and the Facility Expenses (resulting from the resource type „facilities"). After several observations and interviews with medical resources in the ED, the values are found to be: $\eta_2 = 0.3$ and thus $\eta_1 = 0.7$ since $\eta_1 + \eta_2 = 1$.
- Consultation fees = $35

As per Arena simulation, system number out before optimization is found to be 489 patients (refer to table 2). Therefore, F_{2c} = 32.37%. This is also a low satisfaction measure and needs to be considered during future optimization.

Resource Satisfaction Factor: „Actual load" are values resulted from the simulation with Arena and are used to calculate the resource satisfaction factors of the eight different resources in the system during catastrophe conditions. The „maximum load" is considered 80% as per interviews with the hospital's resources and management observations. The values of the eight satisfaction factors are depicted in table 3 using the equations already defined before.

Table 3 – *Resource satisfaction factors*

Resource Satisfaction Factors	
Resource Type	**Satisfaction Factor (%)**
Doctor	f_{1c} = 18.54%
RN	f_{2c} = 13.81%
Nurse	f_{3c} = 22.01%
Transporter	f_{4c} = 27.56%
Accountant	f_{5c} = 57.41%
Receptionist	f_{6c} = 57.94%
Physician	f_{7c} = 41.25%
Technician	f_{8c} = 63.97%

After calculating the eight measures of the resource satisfaction factor, F_3, it is obvious that during catastrophe events, doctors, RNs, nurses and transporters are the highest affected resources (very low satisfaction measures) and thus need to be enhanced accordingly for a better performance of the system. It is normal that physicians, technicians (responsible for the extra facilities, such as imaging) and receptionist and accountants (responsible for billing) are not highly affected since patients are not reaching those stages and are stuck in previous stages such as triage, diagnosis, treatment, etc.

Therefore, F_{3c} = 37.81%.

Also, F_{3c} is a low satisfaction measure and should be taken into consideration for future improvement; keeping in mind that the lowest satisfaction factor was F_{1c} and needs to be highly prioritized.

Calculating the Reward System. Using the calculated satisfaction factors from the previous sub-sections, the reward system for catastrophe case is equal to: $\Re_c$ = 7.08%. Based on management perspectives, this low value of the reward system is undesirable and thus the system requires urgent improvement. This is due to the surge of patients arriving at the ED during catastrophe events. The current ED system is extremely unprepared for such events. In Section 7, a new optimization algorithm is suggested in order to suggest better resource allocations and prepare the ED to such events.

Optimization Algorithm: MRA

The Maximum Reward Algorithm (MRA) is an original optimization algorithm proposed for the first time in order to enhance any industrial system. It is a new way to target the satisfaction of three factors: Customers, Management and Employees. This algorithm was previously applied by the authors to the same emergency department during normal flow (Oueida, *et al.*, 2018). This algorithm is generic for any type of systems with queuing behaviour and it is a reward system-based in which a reward is calculated before and after optimization. MRA is applied to our studied ED in order to enhance the flow of operation and maximize the reward system, $\Re$, during disaster conditions. The MRA flowchart for the normal flow of operations is represented in figure 1 where all steps to be followed in order to reach the final result and the near-optimal solution are presented.

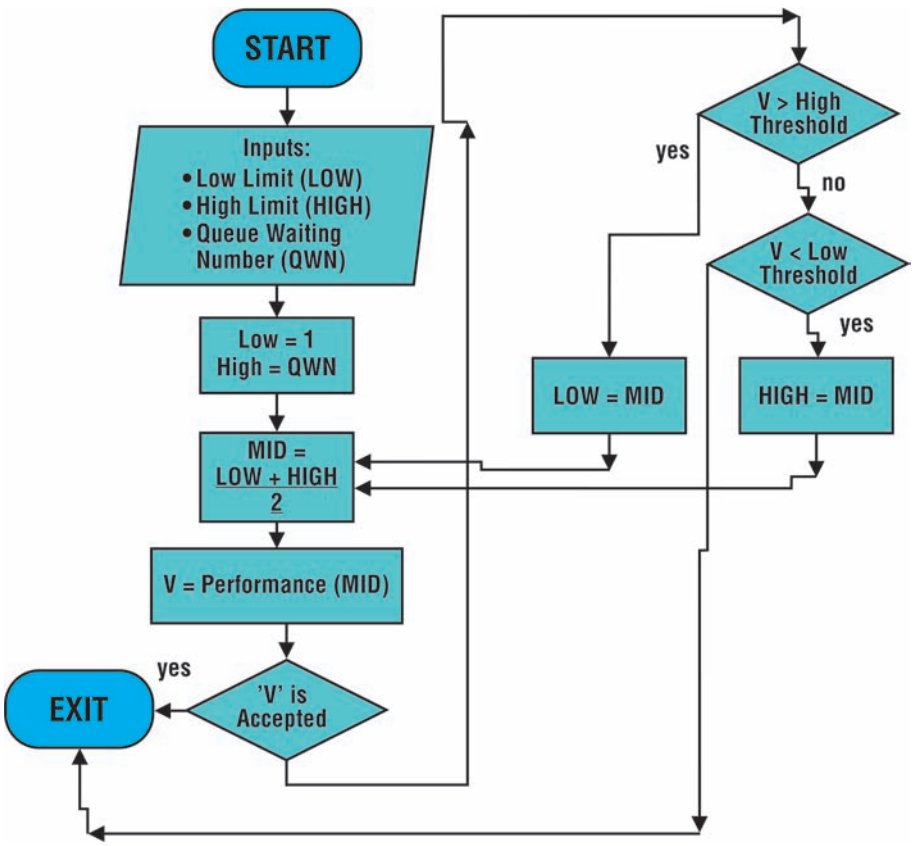

Figure 1 – *MRA Flowchart*

Some variables used for the algorithm are:

- The first type of resource to start the algorithm with is the one causing the bottleneck in the ED
- The next type of resource is the one with the less wage
- The threshold is the accepted value
- The algorithm is stopped when no more changes are occurring to the system
- The performance is the simulation results using the MID (medium) value of a resource; it includes the performance of resource utilization rates, patients LoS and Queues waiting number
- The threshold value is a range between two numbers. The optimal value should be lower than the high threshold and greater than the low threshold
- The threshold for patients LoS: LoS should be less than 2 hours and not exceeding 4 hours
- The threshold for resource utilization: resource utilization rates should not be less than 20% in order to avoid wastes and not exceeding 80%
- The threshold for queues waiting number: the waiting number in queues should not exceed 20 and cannot be 0 in order to avoid wastes
- The threshold values, low and high, for each metric, are based on ED observations and the hospital's management decisions

The emergency department operations are expected to dramatically change during disaster conditions; thus, new policies should be suggested, different from the normal flow periods. The optimization algorithm MRA is slightly updated during catastrophe events. When talking about disaster events, the bottleneck may occur on several stages of the system where a high number of patients will be waiting on corresponding queues. Therefore, the high value here should be considered the maximum number of resources that can be added to the system as per management constraints. The performance, V, includes only the system number out since in catastrophe case the most important part of a daily operation of the ED is to save as many lives as possible. If the performance of this bottleneck and dependencies is not accepted than an interview with management is needed again to convince them to increase the high values. The updated optimization algorithm is presented in figure 2.

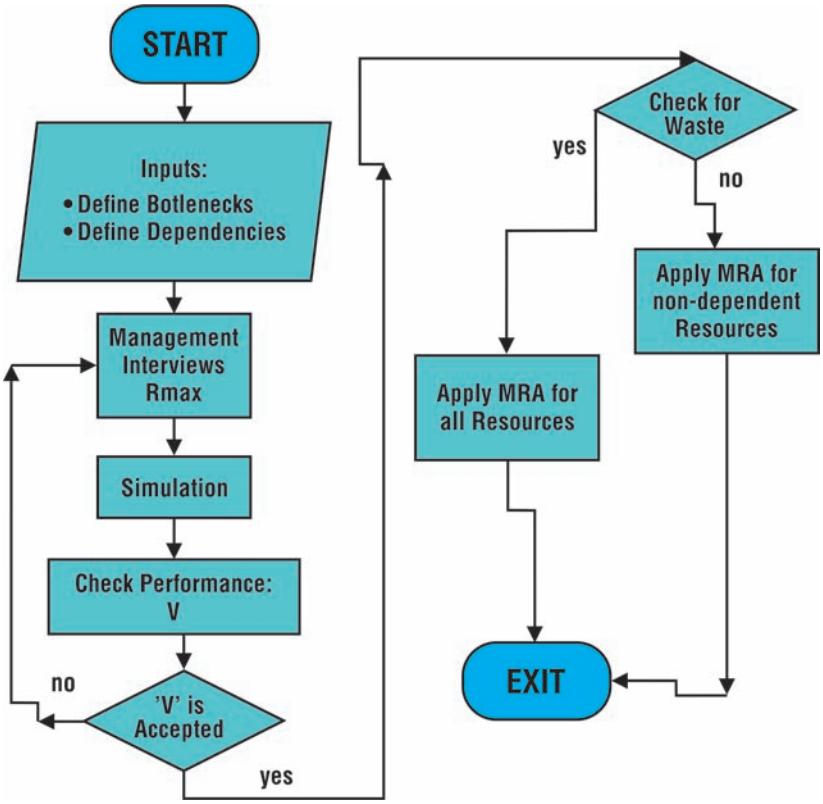

Figure 2 – *MRA Flowchart_Catastrophe Event*

To start with the algorithm, three steps should be followed:

- Define bottlenecks
- Define dependencies
- Conduct interviews with hospital management to realize the high values for resources, R_{max} (Table 6)

Once the bottleneck stages are defined, dependencies among the corresponding resources are studied. The first model simulation starts with the highest values of these resources. As per Arena simulation, the bottleneck occurs in the transporter, nurse, RN and doctor queues; where a high number of patients is waiting to receive care. Note that, nurses are responsible for data collection, RN responsible for triage and doctors for treatment. Moreover, the resource type „facilities" is a dependent resource among the four bottlenecks. Therefore, the model will be simulated after changing the number of doctors, nurses, RNs and transporters to 20 and the number of facilities to 20. Simulation results show that the system number out is equal to 6,222 which is an acceptable performance of the system. Also, the LoS is decreased from 78 hours to 15 hours. In case more improvement is needed and wastes are available, then MRA (Figure 1) should be applied to the rest of resources (Accountant, Receptionist, Technician and Physician).

The new resources capacities in the model are depicted in table 6 along with their actual pay. Now that the number of resources is optimized, a new reward system, $\Re_{oc}$, is calculated for the catastrophe case using equations of Section 1 and the simulation outputs from Arena after applying the new resource allocation (Table 4). The values are presented in Table 5.

Table 4 – *Arena simulation outputs after optimization*

Arena Simulation Outputs after Optimization	
Metric	**Results**
System Number In	19,864
System Number Out	6,222

Table 5 – *Resource satisfaction factors*

Resource Satisfaction Factors	
Resource Type	**Satisfaction Factor (%)**
Doctor	$f_{1o} = 32.37\%$
RN	$f_{2o} = 36.5\%$
Nurse	$f_{3o} = 25.75\%$
Transporter	$f_{4o} = 27.46\%$
Accountant	$f_{5o} = 26.5\%$
Receptionist	$f_{6o} = 29.13\%$
Physician	$f_{7o} = 15.16\%$
Technician	$f_{8o} = 54.25\%$

Patient, management and resource satisfaction factors are found to be: $F_{1o} = 31\%$, $F_{2o} = 92.01\%$ and $F_{3o} = 30.89\%$ respectively.

Note here that the satisfaction factors for the resource types: Accountant, Physician, Technician and Receptionist, are decreased after applying the optimization in catastrophe. This is normal since decision makers are concerned to add resources for the bottleneck stages only. This leads to a limitation where no additional resource is granted for these four types of resources. Therefore, future improvements can be achieved by applying the algorithm again taking into consideration an additional number of accountants, physicians, technicians and receptionist.

The reward system for catastrophe after optimization is: $\Re_{oc} = 38.32\%$. The system satisfaction measure is increased from 7.08% before optimization to 38.32% after applying MRA for catastrophe. This increase in the reward system proves that the suggested reward system, $\Re$, and the optimization algorithm, MRA, are efficient and reliable for catastrophe events. Note that there is always room for additional improvement, but limitations may arise based on budget constraints and management observations.

Table 6 – *MRA resource allocation for catastrophe*

MRA Resource Allocation for Catastrophe		
Resource Type	**Actual Pay($) / Resource**	**MRA Resource Allocation in the ED (ER A+ ER B)**
Doctor	2000	20
RN	1100	20
Nurse	850	20
Transporter	650	20
Accountant	1000	8
Receptionist	500	1
Physician	1200	1
Technician	800	3
Facilities	800	40

Conclusion

Table 7 below summarizes all satisfaction factors and the reward system calculated in previous sections before and after MRA for catastrophe along with the satisfactory level. It is obvious that almost all satisfaction values are increased and therefore the reward system value is increased except for F_{3o}. This is due to some limitations from the hospital's management, where they granted additional resources for the bottleneck stages only. Therefore, accountants, receptionists, physicians and technicians were not optimized and therefore future improvements can be achieved by applying the MRA to these resources. Nevertheless, the reward system was increased from 7.08% to 38.32% for catastrophe events and thus proving the reliability and efficiency of the MRA and reward system suggested, $\Re$.

As a future work, more enhancements will be suggested by applying the reward system defined in this work to other units of the hospital.

Table 7 – *Satisfaction factors and reward system for catastrophe*

Satisfaction Factors and Reward System for Catastrophe			
Factors	**Before MRA(%)**	**After MRA(%)**	**Satisfactory Level**
F_{1o}	2.43	31	Satisfied
F_{2o}	37.37	92.01	Extremely Satisfied
F_{3o}	37.81	30.89	Satisfied
$\Re_o$	7.08	38.32	Satisfied

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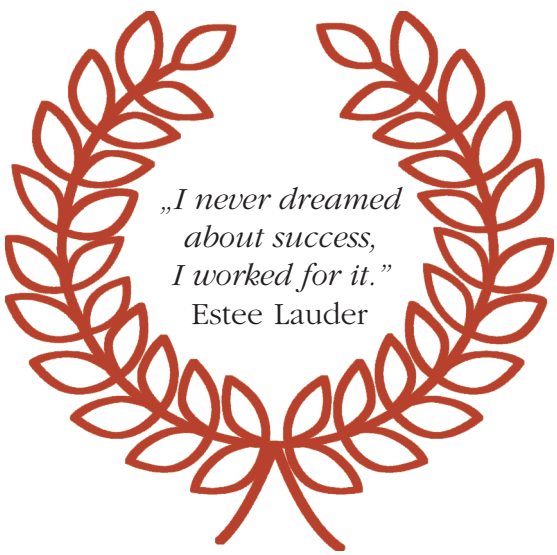

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