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CONTENTS

Interconnections Between Businesses

Motto

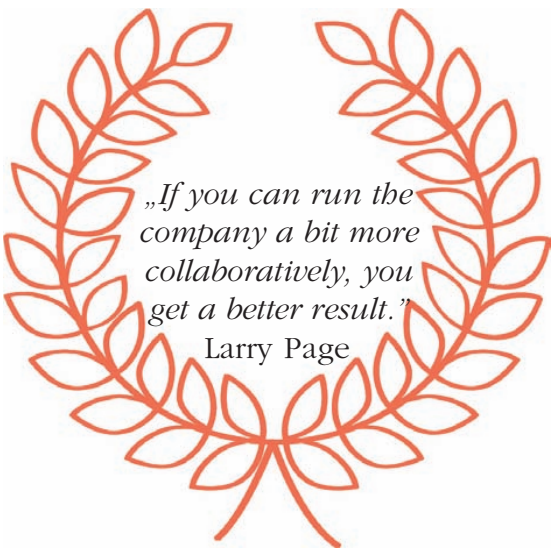
It's not about who you know... but who knows you!!

With the rise of the industrial revolution in the 18th and 19th centuries came the need for businesses to collaborate and trust a wider range of people and other businesses. In business, risk sharing and resource pooling became more common as a way of „expanding the pie" and making more profit for everyone involved. A business network is a type of business social network which is developed to help businesspeople connect with other managers and entrepreneurs to further each other's business interests by forming mutually beneficial business relationships.

Nowadays exponential technology advances, greater consumer power and increased competition mean all industries face the threat of commoditization. The winners will act now, and build a strategic advantage that leaves their counterparts wondering what happened.

Some of representative types of networks emerged over time are: business voice communication on mobile phones, linked together by cellular networks or on Smartphones connected to Voice over Internet Protocol (VoIP) networks; financial networks, specialized in printed money and checks to flow between individuals and banks, while funds; Automated Teller Machine (ATM) networks and Automated Clearing House (ACH) network, through which banks transmit electronic payment requests and disbursements; services networks of wholly owned or franchised locations where services are sold and performed; retail networks affiliated with one specific brand or others that sell goods from multiple manufacturers; supply networks through which manufacturers buy the raw materials and fabricated components needed to produce finished goods; social networks which have always been foundational to business being used to produce measurable, positive impact business results.

The thinking of today's network engineers as they plan „next-generation" infrastructure is dominated by massively distributed computing, software definite networking and network functions virtualization. Alex Hoff presented on the website www.auvik.com some of the coolest network research projects taking place right now – amazing projects that could have a big impact on the network designs and careers of tomorrow.



Time cloaking – The goal of this project is to create „bubbles in time" by tracking gaps between photons. If this works, information can be encoded within the gaps and transmitted by laser lights and fiber optics. For now, this remains highly experimental.

The Machine from HP – Speaking of nano-age super-computers, engineers work on new hardware and software that stands to revolutionize the way computers „think and communicate". The platform brings three new computing components to the table: nanoelectric memory called memistors, ultra-fast phototonic buses, and an operating system tailor-made for the device.

Ambient backscatter – On the topic of major advances in wireless communications, researchers are working to open new doors in the Wi-Fi world by *„backscattering" wireless signals*. That means re-using existing radio frequency signals instead of generating new ones.

Wireless data links for drones – Academic and industry researchers are now working to make long-distance, high-speed wireless networking feasible.

4D network – This research project has a hugely ambitious goal: replace the Internet Protocol (IP) as the basis for computer networking. The 4D refers to four network planes: decision, dissemination, discovery, and data.

eXpressive Internet Architecture – or XIA project aims to build „a single network that offers inherent support for communication between current communicating principals – including hosts, content, and services – while accommodating unknown future entities."

Diamond semiconductors – Smaller than silicon wafers, 20 times better at displacing heat, and more efficient as a conductor of electrons, diamonds are already helping to build new generations of devices.

„It is profitable for us both, that I should labour with you today, and that you should aid me tomorrow."
David Hume

In these conditions, the future of networking depends on of how fast the businesses realize that they must use digital channels to engage with their key stakeholders to maintain relevance and drive the conversation. The proliferation of digital channels, platforms and devices has produced a generation who are born 'plugged-in'. This „Generation Y" already plays a major role in accelerating the emergence of a new, digital world, and its impact on new types of networking is impossible to ignore.

Florin Dănălache,
Senior Editor

Simulation Models for Enhancing the Health Care Systems

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Abstract

Health care is a very vast and complex system in which different departments interact with each other to deliver services to patients. In this paper we study, specifically, the emergency department of a hospital with its existing problems and how simulation can influence solving these problems, increase patient satisfaction and increase revenue. The simulation has emerged as a popular decision support in the domains of manufacturing and services industries. In this study, we will present the advantage of this technology in improving the health care services. A review of the advantages of the simulation modeling is presented along with a comparison between the most two popular simulation software in the market nowadays: ARENA and SIMIO.

Keywords: Simulation Modeling, Optimization, Healthcare, ARENA, SIMIO

Introduction

The medical sector has been growing largely over the last decade, and the health care services became more complex and costly, amplified by a poor health care delivery system. Health care is a highly interconnected dynamic environment where individuals and teams contribute to serving patients' demand. The main focus of this study is to improve some problems arising this revolution by taking care of the whole medical community, not only illness, but also improving patient safety, quality, and effectiveness of the health care system. This can be achieved by developing new methodologies to improve the health care systems.

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The first area to focus on to develop an efficient and effective health care system is the development of the system's perspective, where simulation modeling can be generated, and a review can be achieved, thus leading to a more effective and efficient structure. Computer simulation modeling can be a solution to tackle this complexity and valuable in providing predictions to forecast the outcome of a change in strategies or policies. The computer simulation is a decision-making technique that allows management to conduct experiments with models representing the real system of interest. Busy and complex health care systems provide big challenges to managers and decision makers who should be able to serve the high demands constrained by limited budget and high costs of health care services. The highest number of patients should be cared of within a limited period to ensure patient satisfaction (for instance reduce waiting times) and increase hospital's revenue.

Health Care Problems

Health care problems are very important and constitute a priority concern that we are facing in our daily lives. The five major components that are seriously impacting this system can be highlighted as follows (Akshay, 2012):

Timeliness of care

One of the dissatisfaction among patients is the waiting time which can be in some cases unpredictable and can affect the health care provided to these patients. This factor can hugely affect the effectiveness of health care delivery, when patients waiting in the queue can be in contact with other infections and environmental factors which may complicate their condition. This delay will reduce the effectiveness of the medical treatment.

In order to avoid this kind of dissatisfaction, care providers should achieve a stable and predictable timetable workload in order to lessen waiting times and provide a consistent service quality.

Simulation modeling has been used for over 60 years and is considered the key factor for clinics and medical industries. Its main purpose is to allocate resources and predict patients' flow appropriately, thus leading to a maximum utilization, providing best service and achieving patients' satisfaction. As a part of our future work, we will focus on improving the current simulation methodologies to increase this key factor and enhance the health care systems.

The quality of care

In the health field, the quality of care falls under patient satisfaction as services and fees. The challenges often arise in this area, where the hospital management should ensure a high level of care with the minimum fee, also taking into consideration the reasonable utilization of resources. Therefore, complications can arise in delivering the quality of the desired care. To solve this problem, simulation modeling can be used, helping to reach an understandable and desirable outcome.

Errors in care delivery

Research has shown that death due to medical errors exceeds death due to real diseases or human accidents (Kohn *et al*., 2000). The main problem causing these errors is the unstable structure of the health care service, or the non-existence approach of health care delivery. To analyze the system and prevent errors, simulation modeling can play a major role when systems' behavior can be easily interpreted and investigated using the advanced features of different simulation languages.

Complexity in health care delivery

The best way to solve the complex problem is to break it down into several simple steps. Therefore, in the health sector is very beneficial to use checklists to reduce the complexity of the service and deliver a better outcome. In this field, simulation models are a very precise way to formulate and test these checklists.

The value of health care services

The value of health care services can be expressed by the amount of money spent by the patient versus the amount or quality of care received. Since the quality of health care service is variable and depends on different factors (like patient's age, patient's personal point of view about care), the mentioned formula seems ambiguous.

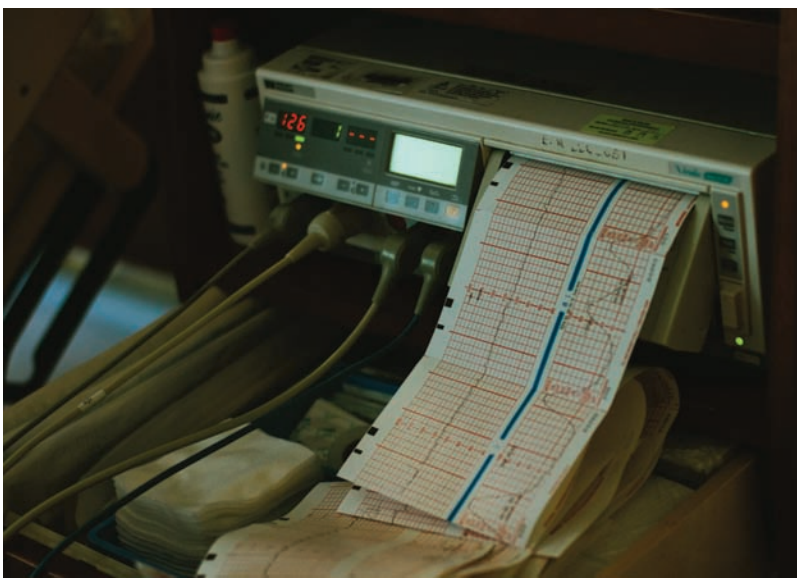
The simulation modeling has to be integrated into the development of these processes in which the employees/managers get to understand the dynamics of any changes and to put in place effective change management policies. With the increasing trend of the health care field, the adoption of simulation modeling methodology is also going to increase (Young *et al*., 2004).

Simulation Modeling

Three dynamic modeling paradigms can interfere in the process of identifying the complexity in a health care system: Discrete Event Simulation (DES), System Dynamics (SD) and Agent-based Model (ABM). Another simulation paradigm that serves the health care literature is the Monte Carlo Simulation (MCS) (Katsaliaki *et al*., 2011). The main difference in the behavior of these dynamic modeling paradigms is that the first two (DES and SD) depend on the rules defined in the physical world, the entities being then modeled based on these rules. As for the ABM, the interaction between entities based on these defined rules is the key factor in developing the system behavior.

System Dynamics (SD)

In order to understand the behavior of the entire complex system, this simulation paradigm focuses on the internal complexity of the system and uses the feedback processes as an entity to solve this complexity. The system dynamics models capture the non-linearity using feedback (or causal) loops and stocks and flows.



This can be linked to the dynamic behavior of the health care system, being a complex system by nature (Sterman, 2000).

Discrete Event Simulation (DES)

DES is the most popular technique, in which the system is visualized as discrete units of traffic (or transaction) flows. The model's state changes only at discrete points of time called event times which can be randomly generated. This can be linked to the health care environment, proving that every event in the system, such as the arrival or the discharge of patients can change the overall behavior of the system (Schriber *et al.*, 2013).

Agent-Based Modeling (ABM)

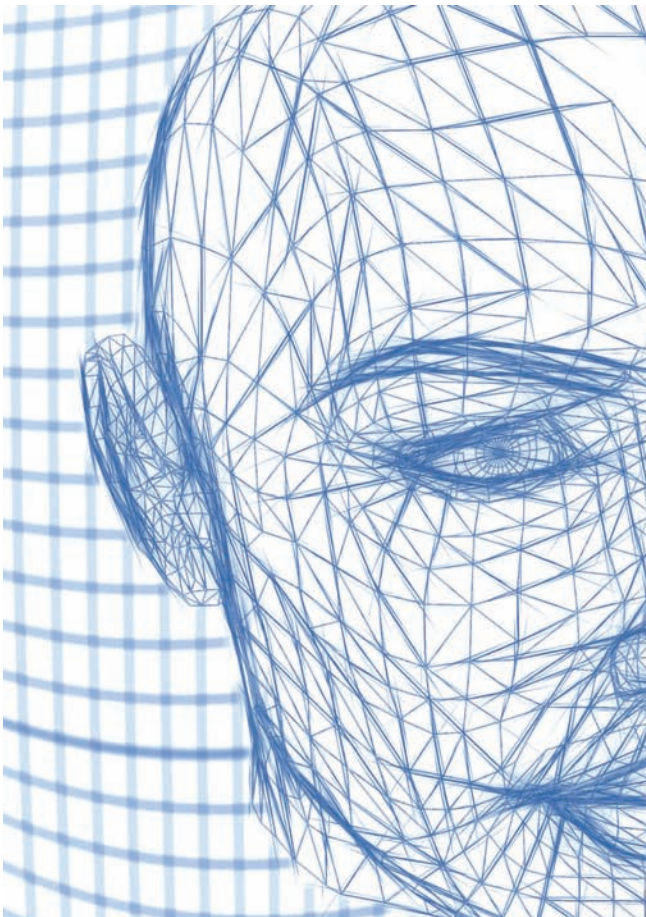
ABM is the latest technology. This method tackles different levels of problems compared to SD and DES and has a wide range of applications in real world. It makes the modeling of the human behavior more efficient, since it is based on simple decision-making agents which follow some simply defined rules. The outcome of this paradigm results in the interaction of these agents with each other and the external world. This applies to the health care industry also, in which patients and resources interact to accomplish a certain task (Bonabeau, 2002).

Monte-Carlo Simulation (MCS) is based on the probability distribution, where uncertain inherited events are substituted by random values. Results are calculated several times using a different set of random values from this probability function. This is also related to the health care systems, where a big amount of data is to be collected for system interpretation (Fishman, 2013).

Simulation modeling software

Simulation modeling software became the ultimate way to address problems caused by complex systems in a cost-effective way. The computing power and the programming languages were highly developed in the last decade, leading to an explosion in simulation languages such as GASP, SLAM, SIMIAN/ARENA, SIMIO etc., which made simulation a powerful, useful and cost effective modeling technique.

Since health care systems are very complex, a more developed and cost-effective simulation model should be integrated. This can be handled using object libraries and visualizations in order to handle the complexity with ease. Some modern simulation packages for health care systems are: Medmodel (Harrell, Lange, 2001), Flexsim (http://www.flexsim.com/flexsim-healthcare), ARENA and SIMIO.



Advantages of ARENA and SIMIO

Figure 1 presents a literature survey from 1997-2010 on the breakdown of the use of simulation. Most of the earlier simulation projects highlighted specific issues. Based on the papers reviewed and researches done before, only five percent dealt with multi-facility modeling (Günal, 2010).

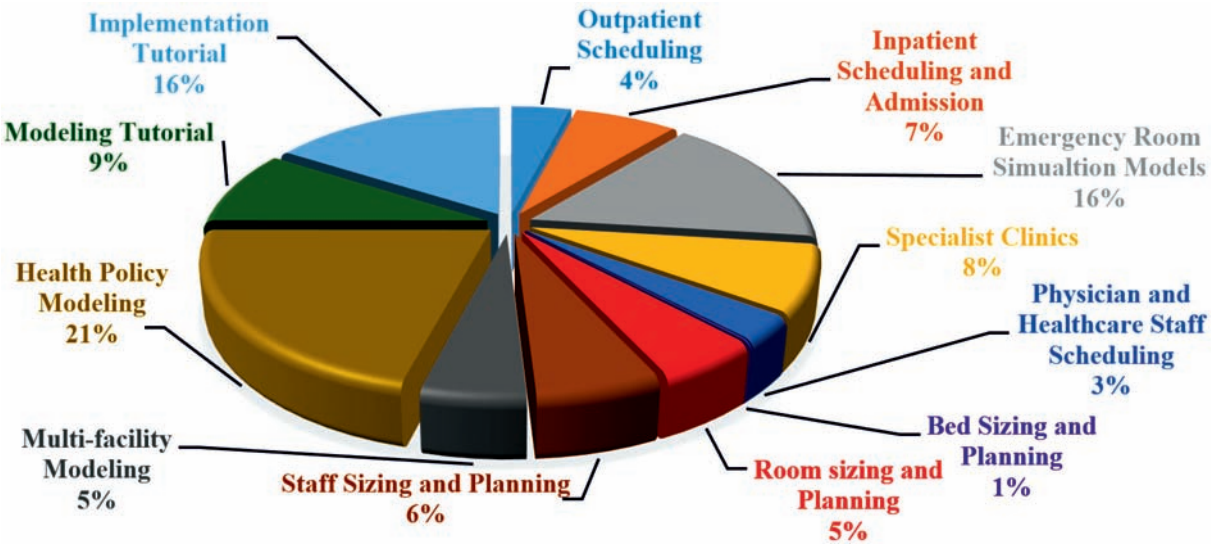
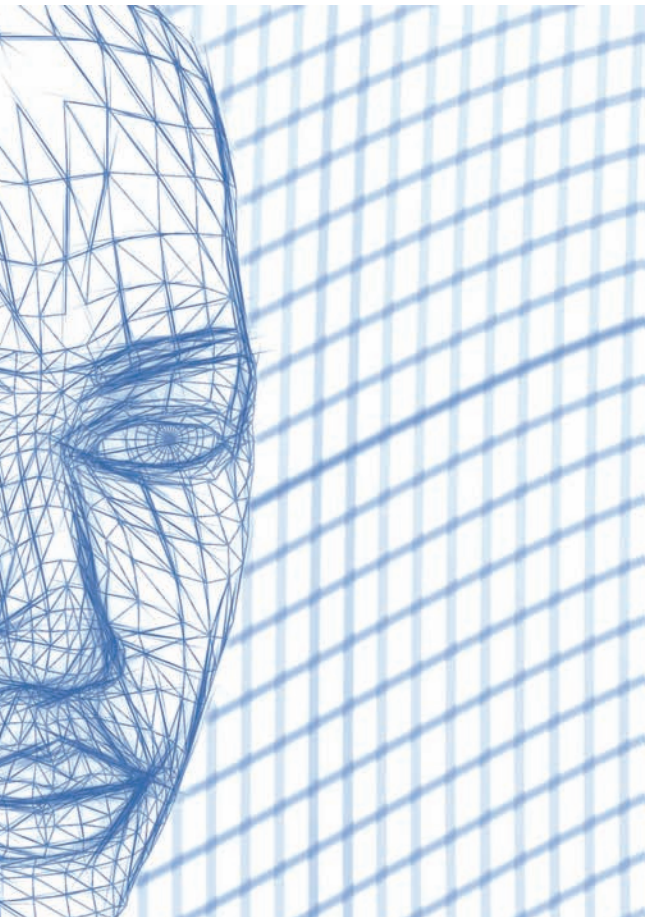


Figure 1 – *Literature review breakdown (percent of papers)*



The lack of flexibility in modeling tools in order to modify the software output generation, to provide custom statistics and visualizations, as well as the inability to use the tool in more than one simulation paradigm led researchers to resort to using an object-oriented approach to a simulation framework development in a multi-paradigm supporting simulation environment. Examples of such a simulation environment can be SIMIO or ARENA software programs.

In this paper the authors focus on the development of guidelines for a best practice of the simulation modeling software. A very common reason for the low implementation of health care simulation models is that 50% of the papers focus only on facility-specific issues, ignoring the complex interaction that occurs in real life between

different facilities in different departments, and leading to a poor effect on the entire health care system. One of the goals of this paper is to improve the simulation modeling in health care in order to handle complex systems thinking. For that, as a modeler, facility-specific issues must be transformed into multi-facility problems. To achieve this, an object-oriented approach will be used for the development of simulation models. Each facility can be modeled independently and then combined to form an entire hospital model system. An earlier proposal of this concept was made by Gunal (Gunal *et al*., 2001).

ARENA software

As a huge complex system, the health care industry is facing continuous changes. Therefore, predictive modeling is very useful and effective for achieving better results like controlling system costs, responding to new regulations, enhancing patients' experience etc.

Nowadays, the leading health care simulation software solution in the market is ARENA, developed by Systems Modeling Corporation. It facilitates the study of patient flow, the staffing requirements, optimizes the use of facilities, the streamlining of ER (Emergency Rooms) and admission processes, facilities planning and much more. ARENA is a modeling system that is built on SIMAN/Cinema. It is a graphical and animation system based on the concept of object-oriented programming and hierarchical modeling (Drevna and Kasales, 1994).

ARENA is a very friendly user tool in which a predictive modeling flowchart methodology can be designed to facilitate and process fast the investigated health care system. A common feature of ARENA is the drag and drop elements and structures which allow the user to build simulations and visualize results. Moreover, the model analysis is quick and easy with ARENA's built-in dynamic dashboards where you can build customized displays of the model information which enable the better understanding of what is happening in the hospital and the predictive analytics development of the operations. ARENA customers can use the basic modeling primitives included in the SIMAN blocks and elements library to create new modules. These modules can then be saved into templates (or libraries) and tailored to serve the project in the study (i.e. health care modeling primitives such as doctors, nurses, beds, X-ray etc.). This mechanism provides the modeler with the ability to build a modeling system that is similar to the real system being modeled.

Defining a realistic patient flow and collecting accurate data are key factors to the success of the modeling project. The final model consists in an Excel user interface coupled with the ARENA hospital simulation model. The Excel interface enables the users to enter inputs, run the model and view outputs easily. Numerous

scenarios for comparison can be created by changing various inputs in the Excel interface. The user can manipulate process flows, process delays, patient routines, as well as resource schedules and bed capacities, all from the user interface. Once the scenario is run, the user can quantify results by examining multiple pages of output reports. From patient cycle times to resource utilizations, various key outputs for analysis can be recorded for each run. Analysis and comparison of scenarios provide key information for making the right decisions.

The basic advantages of this software are: modeling the processes in order to define, document, and communicate, simulating the future performance of the system to understand complex relationships and identify opportunities for improvement, visualizing the operations with dynamic animation graphics, and analyzing how the system will perform in different possibilities so that the best decision can be chosen. In ARENA, modules are the flowchart and data objects that define the process to be simulated where all the information required to simulate a process is stored. However, entities can be the customers/patients being served. One model can have different types of entities. For example, in the pharmacy, prescriptions would be modeled as entities, running through the process of being filled. At the same time, customers might be competing for the pharmacist's attention with medical inquiries; they would also be modeled as entities.

SIMIO is defined as **SIM**ulation modeling framework based on **I**ntelligent **O**bjects. It was created in 2005 by Dennis Pedgen, who is a leader in this area, having a significant experience in simulation and scheduling techniques.

SIMIO provides an object – oriented approach to simulation modeling, which helps in breaking down a complex problem into smaller, easy to manage problems. It is considered as the 4th generation simulation software, flexible for object design, scheduling risk analysis and managing daily operations. SIMIO can be one of the options that can be used as a simulation software for health care systems in which complex problems arise.

The guidelines for OOS class development starts by setting three attributes for each class: „Usability", „Complexity" and „Utility". „Usability" is used as a user-friendly class which is easy to understand and use. „Complexity" is a more advanced class, where advanced logic cases can be executed. This class can be used for alternatively modeling many different processes. „Utility" is defined as the resultant value, which is a function of the two previous classes, complexity and usability.

As shown in Figure 2, SIMIO standard library is composed of six basic classes of objects derived from one super class – Intelligent Object. These basic classes provide modelers a starting point for developing and extending intelligent objects within SIMIO. All the base classes except for the Entity and Transporter class can be seized, released or follow a schedule:

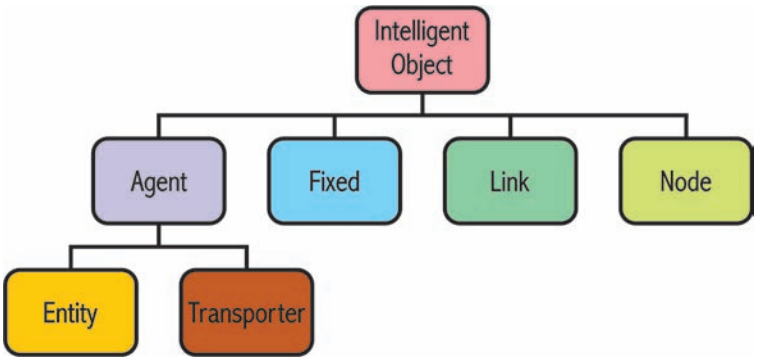


Figure 2 – *SIMIO Base Classes*

With Object-Oriented Programming languages, basic classes can be extended to build new classes with complex behavior. Using SIMIO, a new class can be built in two ways: „Composition" and „Inheritance". With „Composition", we can build a new object by combining two or more component classes. For example, for modeling a two stage processes, a two Server classes can be combined. On the other hand, with „Inheritance", we can create more specialized objects. This method is more powerful and useful in order to modify the behavior of an existing object. It is very important to highlight that subclassing an existing object inherits all the methods and variables of its parent object. SIMIO provides the user the power to modify existing processes and add new variables to create new object behaviors. For example, in order to create a transporter with external assistance to move, a subclass of the Vehicle class should be created along with adding new properties and variables to seize a resource when its capacity is allocated.

In addition to sub-classing from the standard library, users can add new methods and variables to build a new class onto one of SIMIO's base object classes, where it inherits all its properties. Here, SIMIO offers modeling flexibility, where objects can be built from scratch and thus improves the run-time performance for the object. Regardless of the employed method, newly created objects and SIMIO standard objects run and can be used in the same way. Based on the nature of the new object desired, the user can choose the method of building this new object. Objects then can be stored in libraries and easily shared. Objects can be a machine, a doctor, a nurse, a patient etc.; after studying the system to be modeled, these objects are combined together to form a system identical to the real one. The modeler can work in 2D view to create and edit the model and then quickly switch to 3D view for animation and reflect the changing states of the object. The composition is an effective method if the new object's behavior can be generated by combining two or more objects, while inheritance is an effective method when your new object's behavior can be generated by specializing or adding methods or variables from an existing object. Thus, hierarchical modeling is very easy using SIMIO, since a model can be placed as a sub-model within a higher level model.

The OptQuest facility can be used with SIMIO, offering the capability of evaluating all the scenarios and reaching a decision based on the optimal scenario. This tool

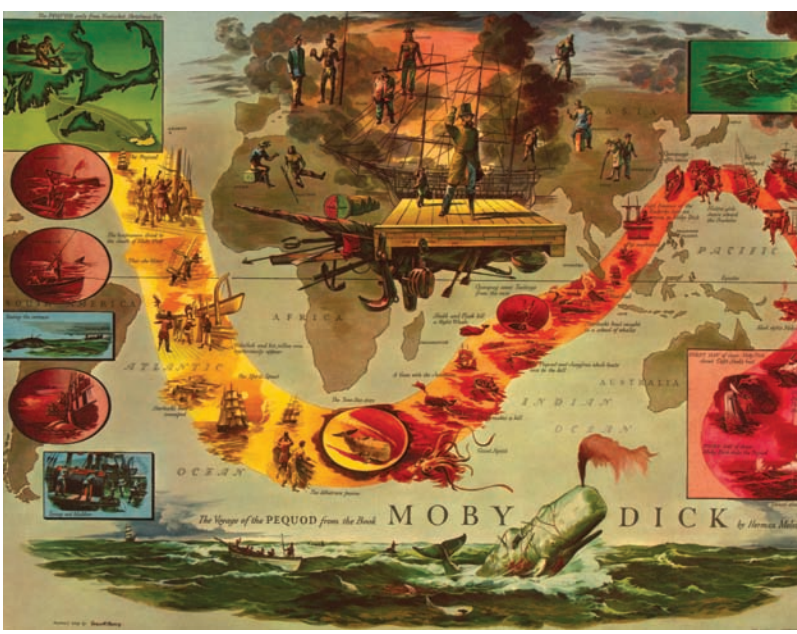
is an add-on feature of the standard SIMIO product. The SIMIO scheduling Software is another valuable feature, allowing the system to be modeled in two different approaches. First, the system can be run in the perfect environment. Secondly, many replications can be run each time with a different variation of the system (such as adding overtime, adding staffing resource, adding material resources, expanding units etc.). Thus, probabilistic analysis using the Entity Gant Charts can be executed to estimate the risks associated with each replication. In this way, risk measures can be predicted and optimistic targets of the real system can be achieved by taking early actions in the operational plan. Therefore, a long-term performance of the modeled system can be evaluated, to provide managers with an operational strategy at minimum cost.

A Brief Literature Review

The widespread and use of the simulation modeling for improving system performance were presented earlier in 1999 and 2000 (Hlupic, 1999, Hlupic, 2000). Dias *et al.* based their tools comparison on the concept of popularity over the internet/social media and scientific publications (Vieira *et al.*, 2014). The best tools are normally the most popular ones, indicating that ARENA was classified as the most popular tool. SIMIO is a new tool with a good ranking which makes it a great option of becoming more popular and widely used in the future.

ARENA is a simulation environment that consists of module templates built using SIMAN language and the CINEMA animation package. The tool consists of blocks (logic constructs to represent operations) and elements (objects to represent resources). Since ARENA is on the market for several years, it is more popular in a large number of publications (Kelton *et al.*, 2002, Altiok and Melamed, 2010 etc.).

SIMIO was developed in 2007 with the ability to create intelligent objects to be used in multiple complex projects, as said by some researchers (Pedgen, 2007, Vik *et al.*, 2010), Pedgen and Sturrok, 2011). Objects can be stored in libraries and easily shared. Programming coding is not necessary since it is a graphical based platform. The activity of building an object is identical to the activity of building a model. Therefore, the modeled system looks exactly like the real system under study. The logic of the model in SIMIO along with the animation can be easily built in one single step, which makes the model effective and intuitive as mentioned earlier in previous sections. This animation approach reflects the changing states of the object/model. The 2D and 3D animation features of SIMIO turn it into a valuable tool where the quick shift between the two views can be done with one click. Moreover, it has a direct link to Google Warehouse, a library of graphic symbols which is available to be used in



the model and represent the system's components. The two-mode feature discussed earlier (interactive and experimental) helps the modeler in validating the constructed (interactive) model where the animated system can be executed, and in defining some changes in the model to study their impact on system's performance.

It is obvious from the recent publications that not many modelers use SIMIO for their simulations, but the discussed advantages of this tool predicts a bright future. Akhtar *et al.* (2011) used this tool for their study on consanguineous marriages. Li and Wang (2011) approached a ticket office and evaluated its service level performance. Vik *et al.* (2010) modeled a logistic system design. Brown and Sturrock (2009) used SIMIO to improve a set of production processes. Kai explored a simulation of casualty treatment in wartime (Zhang *et al.*, 2009). Vieira *et al.* (2014) presented in their study two different case studies using both tools.

The main difference highlighted between ARENA and SIMIO is the animation. SIMIO's model is more realistic and looks like the real system. As a result, the authors of these studies concluded that building the model with SIMIO was easier, faster and more intuitive (Zhang, *et al.*, 2011).

As a conclusion, SIMIO is based on ARENA, and was developed by people who helped develop ARENA. However, SIMIO has some advanced features that ARENA does not have, such as converting a model from the 2-dimension to the 3-dimension with the press of a button, but ARENA is the oldest software, with 20 years of experience in the market, and was ranked to be the most user-friendly tool of all (Edmonson, 2012).

Advantages of the Simulation in Health Care

Programming languages were the first entities presenting Object Oriented Simulation (OOS) models. Multiple processors can be executed in parallel using the OSS models, leading to a higher utilization of processing and memory resources. This advantage key factor makes this type of simulation modeling a cost-effective one. Most of the problems that health care systems face can be solved using simulation modeling, thus making simulation a significant strategic advantage and an efficient technology nowadays.

The main factors to be considered for a cost-effective health care simulation modeling are as follows (Akshay, 2012):

- Patient Flow and Optimization: Outpatient Scheduling, Inpatient Scheduling and Admission, Emergency Room Simulation Models, Specialist Clinics, Physician and Health Care Staff Scheduling;
- Health care Asset Allocation: Bed Sizing and Planning, Room Sizing and Planning, Staff Sizing and Planning;
- Health policy modeling;
- Multi-facility modeling.

Patients flow optimization

In order to measure the quality of service of a hospital, the patients' satisfaction should be the first factor to point at. High-quality services can be measured as the patients' waiting time, patients' flow time and patients' service refusal rates. Studies have shown that to improve patients' satisfaction, optimization of these listed metrics should be applied by varying appointment scheduling systems, hospital resource allocation methodology and reorganization of the care processes to better serve the patient.

Outpatient scheduling

Patients can be classified into categories of care. For outpatient clinics, there is a limited number of physicians to serve; this being the situation, in order to maximize patient's satisfaction, effective allocation of these specialized physicians should be applied. Many factors should be highlighted in this case, like no shows, variance in consultation time and variance of walk-in, in parallel with external demand for appointments, supply of provider slots, patient flow logic (internally generated demand) and a scheduling algorithm.

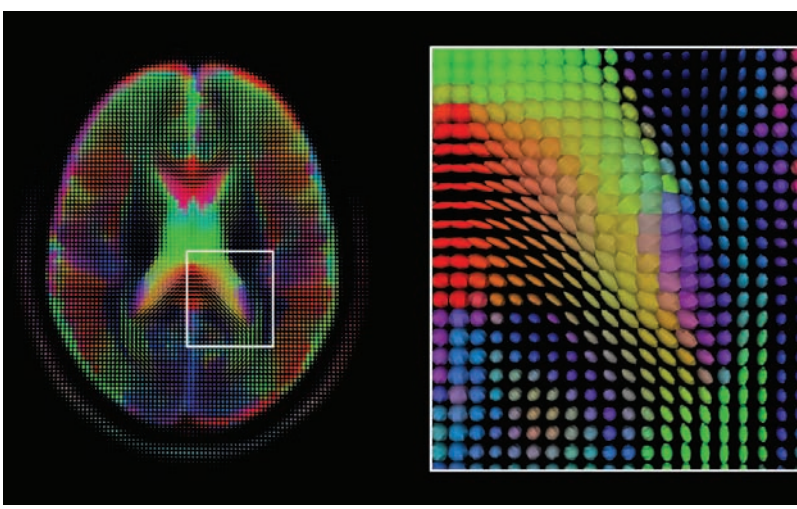
Inpatient scheduling

The most expensive and critical resources in a hospital are Operating Rooms (OR) or Surgical Units. Thus, allocation of these rooms should be performed in a way that increases their utilization rate, always taking into consideration patients' satisfaction and avoiding large waiting times. The complexity and accuracy of these problems have been solved by the evolution of simulation models. Many factors arise here; such as evaluating block scheduling policies, room turnaround time (includes setup and cleanup time), flexible and fixed scheduling policies. Allocation of OR room policies should also be based on elective and emergency surgeries. Moreover, the relationship between OR scheduling and Post-Anesthesia Care Unit (PACU) should be analyzed. An efficient simulation model should take all these metrics into consideration to achieve patient satisfaction and reduce patient waiting times.

Emergency Department (ED) simulations

Since emergency departments are the unpredictable and the frontline of health care service delivery, simulation is highly needed in order to solve any problem that may arise. This service is time – critical and may cause death in the case of a non-effective system. ED departments base their challenges on resource levels and patient flow. Thus, many scenarios and experiments should be examined here in order to reduce harm and satisfy all sectors.

ARENA and SIMIO are excellent simulation packages used by many researchers in order to solve health care problems. Using one of these two models, the maximum capacity of an ED can be estimated,



predicting the patient's waiting time in the system. Based on the simulation results, a study can be conducted to compute the minimum number of resources required to serve the maximum demand. Furthermore, in EDs, patients should also be categorized based on their emergency or non-emergency case and the type of service required. Most of the ED simulations are planning tools used for testing new and innovative policies before being implemented in integrated health care systems.

Specialist clinics

Specialist clinics are facilities that provide special and highly demanded medical care such as Chemotherapy centers, Laboratory, MRI imaging facilities etc. The complexity of these facilities arises new sets of problems that must be solved using simulation models. The objective of these simulation models is to minimize patient waiting time and overcrowding, while maximizing resource utilization.

Physician and health care staffing

This became the focus point for any simulation tool in order to model and optimize patients' problems. The simulation model should minimize the idle time for these workers to serve the patient better. Here, a new factor should be highlighted: „patients' preferred physicians". Therefore, simulation models should present an optimized solution in order to allocate patients to their preferred provider, while trying to minimize the waiting time and physician overtimes. Most studies prove that the poor scheduling of physicians and ineffective process flow is the cause for poor system performance. **Health care asset allocation** is the core of good management strategies. Health care and hospitals should

stay in line with the technological developments; therefore, simulation tools are very efficient in order to stay up to date and forecast any unpredictable assumptions.

Bed sizing and planning

Bed availability is the key factor affecting a health care system, since it should always be available to serve patients' needs especially in primary care units like ICU. On the other hand, excess capacity will mean resource under-utilization and extra maintenance costs which are not a suitable solution. Therefore, simulation models should be developed and optimized in order to solve these problems.

Room sizing and planning

Room Sizing and Planning deal with facility design. Hospitals have to upgrade their facilities to match their demand, and this brings up a range of problems which can be addressed using simulation.

Staff sizing and planning

For a hospital to operate effectively and efficiently, the quality of service should be taken into consideration. This can be achieved by allocating the required size of resources. Simulation models should estimate and plan staff sizing in order to ensure proper facility utilization.

Health policy simulations

Health care is a variable science, since it is based on different physicians' experience and concrete observations. One patient can go through several treatment paths under different doctors. Simulation tools should be the solution to decision making and improved quality of treatment. Health care policy simulations are also used in public health preparedness problems which deal with infectious disease outbreaks and public health response system preparation. Ambulance diversions are another class of problems investigated by health care simulation models. Simulation models should evaluate the direct impact of ambulance diversion on the emergency department. The criteria for evaluation are average waiting time and percentage of ambulances diverted.

Multi-facility simulation models

In previous sections, we have focused on specific problems related to a particular facility, without taking into consideration the cascading effects affecting the other entities of the health care system. For example, improving the functionality of one department in a hospital may increase the patients' dissatisfaction in another department or affect other departments' scheduling. Doctors are shared in different departments. Therefore, any changes performed for one department will affect their work in the other departments. These complex relationships existing between multi-facilities in one health care environment should be highly considered and highlighted. Otherwise, the marked effect will be hitting the overall system, which is the highest reason of low implementation of health care simulation models.

Conclusion

Health care is a large, dynamic and complex system where different units, teams, resources and patients interconnect in order to serve an activity. This interconnection of facilities requires multi-paradigm, flexible simulation modeling methodologies in order to capture this complexity and present a clear view on how to predict critical events and then reach an optimal decision making.

An emergency department (ED) is a medical treatment facility specializing in emergency medicine, the acute care of patients who present without a prior appointment; either by their own means or by that of an ambulance. Most problems affecting

the health care system are derived from the ED, since the patient flow is based on prediction without any prior appointment. This department is the biggest interacting unit of the entire hospital, which makes it the most complex system (as *per* the literature review) and thus the focus of the present paper.

The different problems affecting EDs can be approached and reduced by implementing a flexible/cost effective platform using one of the available simulation tools in the market, thus increasing patient/management satisfaction. As *per* the comparison performed in previous sections, SIMIO and ARENA are the most recent competing tools in the market nowadays, which can act as multi-paradigm and perform the required analysis.

As a conclusion, simulation modeling has evolved to be an efficient technology for enhancing the health care industry, specifically the ED. The choice of the right simulation tool is based on the availability of the software and on the criteria interests of the researcher (such as the need of a user-friendly tool, the animation purposes etc.). For a successful implementation of the health care systems, simulation modeling should encourage multi-facilities investigations in order to cover up the complexity of these systems. A very common way to do so is to develop each facility separately and then combine them together using a simulation model and therefore covering up the whole health care system model.

As a future work, building a multi-facility platform where the complex system is divided into simpler problems by creating a module for each unit and then combining all together to form the ED system can be achieved using simulation modeling. Then, the model should be validated and compared to the real system. After building and validating the model, real input data will be integrated into the model in order to build different scenarios and

test any unpredictable changes and how the system reacts to these changes, in order to avoid any disaster conditions. Different scenarios can be proposed in order to enhance the system, taking into consideration certain managerial constraints. The animation feature will help to monitor and evaluate the system. Some changes can be imposed on the modeled system without affecting the real system in the process and thus predictive analysis can be performed in order to evaluate the performance measures and find the optimal solution for any arising problem. The problem affecting ED may be different depending on the region, season, patient age, patient mentality etc. From these several scenarios, the optimal solution can be chosen taking into consideration patient satisfaction (by decreasing waiting times), increased management revenue (by decreasing costs, increasing staff utilization, reducing hospital resources use etc.). Therefore, the minimum number of resources required to serve the maximum demand should be predicted.

Moreover, adding missing toolbox to the library of the chosen tool can be a great achievement to ease the process of adding entities representing the health care system (such as a patient, doctors, nurses, ambulance etc.). These entities can be created using programming languages and some specific algorithms and saved into the tools library which can be later used for any health care system.

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„It is literally true that you can succeed best and quickest by helping others to succeed."
Napoleon Hill

Towards Total Risk Management

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La Conversion, Switzerland

Abstract

A situation involving exposure to danger is a risk. The objective of risk management is to reduce different risks related to a pre-selected area, up to an acceptable level. He may refer to numerous types of threats caused by environment, technology, humans, organizations, and politics. Risk management is a range of coordinated activities with the aim of directing and controlling an enterprise on risk. It allows a company to identify mitigation strategies data, so the company should be able to achieve its objectives. No definition is advanced as a correct one in our article, because no one definition is suitable for all problems.

Keywords: Risk, hazard, risk assessment, risk management, uncertainty.

Introduction

Numerous studies indicate that the perception of risk varies widely between individuals, and also between how experts assess risks and how risks are generally perceived by the public. The problem is compounded whenever there are wide divergences in the assessment of risks by the experts themselves. A description of possible risks would be that it refers to the uncertainty that surrounds future events and results. It is the expression of probability and influence of an event that has the potential to influence the success of the objectives of a company/organization.

The definition of risk is inherently controversial. The choice of definition can affect the outcome of political power in society. No definition is advanced as the

„The richest people in the world look for and build networks, everyone else looks for work."
Robert T. Kiyosaki

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correct one in this essay, because no definition is suitable for all problems. The choice of definition is a subjective one, expressing someone's views regarding the importance of different adverse effects in a particular situation; there are inevitably elements of subjectivity in expert estimates of risk. Objectivity can rarely be achieved, particularly in complex novel areas such as risk analysis (Fischhoff *et al*., 1984).

Risk means different things to different people. Slovic (1987) argues that public perceptions of risk are shaped by the dread factor of the event (whether it is uncontrollable, consequential, fatal, involuntary, not equitable etc.) and by the severity of unknown characteristics (unobservable, delayed manifestation of harm). While local authorities may judge how dangerous their neighborhoods are based on expected annual statistics of hazards, the perception of safety by the public may be influenced by a single horrifying case. One crime case is enough to make the city/neighborhood/campus residents feel unsafe. A dimly light environment increases the unknown factor and being alone increases the dread factor (increases the possibility of fatal consequences since no one can save you). Lowrance (1976) defines the risk as a measure of the probability and severity of adverse effects.

Risk and Hazard

The term *risk* is used universally, but different audiences often attach different meanings to it (Kloman, 1990). In fact, the details about risk and how it supports decision making depend on upon the context in which it is applied (Charette, 1990). For example, safety professionals view risk management in terms of reducing the number of accidents and injuries. A hospital administrator views risk as part of the organization's quality assurance program, while the insurance industry relies on risk management techniques when setting insurance rates. Each industry thus uses a definition that is uniquely tailored to its perspective. As a result, no universally accepted definition of risk exists.

The risk may be defined as the possible consequences of a decision option times the probability of consequences materializing and special circumstances that may be involved. Increasingly severe magnitudes of consequences resulting from a technological option are sometimes accompanied by increasingly small probabilities that can reach *de minimis* (or insignificant) levels (Muhlbauer, 2004). Thus a dilemma exists for policy development as to what the *de minimis* level of probability is for those rare combinations of circumstances that can produce worst case consequences. One possible guide is the probability level of fatal accidents individuals routinely accept in their personal activities. Another is the establishment of safety cost trade-off criteria that take into account equity of safety

cost trade-off criteria that take into account equity considerations of the diverse opportunities for saving lives by the allocation of finite financial resources.

Kates and Kasperson (1983) and Hohenemser *et al.* (1983) define risks as the possibility that human actions or events lead to consequences that harm aspects of things that human beings value.

Two important handbooks – one American, published by the *US Project Management Institute* (PMI, 2000), and the other one British (*UK Association for Project Management*) (Simon, 1997) – have adopted a broader point a view regarding the risk, advancing very similar definitions (Băjenescu, 2015 a):

Risk – an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective (PMI, 2000, p. 127).

Risk – an uncertain event or set of circumstances that if occur, will have an effect on the achievement of the project's objectives (Simon, 1997, p. 16).

In his book, *Powershift*, Alvin Toffler states: As we advance into the *Terra Incognito* of tomorrow, it is better to have a general and incomplete map, subject to revision and correction, than to have no map at all (Toffler, 1990). This implies that a limited database is no excuse for not conducting a sound risk assessment. Or the contrary, with less knowledge of a system, the need for risk assessment and management becomes more imperative. As knowledge continues to grow in importance, a redistribution of power will take place that will rock the very foundation of the world economy. The old „smokestack system" is being replaced by an entirely new „system of wealth creation". According to Toffler, the span of the Industrial Revolution is finally entering its last stage. „The new system for making wealth is totally dependent on the instant communication and dissemination of data, ideas, symbols, and symbolism." „This new system takes us a giant step beyond mass production toward increasing customization, beyond mass marketing and distribution toward niches and micro-marketing, beyond the monolithic corporation to new forms of organization, beyond the nation-state to operations that are both local and global, and beyond the proletariat to a new „cognitariat."

The definition of Klinke *et al.* (2002) implies that the severity of experienced harm depends on the causal relationship between the stimulus (human activity or event) and the consequences. If we take a non-fatalistic viewpoint, consequences can be altered either by modifying the initiating activity or event, or by mitigating the impacts. Therefore, the risk is both an analytic and a normative concept. If their vast majority, the human beings assess potential consequences as unwelcome or undesirable, and the society is coerced to avoid, reducing, or, at least, to control risks.

The risk is unavoidable and present in every human situation: in everyday life, in public and private sector companies. Depending on the context (insurers, shareholders, technical reasons) there are accepted definitions of risk. The concept which is common in all definitions is the uncertainty of results; they differ in the way the results are characterized. Sometimes, the risk is described as having adverse consequences, while other times it is neutral.

A possible description of risks would be that it refers to the uncertainty that surrounds future events and results. It is the expression of probability and influence of an event that has the potential to influence the success of the objectives of a company/organization. This supposes that, for decisions regarding major risks or threats, it is necessary to perform at least one form of quantitative or qualitative analysis. For each risk, two calculations are required: its probability and the extension of impact or of its consequences. Finally, it is recognized that for certain companies, risk management is applied to predetermined results that can lead to unintended consequences or effects. For these companies, the definition of risk refers to the risk as „a function of the probability of an adverse or unwanted event and to the size and severity of the consequences of that event" will be more relevant to public or private contexts of decision making. The ISO 31000 defines risk as the uncertainty effect on the achievement of objectives (Băjenescu, 2015 b).

Underlying the definition of risk is the concept of hazard. Hazard is typically defined as a characteristic or group of characteristics that provides the potential for a loss. Flammability and toxicity are examples of such characteristics. It is important to make a distinction between a hazard and a risk, because we can change the risk without changing a hazard (Muhlbauer, 2004).

Risk Evaluation

Risk evaluation is the process by which societal institutions (such as agencies, social groups within society) or individuals determine the acceptability of a given risk. If a risk is judged as unacceptable, adequate measures for risk reduction are required. The process of reducing the risks to a level deemed acceptable by society and to assure control, monitoring, and public communication is covered under the term risk management (Zimmerman, 1986). The debate on how to evaluate and manage risks focuses on three major strategies (Stirling, 1999):

- Risk-based approaches, including numerical thresholds (quantitative safety goals, exposure limits, standards etc.);
- Reduction activities derived from the application of the precautionary principle;
- Standards derived from discursive processes such as roundtables, deliberative rulemaking, mediation, or citizen panels.

There is no simple recipe for evaluating and managing risks. What risk managers need is a concept for evaluation and management that on the one hand ensures integration of social diversity and multidisciplinary approaches and, on the other hand, allows for institutional routines and easy-to-implement protocols.

The approach to determining acceptable risk is based on what is acceptable to the general public. In democratic societies, according to accepted theories, the views of the general public are pre-eminent when determining what acceptable risk is and what it is not. While perhaps superficially appealing as a model for determining levels of acceptable risk, this approach immediately raises a number of theoretical and practical problems.

For a public-based approach to acceptable risk to work, all sections of the community must have full access to all information required on levels of risk and have the skills to interpret that information. There must also be an effective means of reaching consensus within the community and canvassing that consensus opinion. Unfortunately, each of these preconditions is unlikely to be met in most circumstances.

Risk-based decision-making and risk-based approaches in decision-making are terms frequently used to indicate that some systemic process that deals with uncertainties is being used to formulate policy options and assess their various distributional impacts and ramifications.

Uncertainty colors the decision-making process regardless of whether it *(a)* involves one or more parties, *(b)* is constrained by economic or environmental considerations, *(c)* is driven by socio-political or geographical forces, *(d)* is directed by scientific or technological know-how, or *(e)* is influenced by various power brokers and stakeholders.

The worst case analyses of risk become important whenever there are wide ranges of uncertainty surrounding estimated risks of technological applications, especially if environmental and societal impacts can reach catastrophic proportions.

In the economic theory, risk refers to both gains and losses. If we are dealing with risks affecting the environment and human health, the confinement to negatively evaluated consequences is more in line with the average understanding of risk in this context. One should note, however, that the labeling of consequences as positive or negative refers to genuine social judgments and cannot be derived from the nature of the hazard itself. It is difficult to identify and mitigate risks without an objective and professional opinion.

Risk Management

A generic definition of risk management is the assessment and mitigation of potential issues that are a threat to a business, whatever their source or origin (Southern, 2009). Risk management is an activity directed toward assessment, mitigation and monitoring of risks of an organization. The risk management process involves setting institutional priorities and making key decisions about risk acceptance needs.

Risk management is based on three main concepts: asset, threats and vulnerability (Figure 1). Risks exist because entities, companies and organizations have assets of a material or immaterial nature that could be subject to damage:

Figure 1 – *Threat, asset, and vulnerability determine risk*

An *asset* is a resource with economic value that an individual, corporation or country owns or controls over, with the expectation that it will provide future benefit.

The threat is the potential cause of an unwanted impact on a system or organization (ISO 13335-1). It can be defined as an undesired event (intentional or unintentional) that may cause damage to the goods of the organization.

The vulnerability is a weakness in system procedures, architectural system, its implementation, internal control and other causes that can be exploited by bypass security systems and unauthorized access to information. Vulnerability represents any weakness, administrative process, act or statement that makes information about an asset to be capable of being exploited by a threat (Stroie and Rusu, 2013).

Starting or developing a business always requires taking risks. That is why it is important to identify, analyze, control and manage these risks. We define different types of risk management and describe resulting key steps.

Risk can be managed in one of two principal ways:

- By analyzing each identified risk situation and taking specific measures that are adapted to each one, with the broad participation of the management in risk management. This requires an advanced risk analysis model.
- By using general analysis to establish security goals and guidelines, in order to globally reduce risk without managing it through direct and personalized means and likely with less management participation. These two options have a direct effect on each phase of the related process (Figure 2):

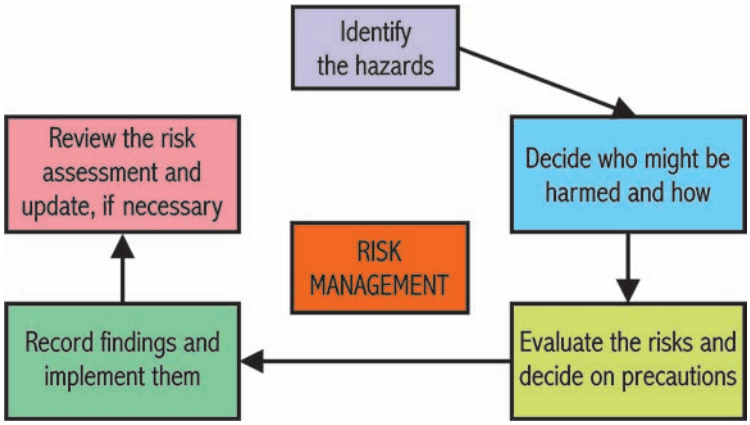

Figure 2 – *Risk management provides reasonable assurance regarding achieving business objectives*

The model of the risk management process is depicted in Figure 3:

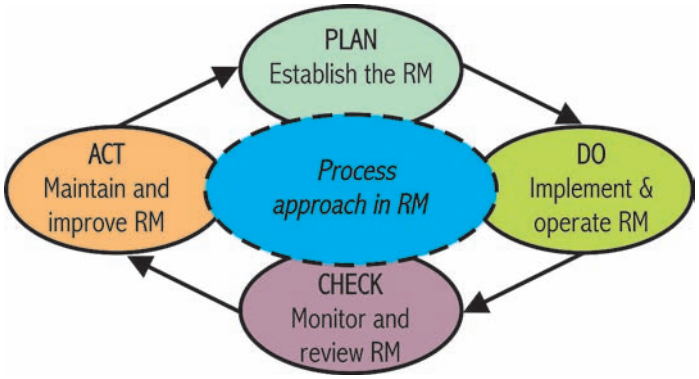

Figure 3 – *Process risk management (RM) model*

Risk management provides a reasonable assurance regarding achieving business objectives. The activity called risk management includes risk recognition, risk assessment, developing strategies to manage risk and reducing risk using managerial resources. The objective of risk management is to reduce different risks related to a preselected area to an acceptable level. Risks may refer to numerous types of threats caused by the environment, The technology, humans, organizations and politics. The progression or the development of a project always demands the control and management of these risks.

Risk management is the process for identifying, and communicating risk and accepting, avoiding, transferring, or controlling it to an acceptable level considering associated costs and benefits of any action taken (DHS, 2010).

In recent years, risk management has become an important tool of security policy. Risk management has many advantages that allow the mastering of the dangers and threats; in practice, however, problems arise: some challenges of an effective risk management are identical for public and private actors, while others enroll in a political and administrative context.

Nowadays the state, economy and society are more closely related than ever and together they constitute a complex interdependent worldwide system. New risks (i.e. pandemics, organized crime, climate change) spread rapidly across national borders.

In addition, the cascading effects complicate the effective damming of the damages. Great uncertainty reigns simultaneously on the really important risks and possible practical repercussions, which requires experts and decision makers to adapt their strategies and methods to the new challenges. Faced with the consequences of high technical risk, the society has gradually become more conscious. The links between risk management and security policy are now easy to imagine: the risk spectrum has enormously widened in the meantime; for example, the respect of traditional military threat scenarios is no longer at the height of the current strategic situation. On the other hand, a security policy is always conceived on the long term; therefore, strategies must be formulated markedly under uncertainty conditions. In addition, it should be stressed that for security policy, the risks are not bad in themselves, and constitute considerable engines of innovation and progress. Maximizing security and minimizing risk by any price, leads, after all, to more harm than good, because it does not properly take into account the productivity of risk or the dangers of an exhaustive security. On the contrary, in policy the starting situation is different; often the risk management of the state suffers from the lack of strategic governance. Given the value judgments and different interests, it is rare to have a consensus beyond the generic objectives – such as security and prosperity. It is, therefore, difficult to prioritize the risks and the possible measures to combat them. The Central task of politics is not to overcome conflicts of objectives, but to ensure the legitimacy of political action. Legitimacy is not measured, above all, by the ability to generate the most effective solution, but by the opportunity – for citizens and for the people's representatives – to influence the decision-making process and, eventually, to give more weight to other criteria (Băjenescu, 2015 c).

Risk management is an activity directed towards assessment, mitigation, and monitoring of risks to an organization. Information security risk management is a major subset of the enterprise risk management process, which includes both the assessment of information security risks to the institution, as well as the determination of appropriate management actions and established priorities for managing and implementing controls to protect against those risks.

The risk management process involves setting institutional priorities and making key decisions in regards to what is sometimes called the institution's „appetite for risk". The primary direction in making decisions about risk acceptance needs to come from institutional leadership. Information security organizations may manage

the risk management program, but it is necessary to consult with institutional leadership about handling risks that cannot effectively be reduced or mitigated. The risk management framework provides useful guidance to assist with developing these processes.

The process can be broadly divided into two components: risk assessment and risk treatment. Risk management encompasses risk assessment and vulnerability assessment along with the mitigation. It also includes measuring the outcome of the process and repeating the process again and again. The risk assessment and management must be an integral part of the decision-making process, rather than a gratuitous add-on technical analysis. Figure 4 depicts this concept and indicates the ultimate need to balance all the uncertain benefits and costs:

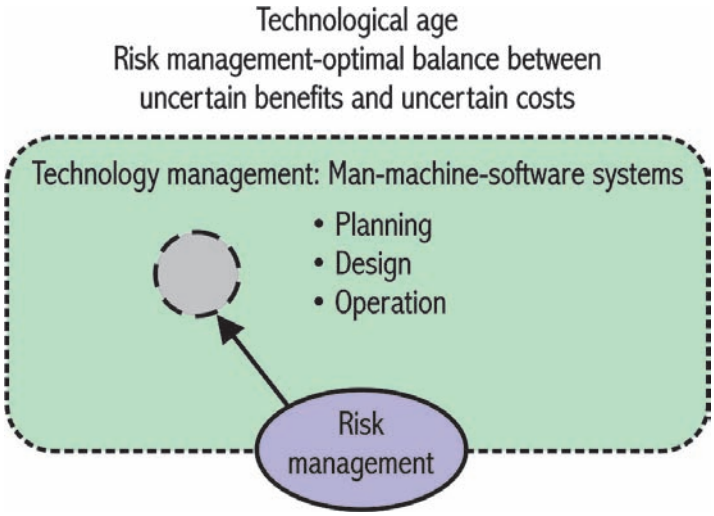

Figure 4 – *Risk management as an integral part of overall management*

The term management may vary in meaning according to the discipline involved, and/or the context. The risk is often defined as a measure of the probability and severity of adverse effects. Risk management is commonly distinguished from risk assessment, even though some may use the term risk management to connote the entire process of risk assessment and management. In risk assessment, the analyst often attempts to answer the following set of triplet questions (Kaplan and Garrick, 1981):

- What can go wrong?
- What is the likelihood that it would go wrong?
- What are the consequences?
- Here we add a fourth question: What is the time frame?

Answers to these questions help risk analysts identify, measure, quantify, and evaluate risks and their consequences and impacts. When these questions are addressed in the broader context of management, where all options and their associated trade-offs are considered within the hierarchical organizational structure, a ***total risk management*** (TRM) can be realized. Indeed, evaluating the total trade-offs among all important and relative system objectives in term of cost, benefits, and risks cannot be done seriously and meaningfully

in isolation from the modeling of the system and the broader resource allocation perspectives of the overall organization (Muhlbauer, 2004).

Conclusions

No general definition of risk exist because no one definition is suitable for all problems. That is why an organization may use risk assumption, risk avoidance, risk retention, risk transfer, or any other strategy (or a combination of strategies) for the proper management of future events (www.businessdictionary.com). The risk is part of everybody's daily life, its part of the decisions we make. The word risk is commonly used to express a certain probability that an undesired event will happen. The difference in perception on this issue can lead to different identifications of risks and therefore different outcomes of a risk assessment, and can be a threat to the technical performance of a project. Paradoxically, it seems that the assessment of risks can be considered as a risk of its own when the perception of risk differs among the assessors or the assessed. Fortunately, this risk can be mitigated by choosing a clear definition of risk (DUT, 2002).

After initialization, risk management is a recurrent activity that deals with the analysis, planning, implementation, control and monitoring of implemented measurements and the enforced security policy. On the contrary, risk assessment is executed at discrete time points (e.g. once a year, on demand etc.) and, – until the performance of the next assessment –, provides a temporary view of assessed risks and while parameterize the entire risk management process.

For private business, risk analysis and risk management are usually associated with what is generally known as enterprise risk management (ERM), with a specific calculative methodology for assessing risk by identifying vulnerabilities, likelihood and impact, and for determining the right responses. Although calculability is absolutely central to an understanding of risk, the concept has in current times been subject to much theorizing within a wide range of social science disciplines, all emphasizing different aspects of its function in society and politics.

Risk identification is the process of determining risks that could potentially prevent the program, enterprise, or investment from achieving its objectives. It includes

documenting and communicating the concern.

A synthetic definition of risk could be: a probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through preemptive action. And risk management could be defined as identification, analysis, assessment, control, and avoidance, minimization, or elimination of unacceptable risks.

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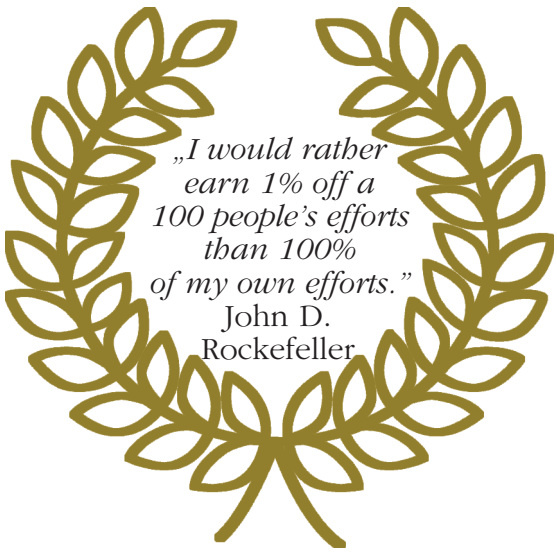

The Impact of New Technologies on Networking

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Abstract

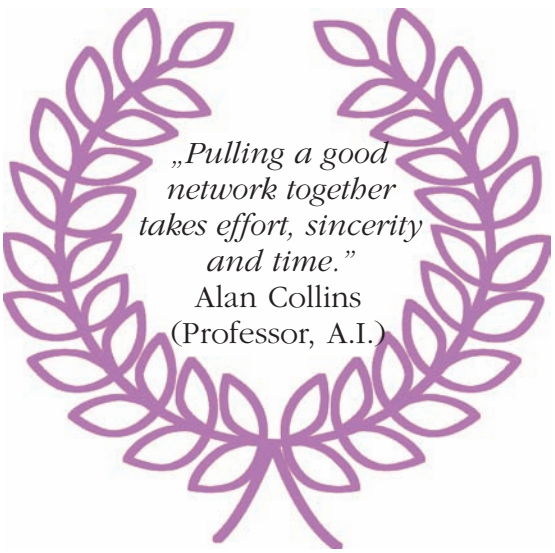
ICT has been all – pervasive, fertilizing and empowering nearly all areas of our life, creating interaction and interdependence. The present paper examines some of the developments, starting with the economic and technologic state of the industry, the transition from mM to MtM and the impacts on individuals and society. Additionally, it renders tribute to the two anniversaries deserving special attention: 50 Years of „Moore's Law" and 25 years of public Internet.

Keywords: Moore's law, storage class memory, neuromorphic chips, social networking

Introduction

The major common denominators of the economy today are change and re-structure, rapid developments as tablets reaching 50% of the market share, making it one of the most disruptive devices ever, the cycles for wearables now averaging two years, and for smart TV's six years only. Or other emerging phenomena are Android surpassing iOS (Apple OS), US adults spending more time on smartphones than on PCs (34 *vs.* 27 h/month) or the growth of health and fitness software applications by 62% last year (women use them three more than men).

The economic gravity center shifted from the „saturated" West to the East as the market of future, making China in 2016 the largest smartphone market in the world. Economics was at the core of Moore's



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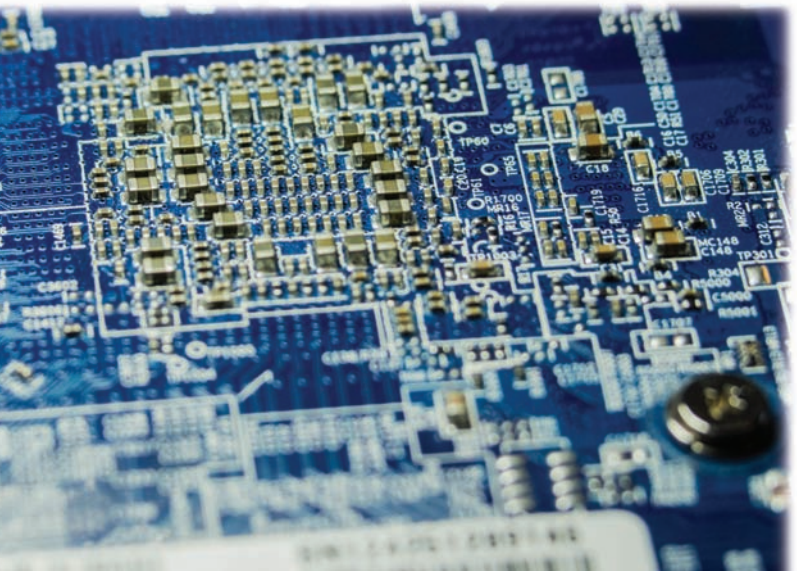
1965 paper. He argued that there is a cost curve of manufacturing technology. The cost of making a component declines the more you pack onto an integrated circuit, but past a certain point, yields decline and costs rise. The sweet spot, where the cost per component is at a minimum, moves to more and more complex integrated circuits over time. Ten years later, Moore revised his prediction. In an analysis for the 1975 IEEE meeting, he argued that three factors contributed to the trend: decreasing the component size, increasing chip area, and „device cleverness," which referred to how much engineers could reduce the unused area between transistors.

Moore's Law

Of the three technology drivers that Moore identified, one turned out to be special: the decreasing of the dimensions of the transistor. For decennia, shrinking transistors offered something rare in the world of engineering: no trade-offs. The scaling rule postulated by the IBM engineer Robert Dennard says that every successive transistor generation is better than the last, faster and less power consuming.



This single factor has been responsible for much of the resistance of Moore's Law, which lasted several decennia.

In the early 2000s, transistors' sizes began to reduce below 100 nanometers, and Dennard's scaling rule reached its limit. Transistors became so small that it was quite easy for electrons to tunnel through them even when the devices were supposed to be off, leaking energy and lowering device reliability.

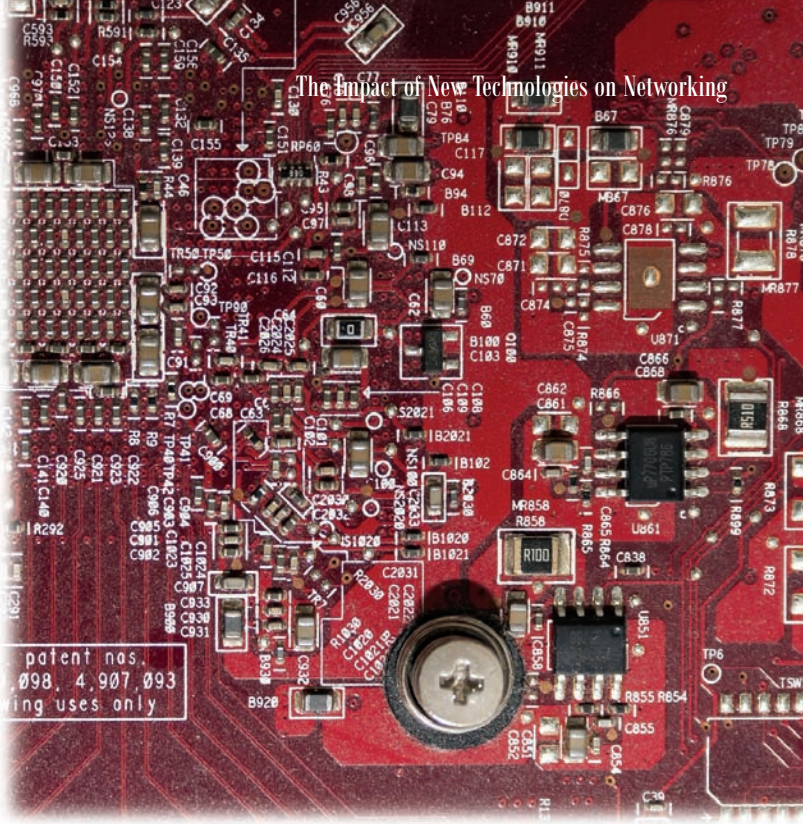
For the last decade, Moore's Law has been more about cost than performance, making transistors smaller to make them cheaper. There have been designing improvements, but much of the gains have come from the integration of multiple cores enabled by cheaper transistors. Today's smartphones have three times the computing power of yesterday's Cray's supercomputer. Without this progress, we would not enjoy mobile computing, GPS in the car or HD video.

The steady work also improved yield, starting in the 1970s at around 20% and now reaching 80-90%. The tools employed in lithography cost 100 times as much today as they did 35 years ago. However, these tools pattern wafers 100 times as fast, making up for the cost increase while delivering far better resolution.

Over the last decade, the manufacturing cost per unit area of finished silicon raised about 10% p.a. Since the area per transistor shrank by about 25% p.a. over the same period, the cost of each transistor kept decreasing. If lithography costs rise fast, Moore's Law as we know it will not be effective. Innovations in semiconductors will continue; instead, new forms of integration will define progress, gathering disparate capabilities on a single chip to lower the system's cost. This makes possible uniting the non-logic functions that

have historically stayed separate from the silicon chips. An example is the modern cell-phone camera which incorporates an image sensor directly onto a digital signal processor using large vertical lines of copper wiring. Chip designers are integrating microelectromechanical systems, like accelerometers, gyroscopes, relay logic, or microfluidic sensors.

However, this new phase of Moore's Law also called „more than Moore" (MtM) may not always make economic sense. Instead of a regular, predictable roadmap for continued success, the path forward will be much more difficult and Moore's Law as we know it is ending. However, new options will emerge.



Information and Communication Technology

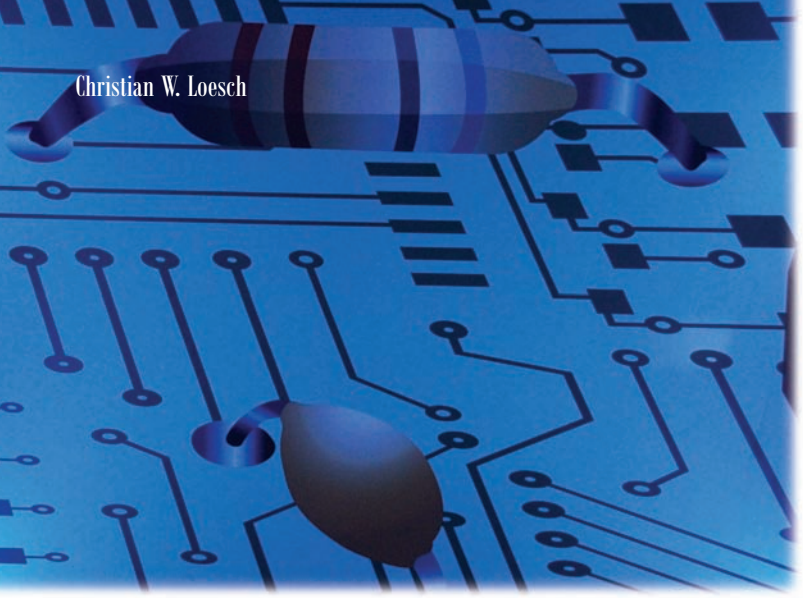
Overall characteristics of the Roadmap:

- DRAM: Half pitch 2013 28nm, 4-years cycle i.e. 0,5 every 8 years, formerly before 3-years cycle;
- MPU: For faster MPU/ASIC the 3-years cycle will continue;
- FLASH: Four years cycle until 2018 (0,5 per 8 years);
- Increasing the role of non-traditional scaling.

Devices. The era until the beginning of last decade classical geometric scaling has been followed by the era of equivalent scaling, strained silicon, high k/metal gate, and multi-gate transistors integration of Ge and compound transistors. The new era of scaling is characterized by features like 3D, reducing interconnect resistance by increasing the vertical conductor cross section, reducing the length of each interconnection, new materials to improve performance by III-V materials and Ge (higher e-mobility than Si).

MtM and mM (More than Moore, more Moore). It encompasses the incorporation of functionalities that do not scale with Moore's law, but provide additional value to migrate from system board level to SiP and SoC (System in Package, System on Chip), provide functional diversification, interaction with outside world. This implies analog and digital signal processing, the incorporation of passive components, high voltage components, micromechanical devices, sensors, actuators, micro-fluid devices enabling biological functionalities, as well as an increased role of software.

Storage Class Memory (SCM). The specialists describe the situation with a term called „Pentalemma" – which represents a conflict in five different requirements such as write current, the stability of the bits, readability, read/write speed and the process integration with CMOS. Approximately ten new technologies, called Storage Class Memory (SCM) are currently under development and they promise to be fast, inexpensive and power efficient, showing the potential of a 100 – to 1,000 – fold



improvement for SCM in terms of the space and power required. Examples are: MRAM (stored by magnetic storage), SRAM (Static random-access memory), Universal memory (ferroelectric gate over Ge channel material), FeFET, STT (spin transfer torque) spin-aligned „polarized" electrons, ReRAM (resistance), TAS-MRAM (Thermal Assisted Switching), 3D Xpoint.

Transistors Emerging Alternatives: Graphene, Ge, InAs/Si Nanotube Tunnel Transistors, Spin-based computing schemes.

The 450 mm Wafer Transition. The transition of leading-edge semiconductor manufacturing to 450 mm wafers is a complex and challenging issue. Improved silicon productivity is the primary argument for wafer size transitions, leading to a theoretical reduction in die cost of approximately 30% (all other costs constant). Even after two years of analysis, the 450 mm wafer scale-up still represents a low-return, high-risk investment opportunity. Advocates claim larger wafers are necessary to keep pace with Moore's Law cost targets and that there are no technical showstoppers. Opponents claim it will negatively affect profitability and drain precious R&D funding away from essential innovations in scaling, cycle time improvements and manufacturing.

Quantum Computation. This idea seems promising, but there are tremendous obstacles to overcome, such as:

- De-coherence: During the computation phase of a quantum calculation, the slightest disturbance in a quantum system (a stray photon or wave of EM radiation) causes the quantum computation to collapse;
- Error correction: Because isolating a quantum system has proven difficult, error correction systems for quantum computations have been developed. Error correction is critical – a single error can cause the validity of the entire computation to collapse;
- Output observance: Closely related to the above, retrieving output data after a quantum calculation presents the risk of corrupting the data.

Even though there are many problems to overcome, the advances in the last years have made some form of practical quantum computing feasible, but there is much debate as to whether this will be a decade or fifty years away.

Neuromorphic Chips. The idea of neuromorphic chips dates back decades. Carver Mead, the Caltech Professor Emeritus coined the term in a 1990 paper. One neuromorphic processor, a noise suppression chip developed by Audience, sold with hundreds of millions. The chip, which was based on the human cochlea, has been used in phones from Apple, Samsung and other producers. Neuromorphic chips detect and predict patterns in complex data using relatively little electricity. Applications are in visual or auditory data, and they require a machine to adjust its behavior as it interacts with the word.

These „neuromorphic" chips will be designed to process sensory data such as images and sounds and to respond to changes

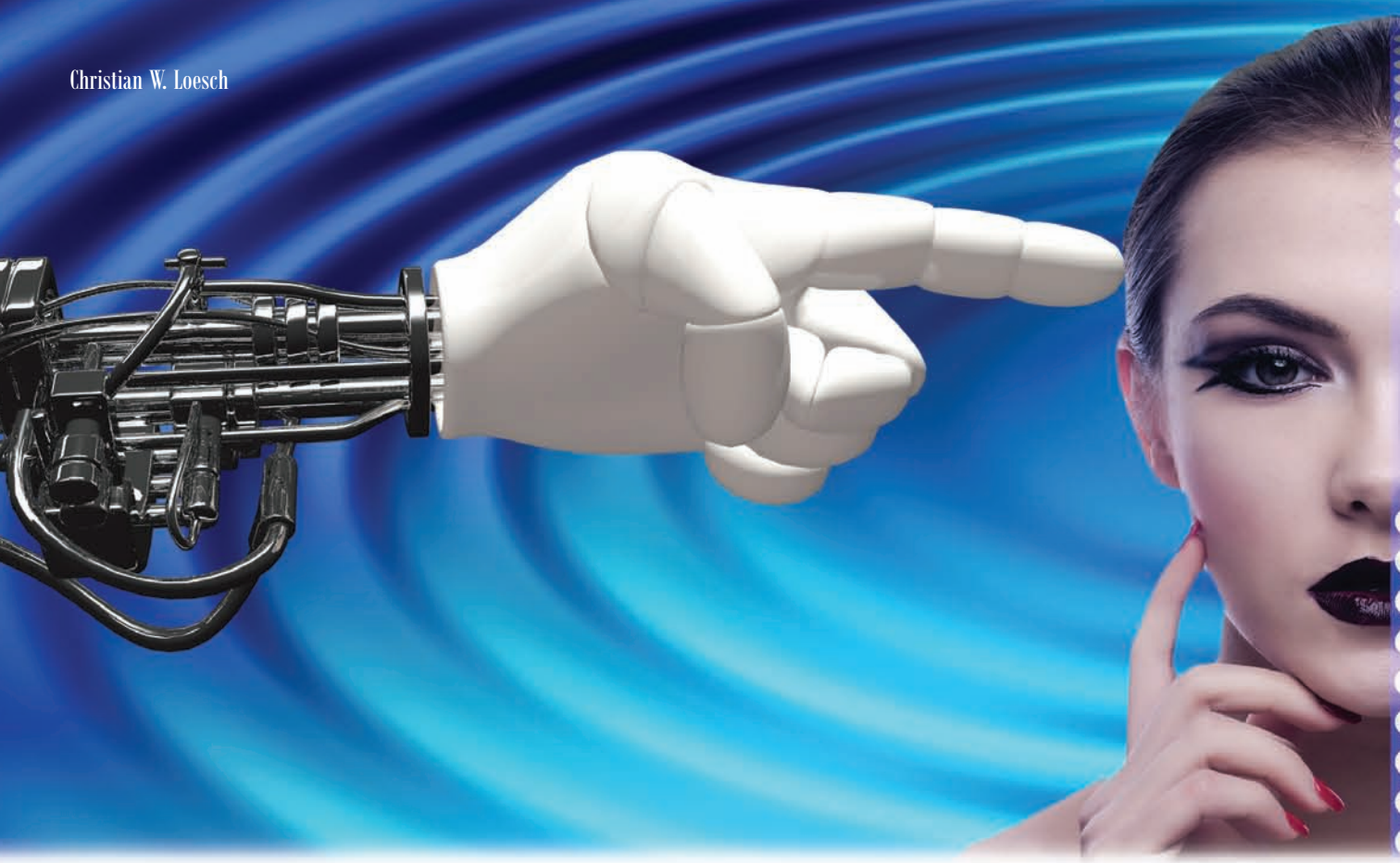
in ways not specifically programmed. They promise to accelerate progress in artificial intelligence and lead to machines that are able to understand and interact with the world in a more humanlike way. Neurons also change how they connect with each other in response to changing images, sounds etc. Of special interest is the possibility that neuromorphic chips could transform smartphones and other mobile devices into cognitive companions.

ICT, Robots, AI and their impact. The working force costs (salaries) increased faster than productivity in industrial countries, thus promoting the development in the areas of robotics, sensors, and software to replace expensive human work by cheaper machines. Four companies (i.e. Fanuc, Yaskava, ABB and Kuka) are sharing two-thirds of the world industry automation market of 122 billion US$ (annual). According to several studies, the impact can be dramatic, potentially replacing (in the German labor market only) over 18 million jobs. Especially administrative and accounting jobs are highly exposed (up to 86%), as well as delivery, sales and secretarial jobs. The less qualified, the more exposed. Nevertheless, there are areas less impacted as healthcare, chemists, or physicists. The experience of preceding technological developments shows that it is not realistic to assume that all people losing jobs by these changes will be easily absorbed in other fields. As two of the most disruptive technological innovations of the recent decennia came from Mobility and Communication areas, the future impact of ICT remains to be seen.

The Internet Era and the Effects of ICT

A fundamental, if not the most important and disruptive development in communication is the Internet. Its potential fascinated brilliant people around the world, who contributed to its success. The enthusiasm and joy of the early years faded, as today it has become an integral part of modern life.

Some of the well-known positive effects of ICT on Social Media, society and us as individuals are: facilitating meetings, communication and organization; making researching information easier; communicating 24/7 to and from anywhere; bringing many benefits to the organizations, such as cost and productivity improvements as VoIP, email, messaging, video conferencing, and e-commerce, accessing worldwide markets and processing financial and other transactions 24/7, social networking allowing people to participate in a wider, even



worldwide society; increasing opportunities for education; real-time information sharing and increased news cycle speed; free promulgation of ideas and advertising etc.

The personal impact of ICT. There is a plethora of phenomena arising in the context of the personal use of ICT and the rise of social networks. Social networks allow an individual to have thousands of „friends". However, these supposed „friends" are no more than strangers. Many of those people will „know what fifteen of their friends had for breakfast, but don't know of their struggle with major life issues". Social networks became the marketplace („Basena") of the 20th century and psychologists compare using the mobile phone for social media to searching for rewards. Research has also proven deteriorating influence on the storage capabilities in the working memory, reaction to false alarms, the capability of multitasking, judgment of order of magnitude, capability to differentiate between important and unimportant information.

This is not just speculation; it can be measured and related to the volume of the amygdala, while the size of the prefrontal cortex relates to the size of social group. There are correlations between low IQ and the use of the screen, TV use as a child is inversely proportional to education level in future, video games alter the programming of the brain by using and activating different regions than reading.

Network (NW) structure is not accidental; it follows „power laws". Search machines are ranking high if a web page is read/consumed by many people and creates much traffic. The number of links, not the actual content is important. Additionally, the selection of content is shifting from established journalists, newspapers, and TV and radio stations to uncontrolled

secret search algorithms and private companies. The thesis of men as „informavores rex" as carnivores' successor according to the Digital Darwinism, is based on the belief that the best-informed person survives. Being afraid to miss something, the compulsion to consume every information leads to neglecting independent thinking and losing the distinction between important and unimportant information.

With ICT, many new legal issues arise ranging from copyright to personal privacy. All major technological evolutions triggered an adequate legal framework: the industrial revolution led to the labor law, motorization led to traffic laws, so it is expected that the digital revolution will lead to specific laws.

Privacy. Technology should be used to create social mobility and improve the lives of citizens. However, it added also new dimensions of surveillance. The Cataphora company offers tools to identify the employees who contribute more than others, thus estimating their value to the company. The information provided by Cataphora may, however, include employees' medical/genetic data in the future.

After Snowden's revelations, one question was asked repeatedly: why wiretap an entire population? One of the obvious answers may be: nowadays it is reasonably cheap and becomes cheaper every day. Many people have compared today's mass spying to the surveillance program in communist countries. The important difference is the dimension. The German secret police Stasi employed one snitch for every 50 or 60 people it watched. Today a million person workforce keeps six or seven billion people under surveillance, a ratio approaching 1:10000. Thus, ICT has been responsible for the two to three orders of magnitude" productivity gains" in surveillance efficiency. Stasi used an army to survey a

nation; today secret services use only a battalion to survey a planet.

Technology also brings productivity gains to social programs. Basic sanitation, green revolution crops, cheap material production, and access to vaccines and mobile internet devices allow states to lift the poor citizens into a more sustainable existence for less than ever, affording stability to wealth gaps that might have invoked the guillotine in previous centuries. The mobile phone is an important example, since it is both a means of raising the quality of life through access to information and markets and keeping its users under close, cheap surveillance ironically paid by the user.

Conclusion

The present paper has discussed how Moore's Law is approaching its end, but we can look forward to a decade of further device improvements. We have perused the challenges ranging from lithography costs, interconnect resistance and capacitance slowing performance, to connectivity problems and observed that the historical cost trends are fading out. We have shown that Dennard type scaling has already reached diminishing returns. Since atoms do not scale, and it is hard to imagine good devices smaller than ten lattices across – reached in 2020.

Extrapolations of the next ten years may be technically viable, but the question remains: will carbon nanotubes, graphene, nanowires, InGaAs, spintronics save Moore's law in time? Not likely, and most probably not by 2020. We are witnessing the fascinating developments facilitated by ICT, especially the effects of Moore's law, communication and the Internet and many phenomena which we did not foresee, some of them being very inspiring and innovative. The proliferation of the Internet also contributed to the implementation of a global surveillance and repression tool. ICT is not only an unprecedented technological advancement and cultural asset for all humanity, but it is also an infrastructure easily to be abused.

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„If your business is not on the internet, then your business will be out of business."
Bill Gates

Meta Strategies for Career-Oriented Collaboration

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Abstract

The pace of knowledge growth is so rapid during the last decades that even the valedictorian knowledge become obsolete in the coming years and the lifelong learning emerges as a natural solution. However, unlimited access to unimaginable amounts of data determines a paradigm shift as far as a learning process: from learning to learning to learn. Technology will continue to be the driving force in changing the world: computing, mobility, automation and robotics, an open world of science, neuro-technology, chemistry, nanotechnology, fabulous new intelligent materials – to mention just a few of them. Career paths of the future must be understood and conceived from a quite different viewpoint: the future shall stretch as much as possible our abilities to grow, adapt and learn. Volatile, temporary roles may be superposed over what shall consider being the backbone of our profession. Professions will change dramatically and fast, and switching from one profession to another is going to become the norm. The career planning is turning into professional life planning: from making strategic decisions for career progressing within the certain profession to integrate them in meta-strategic decisions made for fore-sighting one's successful sequence of professions. The purpose of this paper is to launch a discussion about professional life planning – which is changing professions across an extended active life-span (made possible by an increased life expectancy, as result of the same extraordinary technology progress): are we, educators and students, human resource managers and policy makers, ready for this type of meta-strategic decisions?

Keywords: learning paradigm shift, meta-strategic decisions, professional life planning

„It is the long history of humankind that those who learned to collaborate and improvise most effectively have prevailed."
Charles Darwin

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Introduction

Over two decades ago, we were somehow surprised to learn that an average retiring American adult switched between different careers three times during his/her active lifetime.

In other words, this means, in average, four different careers in a lifetime.

A recent event organized at University POLITEHNICA of Bucharest (PoliFEST, April 20-22, 2016) has offered to academics, businesspeople, former, current and future students opportunities to meet and discuss, ask and answer questions, exchange ideas about current and future state of [higher] education as well as employment. It seems that today the average number of careers a student expects to experience over his/her professional life is significantly higher – mostly because of the higher pace of technology development (even the extended life expectancy is a component of this accelerated process). On the other hand, early awareness and informed decisions about the next career steps – at least the very first career to experience – are actually components of meta-strategic decision regarding one's professional life.

Thus, the purpose of this paper is to raise a few questions and offer thinking subjects for the educators and decision-makers from academia, business, administration and labor offices, in order that younger generations be better prepared for the future, for their future professional careers in particular.

A Wide Mix of Generations

Estimations show that the growth of life expectancy shall prolong our professional lifespan up to 60 years across several generations (IFTF, 2001). If we take as a reference (and the development pace is accelerated) the last 60 years, the world today is a dramatically different world compared to the one 60 years ago: „Teams of knowledge workers already include an unprecedented cross-generational mix. Over the next 10 to 20 years, many large and small businesses will have four, sometimes even five, generations in the workplace. Knowledge workers from each generation bring different formative life, technology, early work, and educational experiences to the workplace" (IFTF, 2001, p. 1).

The advancements in science and technology have changed completely the way we work – from robots in the assembly lines to the computers on every desk and in everyone's pocket. The companies' latency has decreased, and the reactions to events, the rhythm of solution building and the decision making has grown significantly. As a consequence, the business success will depend on the ability to maintain the knowledge of these several generations in sync with the pace of the specific knowledge applicable. Life-long learning will definitely continue to be a must as earlier and current literature demonstrate (Hayes, 1998; Fischer, 2000; Field and Leicester, 2003; Hayes, 2004; Mackeracher,

2004; Merriam, Caffarella and Baumgartner, 2006; Field, 2006; Aspin, 2007; Jarvis, 2010; Merriam and Bierema, 2013; Halttunen, Koivisto and Billett, 2014). The concept of lifelong learning (LLL) was launched in Denmark back in 1971 as an initiative of the Society of Danish Engineers (dr. H.B. Lund) which introduced the standard „3+2+3 system". Institutionally, The Magna Charta of European Universities (Magna Charta Universitatum) was signed by rectors of European universities in Bologna, on the 18th of September, 1988; and the Bologna Declaration was signed by Education Ministers from 29 European countries in 1999. Thus, the Bologna Process has started – aiming at creating the European Higher Education Area (compatibility of higher education qualifications).

The Greek antiquity – the time when a genial philosopher could equally be great astronomer and mathematician, physician and physicist, poet and play writer, geologist, and chemist (and the list might continue) as well as leading academia magister – is gone for thousands of years. In spite of Gutenberg printing press, the time of Erasmus of Rotterdam (i.e. *homo encyclopaedicus*) – that gifted the individual who could comprehend the whole humankind knowledge up to his time – is gone too. The pace of knowledge growth is so rapid during the last decades that even the valedictorian knowledge will become obsolete in the coming years and the lifelong learning emerges as a natural solution. However, unlimited access to unimaginable amounts of data determines a paradigm shift as far as a learning process: from learning to learning to learn.

To note that amid current technology progress – Internet and ITandC revolution, mobile technologies, internet of things, dominance of media and social networks – there is a constant knowledge stream transmitted across generations, a subtle essence of wisdom, distilled as result of life experience: the proverbs whose dynamics is associated with four theses and five paradoxes (Scarlat, 2015, pp. 38-44). The mix of generations facilitates the transmission of proverbs.

But the generation mix will not pose only the challenge of keeping up the workforce with the advancements of the knowledge frontiers. New generations are defined by sets of distinctive (with respect to older generations) behavioral patterns. Managing a mixed generation workforce will suppose creating and maintaining the working climate and culture compatible with all those different behavioral patterns. However, the conflicts between different generations are, partially, a negative facet of the mix of generations.

While in the past, the older, the more knowledge one would have gained, the future will bring highly qualified workers in all generations. Authority and legitimacy within the organization will no longer belong only to the elder, as knowledge as a source of power shall be spread across the different generations. This is a potential threat as conflicts may be fueled by this situation. It will take effort and ability to manage an attractive working climate.

New Skills in the Near Future

The analysis developed in 2011 by the Institute for the Future for the University of Phoenix Research Institute took into account six disruptive forces that shall reshape the way we work and generate needs for new skills: extreme longevity, rise of smart machines and systems, new media ecology, computational world, super-structured organizations and a globally connected world (Davies, Fidler and Gorbi, 2011). While extreme longevity will bring as mentioned before increased lifespans that will change the nature of careers and practices of learning, the rise of smart machines and systems will bring more and more the presence of robotics that will replace humans in executing different tasks.

New media ecology, based on new communication tools shall require new media literacies. In a computational world, we shall face the massive increase in sensors and processing power that will make our environment a programmable system. New media literacy shall be a must as information shall be found, presented and delivered in new technology-specific ways as well as by new concepts of representation ways.

Super-structured organizations will implement new social technologies in the value – creating chain and shall bring new forms of production. A globally connected world, based on increased global interconnectivity shall put diversity and adaptability at the center of organizational culture and operations. The necessary skills resulting in such a world include an increased capacity for understanding and making sense, a novel and adaptive thinking and social intelligence. Trans-disciplinarity (seen as the multifaceted specialized education of individuals) shall change the way teams will work as team members shall embrace several roles. The globally connected world shall ask for cross-cultural competencies as well as virtual collaboration abilities.

Computational thinking (already present today) shall facilitate the high-efficiency work in interaction with the computational world. High levels of cognitive loads shall require the ability to manage them in new making sense approaches. Creative thinking will become more and more our job as robotics will replace us in our routine tasks. A mindset for design shall be a fundamental skill in creating value.

The Content and Style of Our Work

Other features of the future working place are revealed by studies focusing on the future of work. The world will change from opacity regarding the access to information to ubiquitous transparency. The content of work will change by adding activities such as *training machines*.

Self-documenting is already a daily component of our work; it will grow in importance. New ways of interacting with machines will ask us to be able to make sense

together with machines (from expert systems to intelligent analysis tools). The huge quantity of information available will need structuring, and this shall be achieved by collective (and in many cases voluntary) work – social filtering through bookmarks, categorizations, rankings, signaling and notifying.

New technologies allow already making the step *from team-work to crowd-work*. Ad-hoc creation of large resources and infrastructures for temporary purposes shall become part of our work. The ability to be part of such a large structure and quickly adapt to the temporary work shall require a new approach to understanding and manage diversity.

We may expect (and dream as far as to *brain-computer interfaces*) that the intensive use of different tools shall transform us into augmented capacity individuals with intellectual „superpowers". The interaction between humans and computers brings new issues as well as challenges (Chen, 2001). This will suppose among other things decoding mental processes. Understanding such mental processes shall help us improve and increase for example

dramatically our abilities to predict the future by extending our computational and analytic abilities and using in a brain-machine direct interaction for Monte-Carlo simulations and Markov chains analysis. Again, the things we shall be able to do will seem magic. But all that kinds of magic tricks shall be needed in a world becoming more and more complex.

The world shall change to be quite different from what we know today. From food to learning, from governance to social structures, from the way we shall build human settlements to the way we shall conceive a *sustainable future*. Technology will continue to be the driving force in changing the world: computing, mobility, automation and robotics, an open world of science, neuro-technology, chemistry, nanotechnology, fabulous new intelligent materials... to mention just a few of them.

Our health will also benefit from science and technology advances. This is one of the factors that will *increase lifespan* and will oblige us to remain young and *active for a longer period of time*. We may hate this or embrace it and consider it a gift as life will be so interesting and each day shall bring us miraculous new surprises.

Conclusion

Career paths must be now understood and conceived from a quite different viewpoint: future shall stretch as much as possible our abilities to grow, adapt and learn. Volatile, temporary roles may be superposed over what shall consider being the backbone of our profession. The professions of today will change dramatically and fast.

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„Coming together is a beginning, staying together is progress, and working together is success."
Henry Ford

Selected E-Commerce Entities for Cooperation

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Abstract

The paper presents partial results of a comprehensive research of online reputation of small and medium-sized enterprises operating on specific market in Central Europe. More specifically, it deals with the issue of online reputation of e-commerce entities operating on the Slovakian virtual market. The objective of the analyses presented in this paper is to identify the main players from among the wide range of e-shops operating on this selected market, to do the primary analysis of these entities reputation by the method called Net Promoter Score (NPS), to identify key factors for success in terms of customer preferences and to review the extent to which changes in customer preferences are significant in relation to the reference studies undertaken in the relevant market in the past. Based on our findings, recommendations for e-commerce entities with emphasis on preferences of their current as well as potential customers are formulated in order to improve their competitiveness and increase their efficiency.

Keywords: reputation, electronic commerce, consumer, Net Promoter Score (NPS), competitiveness, online reputation management (ORM)

Introduction

The increased usage of the Internet led to fundamental changes in the way information is disseminated (Delina, Drab, 2010, Maryška, Doucek, Kunstova, 2012, Fischer, Vltavská, Doucek, 2013, Janke, Packová, 2013, Prídavok, Delina, 2013). In the traditional brick and mortar world, the dissemination of information was based predominantly on spoken word (Soviar, Vodak, 2012). The virtual Internet space has contributed to a significant shift from speech

„Great things in business are never done by one person; they're done by a team of people."
Steve Jobs

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toward written text by its very nature (Doucek, 1996). Written text naturally creates conditions for longer durability of information. In combination with a plurality of views on target and reference customer markets and almost instant access to information (Doucek, 2004, Lajčin, Frankovský, Štefko, 2012), this obviously results in the change of underlying assumptions for a successful management of marketing activities (Doucek, Maryška, Nedomová, 2011, Saruc, Dorčák, Pollák, 2013). At the turn of the 20th and 21st centuries, the issue of online reputation management of entities started to gain importance, normally for companies and organizations, but often even for individuals (Kuncova, Doucek, 2011). Online reputation management is a process of assuring that the right information will appear in the right place at a time when customers are looking for a given company, brand or product, mainly through search systems such as Google, Bing or Yahoo, or using social networks such as Facebook, Twitter or LinkedIn (Randall – Stradman, 2012). Online reputation management (ORM) is a mix of marketing activities on the Internet. The purpose of the efforts of marketers is to protect the name of an entity in the online environment, primarily by preventing potential problems, or resolving and/or eliminating them when incurred. These marketing activities most frequently include monitoring, PR management and SEO (search engine optimization). In the scientific literature, ORM is also known as reputation management and includes the following activities:

1. Monitoring of the Internet and its users;
2. Communication with users;
3. Evaluation of monitoring results;
4. Crisis reputation management.

(Sasko, Micháleková, Šulík, 2014).

As a result, it can be argued that ORM is the monitoring and management of Internet reputation of companies, brands, firms and individuals. The aim of the monitoring is to suppress or completely eliminate negative information acting in the name of an entity in search engines (Delina, Janke, Tkáč, 2011, Szabo, Ferencz, Pucihar, 2013, Delina, 2014). There are a number of reasons why it is necessary to actively use these techniques (Maryška, Doucek, 2011, Maryška, Doucek, Novotný, 2012, Hanclova, Doucek, 2012, Koblen, Szabo, Krnáčová, 2013). To provide just a few of them: 90% of consumers trust recommendations from others; 78% of consumers believe what others say about a company, product, brand or a person on the Internet; 16% of people with a negative experience can affect group of up to nearly 10,000 people; 92% of consumers stated that they consider information about goods or services they find on the Internet more reliable than those provided by a vendor (Sasko, Micháleková, Šulík, 2014).

There is a wide portfolio of methods described in the literature for quantifying reputation. Correct quantification of the reputation is necessary for the process of reputation management (Stec, Filip, Grzebyk, Pierscieniak, 2014). For the purpose of our research, the method of measuring reputation through the so-called NPS was selected. Net Promoter Score, or Net Promoter System (NPS) is a system for measuring reputation, which is based on the fundamental perspective that customers of each company can be divided into three categories, according to how much they are willing to recommend products or services of a company to their friends or family (Reichheld, 2011). The reputation ranking system uses direct questioning, relying on the so-called ultimate question: „How likely is it you would recommend us to your friends?". Asking this question enables companies to trace the three fundamental groups of customers, while this system produces pure measuring of organizational performance in terms of company customers. As already mentioned, the NPS uses direct questioning, while the process itself can be illustrated by the example of the question above: „How likely is it you would recommend us to your friends?". Respondents select answers to this question on a ten-degree scale, with 10 representing an extreme willingness to recommend the product, company, or service to their friends and 1 represents an absolute unwillingness to recommend this product further. The scale is divided into three parts, where each part represents one group of customers.

1. 10-9: Promoters: this customer group is loyal and enthusiastic, and will always buy products of a particular company and will report on the quality of this company to their friends.
2. 8-7: Passives: a group of customers, which is satisfied with company's products, but is no longer as much enthusiastic as the previous group, their disadvantage is that they are vulnerable to competitive offers.
3. 6-1: Detractors: they are disgruntled customers, who can damage a brand of a company and there is a possibility that they will spread negative testimonials about products of a given company (Reichheld, 2011).

The calculation formula for Net Promoter Score, adapted by the authors according to Reichheld (2011) can be depicted as:

$$NPS\ (\%) = \frac{P - D}{N} \times 100 \qquad \textbf{(1)}$$

where:

NPS – Net Promoter Score (%)

P – Number of Promoters (respondents who marked on a scale option 9 or 10)

D – Number of Detractors (respondents who marked on a scale option from 1 till 6)

N – Number of all respondents.

Objectives and Methods

The main objective of the study is to identify key players among a wide range of electronic shops operating on the Slovak market. Then, using the Net promoter score (NPS) method, the authors aim to analyse the reputation of these entities to identify significant factors of their success from the perspective of customer preferences and, last but not least, to explore the extent to which changes in customer preferences are significant in relation to the reference surveys carried out in the relevant market in the past. Based on these findings the aim is then to formulate recommendations for e-commerce entities with emphasis on preferences of their current as well as potential customers.

The analysed objects of the research are selected e-commerce entities/e-shops operating in the Slovak Internet market. The secondary, as well as primary data are included in the analysis. The secondary data is the result of a reference survey named „Internet shopping in 2009" carried out by TNS SK (Rohošková, 2012) on a sample of 1,171 respondents. Key players on the market are identified on the basis of the results of the Shoproku competition (2014) organized by Heureka and Naspres, and more specifically by the „Internet Users Award" category. As part of the competition, more than 50,000 real unique customers selected their favorite e-shops in the reference year. Voting took place by means of a simple electronic form and lasted from the 1st August to 30th September 2014. One overall winner with the highest number of votes and nine finalists were declared. Primary data is based on the results of the authors' own questionnaire investigation on a sample of 634 respondents. Respondents were approached in a non-random manner by 60 evangelists. Evangelists' role was to query respondents of different ages, from different regions or economic status. The data collection was carried out during March and April 2015. The questionnaire consisted of 28 questions; the introduction included general questions, which provided basic sample classification. Another part of the questionnaire included questions necessary for NPS calculation, and the last part included questions aimed at identifying customer preferences with the focus on the electronic shopping. The collected data were then subjected to a thorough analysis and statistical testing. For better authenticity and clearness, the main findings were interpreted graphically through web charts.

Results and Discussion

The chapter describes the results of the primary research, as well as its comparison with respect to a reference research conducted in 2009. In the primary questionnaire querying, 634 respondents were interviewed (44% men and 56% women). In terms of age, the largest group were respondents aged 17-24, which accounted for more than 77% of all the respondents.

As stated above, this reputation ranking system uses direct questioning, relying on the so-called ultimate question: „How likely is it you would recommend us to your friends?" Addressing this question enables companies to trace the three fundamental customer groups: promoters, passive customers and detractors:

Table 1 – *Net Promoter Score of selected e-shops*

Ranking acc. to NPS	E-shop	Promoters N / %	Passives N / %	Detractors N / %	Results (NPS) %	Ranking acc. to Shoproku 2014*
1.	Martinus.sk	196 / 30.91	141 / 22.24	297 / 46.85	–15.93	4.
2.	Alza.sk	100 / 15.77	155 / 24.45	379 / 59.78	–44.01	2.
3.	Mall.sk	55 / 8.68	136 / 21.45	443 / 69.87	–61.20	1.
4.	Hej.sk	59 / 9.31	127 / 20.03	448 / 70.66	–61.36	3.

*Adjusted ranking – for subsequent comparison only e-shops with Slovak localization offering mainstream goods were considered. The following e-shops have been excluded from the original ranking: nejlevnejsi-knihy.cz (formerly 3rd place) and progamingshop.sk (formerly 5th place) (Source: Reichheld, 2011).

We learn from the literature that the NPS of an average company should be between 5-10 percent. This means that promoters of the company barely outnumber detractors. We can argue that many companies and even whole sectors of business have a significantly greater number of detractors than promoters. Even companies like Amazon are within the range of 50 to 80 percent, which means that even such large companies still have room for improving relations with their customers (Reichheld, 2011). However, as we can see in Table 1, an interesting phenomenon can be seen on the researched market: not one of four finalists in „Internet Users Award" category of Shoproku 2014 competition has positive NPS. Thus, based on the information in the literature, neither of the analyzed e-shops meets the „average company" level. The overall ranking is also interesting: except for the online store Alza, which maintained the second position in both final rankings, all of the competitors saw significant changes in customer perception. In terms of the total NPS, the online bookseller Martinus.sk ranked best when it moved from the last to the first place in the overall ranking. At the same time, it had almost twice as many promoters in comparison to Alza which ranked second. In terms of real customers we can say that the analyzed companies have a long way to go to even get close to the parameters that their competitors on the reference markets of Western Europe and North America achieve.

Based on the survey made in 2009, we analyzed two key determinants of electronic shopping on the chosen market on a sample of 634 respondents. The determinants included factors directly influencing the selection of an e-shop by consumers, as well as factors influencing the decision to make a purchase. We then searched for statistically significant differences between analysed factors by means of testing.

The most decisive factor for the selection of an e-shop in the authors' and in the reference research was the length of delivery time. Based on the findings, more than 72% of respondents consider it to be an important aspect. Good reviews are important for more than 70% of respondents. For more than 60% of respondents, providing a sufficient amount of relevant information about products is a decisive factor for the selection of an e-shop. For this category, there is an increase compared to the reference survey carried out in 2009 by more than 15%. Compared to the reference survey in 2009, the factor of multiple payment options registered the largest decline. This is an expected phenomenon, due to more frequent focus on direct benefits instead of focusing on the process. After statistically testing the measured values, we can at the same time say that at for a significance level of $\alpha = 0.01$, there is no statistically significant correlation between the current preferences when selecting an e-shop and customer preferences in 2009. Measured values are presented in Figure 1:

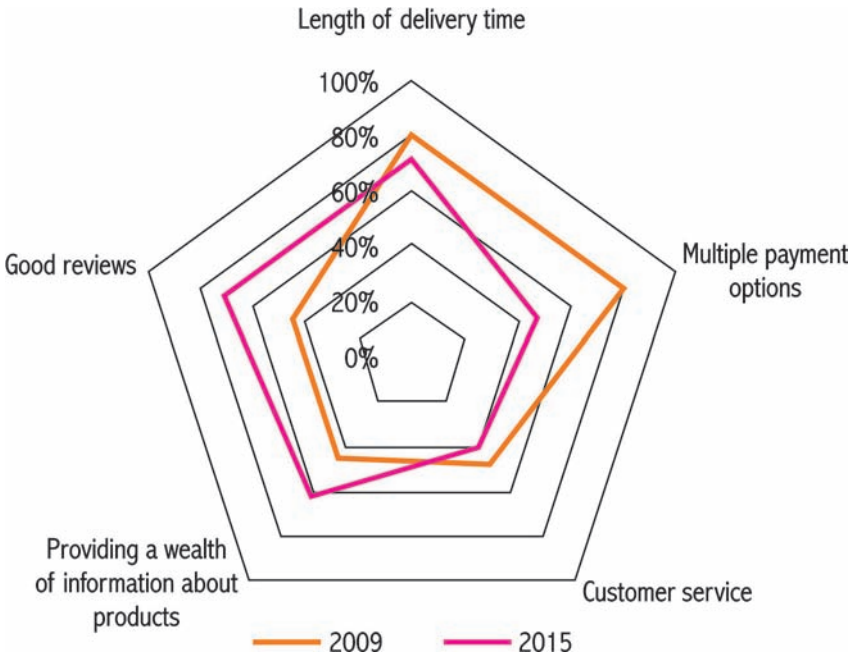

Figure 1 – *E-shop selection*

Based on the findings, more than 80% of respondents also consider the favourable price to be an important aspect. In terms of customer preferences, convenience and speed of purchase ranked second and no significant differences were observed in comparison to the reference survey of 2009. A wide range of products is considered important to more than half of the respondents. Compared to the 2009

study, there is an increase of more than 15% which can be the result of various factors, while the ever increasing offer of online shops is certainly one of them. We consider the fact that comparing to 2009 the importance of good reputation of a shop increased by almost half to be important, while this parameter has a direct association with the researched issue and only confirms the need to implement similar surveys over time. After testing the measured values, we can at the same time say that at a significance level of $\alpha = 0.01$, there is a statistically significant correlation between the current preferences when deciding for online purchase and the customer preferences in 2009. In comparison to brick and mortar shops, the advantages of e-shops are obvious and clearly change only very slowly over the time. Measured values are interpreted in Figure 2:

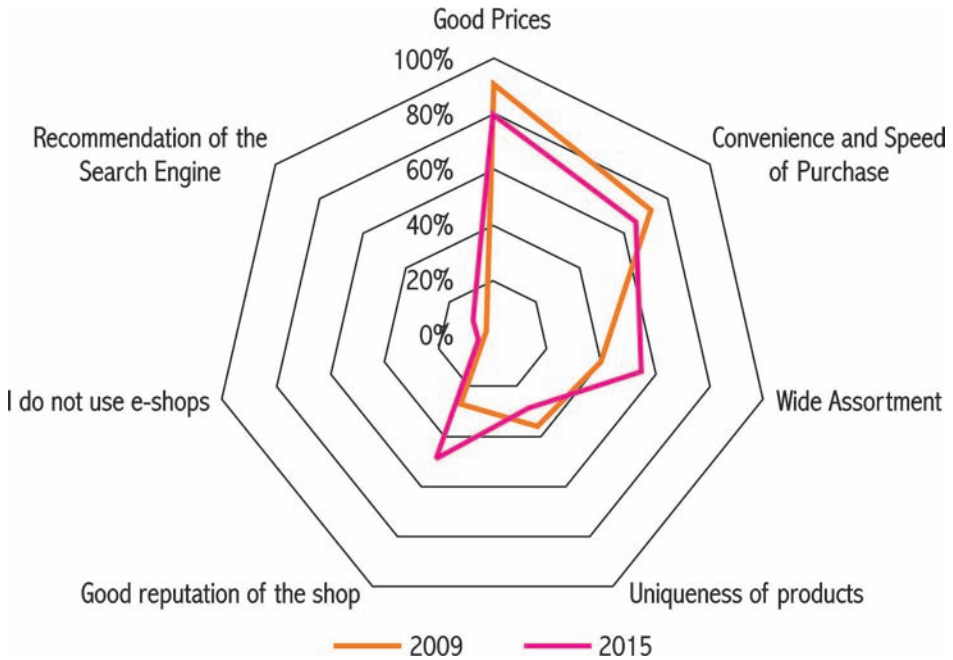

Figure 2 – *Deciding for online purchase*

Conclusion

The paper presents partial results of a comprehensive research of online reputation of small and medium-sized enterprises operating on a specific market in Central Europe. More specifically, it deals with the issue of online reputation of e-commerce entities operating in the relevant market. The objective of our analyses presented in this paper was to identify the main players from among the wide range of e-shops operating on the Slovak market, the primary analysis of these entities through the reputation method Net Promoter Score (NPS), the identification of key factors for success in terms of customer preferences and the review of the extent to which changes in customer preferences are significant in relation to the reference studies undertaken in the relevant market in the past. We verified changes in consumer preferences by statistic testing. It can be concluded that the factors influencing decision making for

shopping via the Internet are almost invariable over the time. On the other hand, there was quite a significant shift in the factors influencing the selection of an e-shop, and multiple payment options offered are no longer a key factor, whereas the importance of good reviews of a shop increased. E-shop operators should place greater emphasis on factors such as reputation and good reviews of their shops, as well as on the wide range and uniqueness of the products offered. Information on the products should be available in the greatest quantity and in the clearest way possible. The fact that more than a third of respondents regularly (at least on a monthly basis) purchase goods and services via e-shops is also positive. Due to the geographic location of our analysis, the established connections are even more relevant, especially for local businesses and organizations operating mainly in the Central European market.

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„None of us,
including me,
ever do great things.
But we can all do small
things, with great love,
and together we can do
something wonderful."
Mother Teresa

Effects of Entrepreneurial Culture on Business Incentive

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Abstract

There are various factors that influence both entrepreneurial culture and the business environment. Of these, the paper aims to prove the influence of entrepreneurial culture through knowledge and information on business incentive. This article's main focus is on finding if there is a reasonable and quantifiable effect of the entrepreneurial culture on the personal system of making the decision of starting a business in Bucharest region. For this, it shall be utilized the forgotten effects model. The author generally considers that the culture of origins is an important field of research in locating „the evil" in the disparities of incomes among people and regions, for the un-synchronicities and the lack or the delays in the convergence to the medium levels of the EU. From this study, the author tries to extract a coherent tool in order to be applied to other regions for finding relevant results in what regards the role of the entrepreneurial culture on the socio-economical behavior.

Keywords: entrepreneurial culture, fuzzy logic, laws and institutions, forgotten effects model

Introduction

Studying the scientific literature on the topic of entrepreneurial culture and its effects on the business incentive, there has been found that this research has a rich scientific theoretical background (Baker and Sinkula, 2009, Casson, 2003, Dubini, 1989, Freytag and Thurik, 2007, Mueller and Thomas, 2001). There are scarce academic results regarding the quantitative surveys that prove the relationship between entrepreneurial culture and business incentive, especially for Romania and Bucharest region

„If we are together nothing is impossible. If we are divided all will fail."
Winston Churchill

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(one of the most developed regions in the country), so the author considers that there is a real need to enhance the knowledge in this field. We have to consider the entrepreneurial education (Laukkanen, 2003) and culture (Lee and Peterson, 2000, Raffo *et al.*, 2000) as main business drivers (Hessels *et al.*, 2008), for two reasons: the increasing rigidity of financial institutions that make money and capital difficult to obtain and rigid bureaucracy and extensive corruption (RIWG, 2014). These restrict the market access and that cannot be avoided without general knowledge about doing business in Romania.

The business incentive is considered to be a personal conduct that overlays European values according to a stated common goal (that of sustaining the European Project by convergence and synchronicity) and is determined by exterior factors (Grossman and Kim, 1998, Guiso, 2006, Iancu, 2014) and by personal regulators (Camerer, 2014). A European economic behavior (Gómez-Chacón, 2003) might be one's decision to start and/or conduct a business (in order to increase the national income by producing goods and services and creating job opportunities for others, to contribute to the national budget by the income tax payment, by the social security and pension system etc.). This topic cannot be dissociated from the general agenda of equality of chances, real convergence and integration promoted by the Lisbon Treaty and European Commission, and must also be treated starting from the national or regional system of values and rules regarding the sustaining of entrepreneurship.

Restrictions on Business

It is important to establish from the beginning the fact that the decision point in planning and driving a business is, in the end, an individual choice. Another hypothesis is that there is a cause – effect relationship between the cultural – social – economic environment and the personal factors involved in the decision of starting a business.

The environment that we take into account in this research consists of laws, market conditions, institutional advantages, work-life balance, private financing and allowances etc.

By the term „laws" we understand „any system of regulations to govern the conduct of the people of a community, society or nation, in response to the need for regularity, consistency and justice based upon collective human experience". We observe that in Romania there are specific rules for commerce, fiscal regulations, competition laws etc. that directly influence business. As shall be argued below, the legal frame can be related more or less to other environment or personal elements that influence the business climate incentive. The trade laws in Romania fundamentally changed in the last decade by adopting the New Civil Code that merged civil and commerce rules. Until then, there was a separation between the Civil and Commercial

Code that emphasized before the objective matters and now is based on the subject meaning the commerce professional. The fiscal frame influences almost any economical decision given that the fiscal burden is one that determines the entrepreneurs and managerial action through taxation and administration costs. In Romania, it changed for more than one hundred times in the last ten years. These changes were due to the inconsistencies in the regulations that had to be somehow regulated or to the fluctuating need for financing the National Budget. The firms were sometimes forced to quickly make the changes for the VAT modified over the night percent or for the social obligations for example. That led to tax cost growth not only due to the direct tax effect (the taxes also decreased during this time span), but also to costs related to the process of implementation. There are inconsistencies, redundant issues and other legal frame issues regarding local, administrative, governmental etc. rules that influence the economic activity. The main issue followed by this article is the individual's perception of the impact of laws over business incentive and economic activity.

By „market conditions" we understand all the elements that create the macroeconomic environment, except the laws. For example, the items that compose the indicator for a country ranking might be included in what is „market conditions" for this paper. The market conditions are considered to promote a positive impact on the social climate and they also may enhance productivity. The concept of market conditions is also intended in this context to mean a reflection of the essential value systems adopted by a certain society in the activity of an enterprise (business customs, managerial systems, personnel policies, principles for participation, training policies and quality management of the undertaking etc.). These represent the main influence on the culture of the organization. We consider that the perceived business environment through the concept of market conditions is a very important component of a business incentive.

Institutional advantages in Bucharest mean that, in general, municipality spends for infrastructure works that relieve traffic jams in some sectors but also that, during infrastructure works traffic jams are created. Depending on a business – specific this might be a fruitful aspect (small shops in crowded areas, gas stations) or a ruining one. Institutional advantages also mean the easiness of access to the resources and information from specific institutions as ANAF (National Agency of Fiscal Administration), ITM (Territorial Work Inspectorate), AMOFM (Municipal Agency of Labor Force Employment), ONRC (National Register of Commerce). It also comprises universities and other training institutions that offer professionals for business. We surveyed the perception of individuals about this kind of institutional advantages impact on doing business in Bucharest area.

When we discuss work-life balance we refer to the average period of work time

versus family, personal and community daily hours that best suits a better life index. According to OECD statistics, we find out that for Romania the work-life balance is not calculated. However, the present study focuses on the importance of work-life balance indicator in the respect of its impact over the personal time for the people that own and/or conduct a business in Bucharest, which resent the lack of personal time freedom.

Allowances, taxation and private financing imply access to various ways of business financing and taxing from/for public and/or private funds at preferable low costs. For this paper, allowances represent any kind of public financial support for business incentives. It also includes various local fees, taxes and penalties. In Romania, according to the law, the start-up business owned by a young person (for a student or an under 35) is entitled to an extra tax benefit of zero costs for the assistance, registration, authorization services of the National Commerce Register and Local Fiscal Administration. This program is ruled by the Agency for Small and Medium Enterprises. Its programs aim at financing the start-up projects up to 50% of their value, but no more than 10.000 EUR, also including state guarantees up to 80% of project's value in the case that the entrepreneur intends to apply for a private bank for financing. It also offers a fiscal year employer's social contribution duties and employee's social contribution exemption for no more than four employees.

Economic Conditions for Business

Studying the entrepreneurial culture environment in Bucharest, we retain that there is a great interest for surpassing the crisis effects through the National Strategy for

Competitiveness 2014-2020. Furthermore, on the 2nd of June, 2016 was approved The Minimis Program initiated by the Romanian Ministry of Economy, Commerce and Business Environment and operated through the Territory Offices for Small and Medium Enterprise.

The personal system of factors that constitute the choice of having a business or being just an employee is considered to be: the economic level, studies and entrepreneurial knowledge, social and business relationships, the personal values and beliefs system, age and health.

The economic level appears to be an important issue in the decision of starting a business because in Romania there are costs related to the registration process, to the first stock of merchandise, to the employees and other professionals like accountants, lawyers etc. The costs for starting a business in Romania are, according to World Bank Group, around 2% of income per capita and it takes 8 days for the

registration procedure. The easiness of starting a business in Romania is 45/189 ranked and it implies a number of 5 procedures. Most of the times, it is difficult for a new entrepreneur to find another financing, so he/she relies on his own or his/her family economies. Social and psychological studies revealed that the business incentive is similar for the people that rely on higher incomes than for those who live near the subsistence level, but starting a business is done by the people that have more than average incomes. As official statistics show about the Bucharest and Ilfov areas economic level, there was an average gross monthly salary in 2015, of 2813 lei/capita, as compared with an average salary of less than 2000 lei/capita in the rest of the country.

Excessive bureaucracy, inconsistent laws and insufficient methodological norms in Romania are real obstacles in doing business without considerable consulting or penalty costs. Entrepreneurial knowledge is provided through various public and private University courses or through training provided by private entities. The correlation to practical business issues often lacks. Scientific literature concentrates on the direct correlation between entrepreneurial culture and economic behavior in the sense that the better informed regarding business issues a person is, the greater the entrepreneurial incentive has. He is also likely to have more rational consumption choices. Another important issue is the source of his education because the informal sources as television and internet might present incomplete or even false data. A former survey conducted by the author (Leuștean, 2015) revealed that for more than 60% of the questioned subjects, the need of knowledge and information is scarcely satisfied through informal channels, and that is a real need for institutional education oriented towards entrepreneurship and business (Mihai *et al.*, 2006).

Social and business relationships are another important issue that forms the decision of starting a business. In a society, they are based on a complex social network and connections, and it is difficult to start a business as a young person that does not yet have the proper relationships. Most of the times, young people rely on the parents, older partners and when the case, they resort even to bribery in order to make connections.

The personal values system is a combination of values, beliefs and identity that define a person. Studying Bucharest Region cultural and historical environment in what regards the entrepreneur's role (Dumitrescu *et al.*, 2014) and its position in the economy and the society, the author was able to synthesize a couple of distinctive traits of the personal values system of this group apart from the rest of Romania,

that consider respect and self-determination important parts of the personal identity and of the socio-economic behavior. According to an empirical survey conducted in Romania 2013-2014 (Ceptureanu, 2015), in order to get valid information regarding young Romanian entrepreneurs, there were applied questions regarding personality, highlighting the main features of behavior, professional background that is considered to influence their interest and performance improvement, risk and crisis acceptance, business and business environment focusing on internal and environmental aspects of the business, social – cultural attitude, highlighting the attitude of society (incentives and disincentives) to entrepreneurial initiatives of young people. The study showed better results in Bucharest comparing to other regions in Romania regarding the number of active legal persons, the distribution of associates/shareholders according to age, the number of active self-employed, sole proprietorships and sole partnerships. The most important personality traits found at the young entrepreneurs were a high level of independence, innovative capacity, self-confidence, a relatively low speed in the decision-making process, a medium level of the ease in identifying opportunities, a high energetic potential. It was also found that the most important incentive for doing business is the substantial gain.

Age and health are other factors that form one's start-up decision. In Romania in 2014 more than 50% of the people that intended to start a business were under 39, according to Amway survey.

Research Results

In this part of the paper, the author analyses using the methodology specific to fuzzy logic (Gil-Lafuente, 2010) the forgotten effects of the entrepreneurial culture on the personal decision of starting a business. Fuzzy logic operates in accord with diffuse values. These values were calculated in this present paper as the means of the results of an opinion survey conducted on 400 people in Bucharest. The respondents were coming from different fields of economic activity, presenting ages from 20 to 55 years old, being students, employees, entrepreneurs and unemployed biased by experts' opinion.

The meaning of each number: 0 – no impact; 0.1 – virtually no effect; 0.2 – almost no effect; 0.3 – very low effect; 0.4 – low effect; 0.5 – medium effect; 0.6 – significant effect; 0.7 – very significant effect; 0.8 – strong effect; 0.9 – very strong effect; 1 – the highest effect.

The results of the analysis can be discussed in the following three matrices: the causes-causes matrix (Table 1), the effects-effects matrix (Table 2) and the causes-effects matrix (Table 3), based on a survey conducted in Bucharest, in April 2016, on 400 respondents.

Table 1 – *The causes-causes matrix*

	Laws	Market conditions	Institutional advantages	Work-life balance	Allowances, taxation and private funding
Laws	1	0.9	0.7	0.8	0.9
Market conditions	0.1	1	0.4	0.7	0.1
Institutional advantages	0	0.2	1	0.6	0
Work-life balance	0	0.3	0.6	1	0.2
Allowances, taxation and private funding	0	0.3	0.1	0.9	1

It is found that, on average, the laws have a very strong effect on the allowances and private financing and working conditions, a very strong effect on the work-life balance and a very significant effect on the institutional advantages. In the same time, market conditions have a very significant effect on the allowances and private financing have a very strong effect on the work-life balance. The most interesting fact this survey revealed was that it is considered that work-life balance has a significant effect over the institutional advantages that is somehow perceived as a positive relationship between an entrepreneur's free-time and his possibility to further study business in an institutional context.

The Economic level has a significant impact on studies and entrepreneurial knowledge and on the personal values and beliefs while studies have a very strong effect on the personal values and beliefs and a strong effect on the economic level. Studies also have a very strong effect on what concerns personal values and beliefs and a strong effect on the economic level.

Table 2 – *The effects-effects matrix*

	Economic level	Studies and entrepreneurial knowledge	Social and business relationships	Personal values and beliefs	Age and health
Economic level	1	0.6	0.1	0.6	0.5
Studies and entrepreneurial knowledges	0.8	1	0.5	0.9	0.1
Social and business relationships	0.6	0.7	1	0.3	0
Personal values and beliefs	0.2	0.8	0.8	1	0.5
Age and health	0.5	0.9	0.2	0.3	1

A rather interesting aspect regarding the opinion of the people of Bucharest is the fact that the social and business relationship has a significant effect on the economic level and a very significant impact on the studies. Personal values and beliefs have a very strong effect both on the studies and on the social and business relationship, while age and health has a very strong effect on the studies.

Table 3 – *The causes-effects matrix evident relationship*

	Economic level	Studies and entrepreneurial knowledge	Social and business relationships	Personal values and beliefs	Age and health
Laws	0.7	0.6	0.2	0.1	0.1
Market conditions	0.4	0	0.3	0.1	0.3
Institutional advantages	0.6	0.3	0.1	0.1	0.3
Work-life balance	0.6	0.5	0.7	0.2	0.4
Allowances, taxation and private funding	0.9	0.4	0.3	0.1	0.3

The causes-effects matrix was also obtained after the centralization of the survey's data and it shows the respondents' perception of the impact of the causes and the effects that lead to the entrepreneurial incentive. Laws, for example, are considered to have a very significant effect on the economic level, a significant impact on studies and a very low effect or virtually none, over the social and business relationships, personal values and beliefs, and on the age and health. Allowances, taxation and private funding are also considered to have a very strong effect on the economic level and the work-time balance, and a very significant effect on the social and business relationships.

The next step of forgotten effects model is applying the min-max function in order to find the most relevant impact of the factors. Table 4 presents the evident relationship matrix, calculated as composition using the max-min function of causes to causes and causes to effects matrices.

Table 4 – *The max-min matrix*

	Economic level	Studies and entrepreneurial knowledge	Social and business relationships	Personal values and beliefs	Age and health
Laws	0.9	0.6	0.7	0.2	0.4
Market conditions	0.6	0.5	0.7	0.2	0.4
Institutional advantages	0.6	0.5	0.6	0.2	0.4
Work-life balance	0.6	0.5	0.7	0.2	0.4
Allowances, taxation and private funding	0.9	0.5	0.7	0.2	0.4

The next step is applying the method of max-min composing the causes-causes matrix with causes-effects and then with the effects-effects matrix. In Table 5 we obtain the accumulated causes to effects matrix that reveals the non-evident relationship that further represents the support for calculating the forgotten effects matrix.

Table 5 – *The non-evident relationship causes-effects matrix*

	Economic level	Studies and entrepreneurial knowledge	Social and business relationships	Personal values and beliefs	Age and health
Laws	0.9	0.7	0.7	0.6	0.5
Market conditions	0.6	0.7	0.7	0.6	0.5
Institutional advantages	0.6	0.6	0.6	0.6	0.5
Work-life balance	0.6	0.7	0.7	0.6	0.5
Allowances, taxation and private funding	0.9	0.7	0.7	0.6	0.5

This is a very useful tool in order to find out if there is a more efficient way to support the business incentive stated in the hypothesis. For example, the direct effect of the laws on the age and health is only 0.1 but, as the non-evident relationship causes-effects matrix shows, there is an effect of 0.5 which means that the chain that induced this forgotten effects of 0.4 must be revealed. We'll take into consideration any effect that is more or equal to 0.5 and study the causes to causes, causes-effects and effects-effects matrices to find out a better fine-tuned chain of the propagation of causes to the effects. This allows the quantification of the extent to which a cause is influencing a lever that will induce another lever or an effect.

In this example, laws have a 1 influence on the laws, a 0.9 influence on the market conditions, a 0.7 influence on the institutional advantages, a 0.8 influence on the work-time balance and a 0.9 influence on the allowances, taxation and private funding.

Table 6 – *The forgotten effects matrix*

	Economic level	Studies and entrepreneurial knowledge	Social and business relationships	Personal values and beliefs	Age and health
Laws	0.2	0.1	0.5	0.5	0.4
Market conditions	0.2	0.7	0.4	0.5	0.2
Institutional advantages	0	0.3	0.5	0.5	0.2
Work-life balance	0	0.2	0	0.4	0.1
Allowances, taxation and private funding	0	0.3	0.4	0.5	0.2

The second matrix shows the 0.7 relevant level of the impact of laws on the economic level and 0.6 impact on studies and entrepreneurial knowledge, market conditions have no relevant impact, institutional advantages have a 0.6 impact on the economic level, work-time balance has a 0.6 impact on the economic level, a 0.5 impact on studies and a 0.7 impact on the social and business relationships. The allowances have a 0.9 effect on the economic level as the causes to effects matrix shows. We choose only those elements that have a significant impact on the age and health and we observe that according to effects-effects matrix the only relevant element is the economic level. Given that there is a direct effect of 0.1 of the laws on the age and health, and a forgotten effect of 0.4, the element that is the most influenced by the laws is the economic level, that influences by 0.5 the age and health. More tuned, the laws influence the economic level through allowances by 0.9, through the work-life balance by 0.6, and through institutional advantages by 0.6. they also directly influence the economic level by 0.7.

Conclusions

By using the fuzzy logic and the forgotten effects model, it could be proven that the laws represent a very important aspect that influences the entrepreneurial incentive. The laws also support the economic level, either through business allowances, lower taxation, stimulation of private funding or improving the market conditions.

There are other important forgotten effects regarding the impact of the market conditions on the level of studies and entrepreneurial knowledge (0.7). This relationship shows that this cause has no impact on the level of studies. Studying the chain of causes to causes, causes to effects and effects to effects, we discover that there is a non-evident relationship between the market conditions and studies through the

work-life balance that is influenced (0.7) by the market conditions. At the causes-effects level, we find that work-life balance relevantly influences the economic level, studies and the social and business relationships and that the economic level and the relationships influence studies. These forgotten effects represent the difference of 0.7 between the evident and the non-evident relationship. This is an enhanced view that might explain the fact that in the countries where there is a great attention to the organizational culture that comprises business customs, managerial systems, personnel policies, principles for participation, training policies and quality management of the undertaking, there are also many people that are engaged in educational processes.

The conclusions might comprise also the forgotten effects of the laws on the social and business relationships, personal values and beliefs, of the institutional advantages of the family status and on the personal values and beliefs. They also comprise the forgotten effects of the allowances on the personal values and beliefs where the differences between the evident and the non-evident relationship are consistent and quantified to more than 0.5.

As such, the laws directed to support studies will have an important effect on the social and business relationships, the same with the laws directed towards a work-life balance that has an impact on the level of studies and, in the end, on the relationships. This topic is biased with the type of studies that has to be followed as the main problem in starting a business is related to age. The long life learning might be a suitable way for combining the need for a better work-life balance and for starting a business.

From interviews and questionnaires, it is noted that potential entrepreneurs of Romania and Europe have a poor knowledge of general economics and entrepreneurship, so we consider that is a real need for business institutional education. Respondents also have a poor knowledge of the macro environment, business laws, basic business principles and information. This situation exists because of two main reasons: the lack of entrepreneurial education that can shape and enhance the vision, and the inflation of the fragmented information, often incomplete and of poor quality extracted from the internet, social media, mass media, friends and other sources. Although the entrepreneurial values were recognized and assumed as being among the most important in the respondents' values system, the insufficiency of an institutional

frame and goal-sensing delays the entrepreneurial incentive up to a more mature age. In order to create the knowledge that leads to specific entrepreneurial behaviors through education, there is a real need for institutional support.

The socio-economic aspects found in Bucharest Region of Romania regarding the entrepreneurial culture iterate the fact that the culture of origins is an important factor in the adoption the specific behavior of conducting a business. But also the institutional framework, through specifically oriented laws and other institutional arrangements is a very powerful instrument that supports people's choice of starting a business as entrepreneurs.

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Partners Identification on an Ethical Basis

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Abstract

A new base for mathematical modeling in the field of information ethics is proposed. A concept of the so-called biased derivative is introduced. It has a potential to investigate dynamical properties of information processing systems where rules of ethics are formulated.

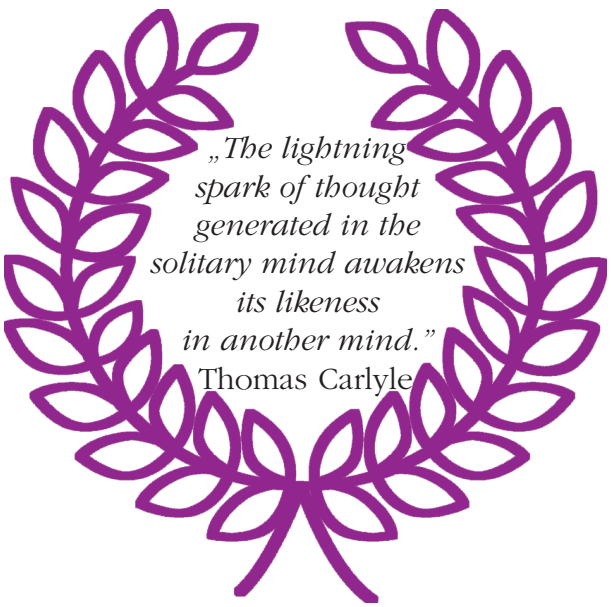
Keywords: Biased derivative, dynamical systems, information ethics, mathematical modeling, moral agents

Introduction

Information ethics is used as a general concept to discuss issues regarding information (or data) confidentiality, reliability, quality, and usage (Floridi, 2008).

There are attempts to introduce information ethics more formally (Bawden, 2014, Dodig-Crnkovic, 2006). Furthermore, the young generation prefers a new approach towards digital content (Sigmund, Pavlickova, 2015).

Until present, there is no attempt to use formal tools of dynamic systems in information ethics modeling. In this paper, a basic mathematical concept is designed in order to model the so-called moral agents based on real human beings. The latter ones are always inferring, using observations and theories about big things and little things, always very confident about some theories and less sure about others. For this purpose, a specific kind of derivative (called biased derivative) is introduced and used. The motivation for using this kind of derivative is given by an inherent part of these agents: the inferring feedback path given by the moral-based information processing beyond the agent activities.



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The paper is organized as follows: section 2 introduces the concept of moral agents, section 3 explains the method used, section 4 presents a few examples of motivation for principles of the moral agent modeling. In section 5, biased derivative as a specific tool inspired by a subjective instant of moral agent behavior is introduced. Mathematics of moral agent models is proposed in section 6, while section 7 has illustrative character given by the case study.

Moral Agents

Moral agents can be represented by single system blocks having one input and one output (as shown in Figure 1). They process information from the associated infosphere (information as the block input) to generate other information (information as the block output) and, in so doing, affect related infosphere (Floridi, 2008). Agents carry out activities that are, in many aspects, information-intensive, and as a part of living in this extraordinary network information environment, they began to manifest many features and actions that are the domain of the highly moral human beings.

There are two paths inside a single moral agent: feedforward path and moral path. The information input of the block is fed by the feedforward path to compare with the built-in moral path values (reference) and the „difference" is fed to the block output. By comparing reference with input and using the difference as a mean of „control", the single moral agent tends to maintain a specific relationship between the input and the output.

Figure 1 – *A single system block*

The Model Method

It has always been the purpose of science to make models (Richalet, 1981). A mathematical theory which seeks to explain and to predict the events always deals with a simplified model, a mathematical model in which only things pertinent to the behavior under consideration enter (Pierce, 1980).

The moral agents are considered to be mathematically modeled. This enables the better understanding of their behavior and the prediction of their action if submitted to a known stimulus. The simplest method to represent the behavior of a dynamical system (or agent) is to mimic it with a mathematical description in the form of differential equation, for example:

$$Tdy/dt + y = Ku \qquad \textbf{(1)}$$

where u, y are the system input and output, respectively, and K, T are the significant structural parameters.

At the beginning, the modeled system is excited to learn the behavior. Immediately, the two behaviors, that of the real system and that of the mathematical representation (the model) are compared. If the behavior of the real system and the model are equal, meaning that, for example, responses to the known stimuli are the same, it is possible to state that a model of the real system is identified. Note that this procedure is indeed that of the experimental science advocated by G. Galilei providing a „closed loop" experimental discovery, opposed to the deductive path of mathematics. Unfortunately, real systems are not so simple to totally encompass them by a mathematical description. Therefore, models mostly tend towards a similarity of behavior with the real systems being represented.

Models of Moral Agents

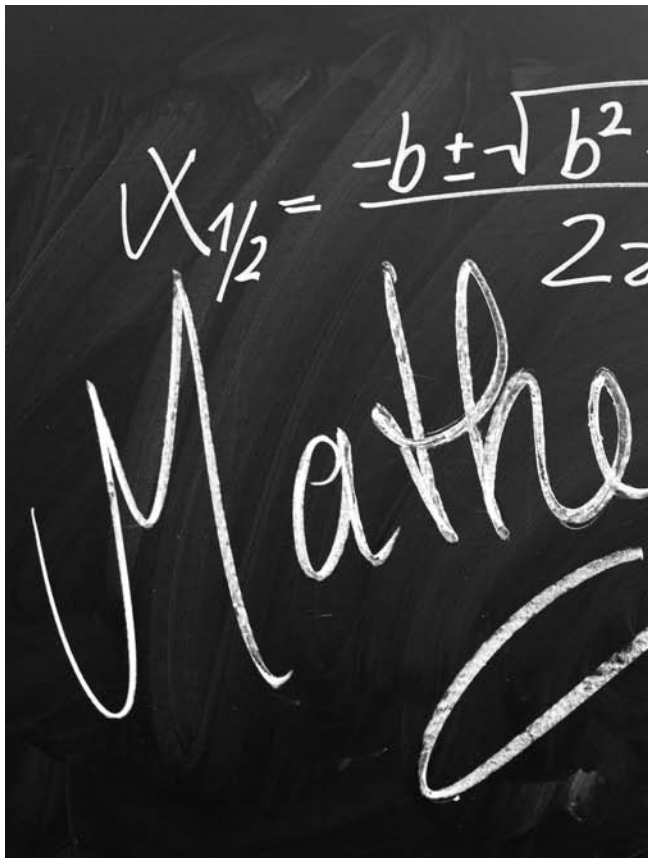
Our experience indicates that the behavior of actual human moral beings is neither as determined as that of the economic man, nor as simply random as the throw of a dice or as the drawing of balls from a mixture of black and white balls (Pierce, 1980).

Due to their information-intensive activities, moral agents have an inherent tendency to evolve over time. Hence, they can be thought of as a dynamic system (Sheinerman, 1996). When growing, dynamic systems self-enhance their initial deviation from the mean. The output of moral agents grows through attracting input information, similarly as cities grow through attracting more people. Based on the intensity of moral path values, the self-enhancing processes evoke inhibiting reactions similarly as the increasing noise and traffic may discourage people from moving into a growing city.

Furthermore, if the moral reaction follows with some delay, the self-enhancing reaction can cause an overshoot.

Imagine the functioning of a moral agent similar to the sand dune paradox. Naively, one would expect that the wind in the desert (feedforward path) causes a structureless distribution of the sand. However, the wind, sand, and surface structure together represent an unstable system where dunes are formed. Sand accumulates behind the wind shelter. Dunes begin to grow increasing the wind shelter which self-enhances the deposition of sand. But the sand, once settled in the dune, cannot participate in the dune formation. Hence, the inhibiting reaction results from the removal of the sand that is able to participate in the dune growth. In this way, the growth of dunes is reduced. This leads to stable dune patterns (Meinhardt, 2003).

The model scheme of a moral agent is composed of an activator and an inhibitor part (as shown in Figure 2). The activator



represents the self-enhancing (native) „substance" of the agent, whilst the inhibitor relates to the inhibiting (moral) activity. The development of both parts participates in a steady state. The stable behavior requires specific inhibiting reactions.

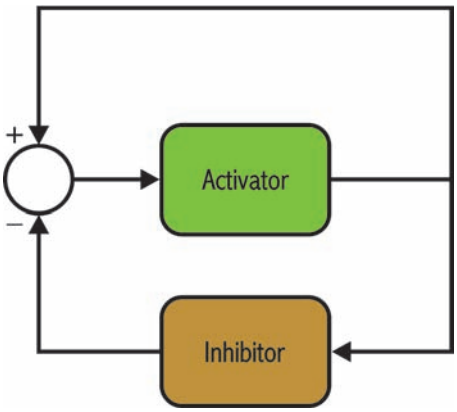
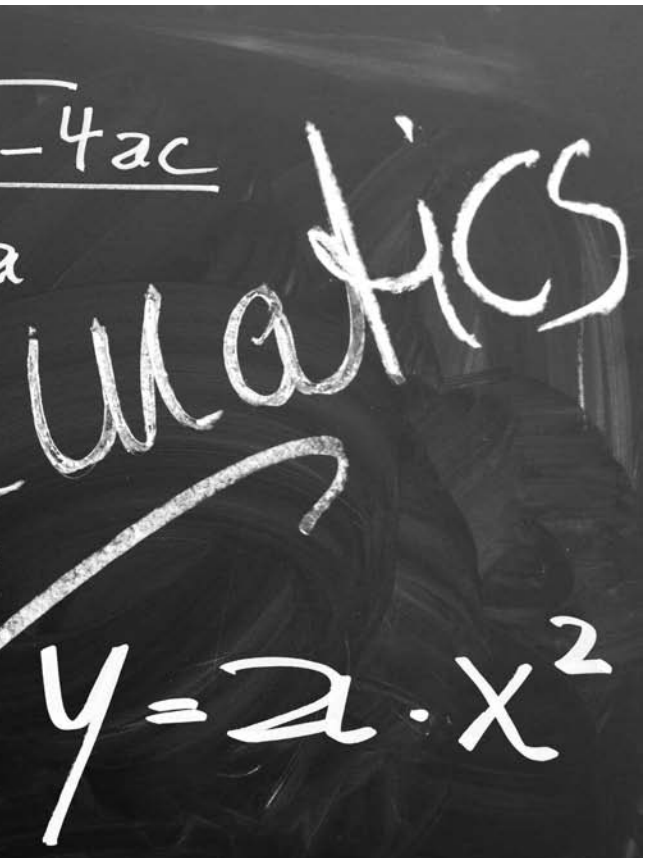


Figure 2 – *An inner activator-inhibitor dynamical structure of the moral agent*

The Biased Derivative

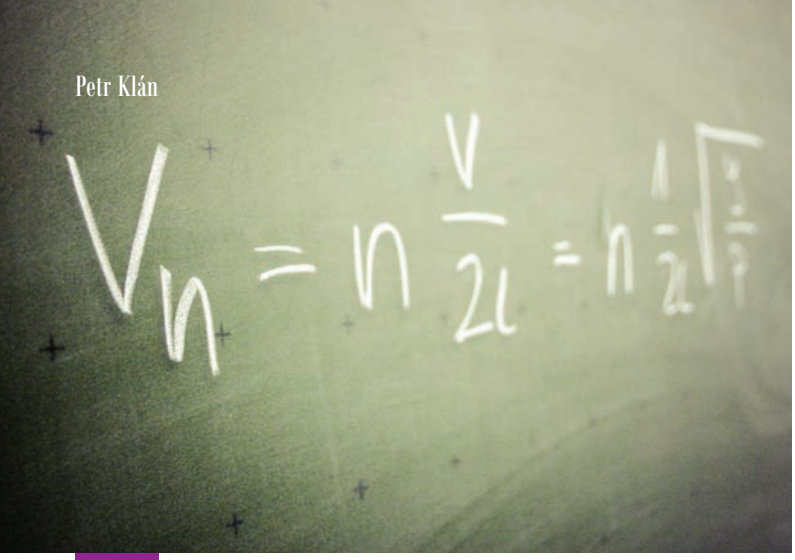
Describing mathematical dynamical systems include a function (i.e. a rule) which states, given the current output, what the output of the system will be in the next instant of time. Typically, it is provided by equations which contain derivatives such as $Tdy/dt + y = Ku$. Here, derivative is defined by the ratio $dy/dt = [y(t + \Delta t) - y(t)]/\Delta t$ for an infinitesimally small Δt. Newton called it fluxion.



Moral values are associated with feeling, emotion, illusion, inferring which concern a piece of fantasy and irregularity to the actual value $y(t)$. The latter becomes biased. This is reflected in an „egofluxion" or *biased derivative*, algebraically:

$$d\hat{y}/dt = [y(t + \Delta t) - (1 - \varepsilon\Delta t)\ y(t)]/\Delta t \quad \textbf{(2)}$$

where ε is taken as a moral coefficient given by the subjective feelings, emotions, illusions, chaotic instants etc. It results in a bias of the derivative. If positive, then the derivative tends to be overestimated; if negative, then the derivative tends to be underestimated; if zero, then the biased derivative becomes the ordinary one; if proportional to $y(t)$, then the derivative can tend to create bubbles; if proportional to square of $y(t)$, then the derivative can tend to have chaotic behavior.



In the normal society development, fluxions and egofluxions are mixed to faithfully reproduce a given structure. The diversity in egofluxions indicates that it is possible to deeply modify the society pattern.

Mathematics for moral agents

Due to the difficulty of understanding dynamical systems, a relatively simple model will be studied as follows. An inherent inhibiting property of the biased derivative is given by the following theorem.

Theorem: If ordinary derivative dy/dt is known, then biased derivative $d\hat{y}/dt$ is determined by:

$$d\hat{y}/dt = dy/dt + \varepsilon y(t) \qquad \textbf{(3)}$$

The proof of this rule is given by a simple rearrangement of **(1)**.

By the method of **(2)**, the differential equation $Tdy/dt + y = Ku$ is represented in the form of $d\hat{y}/dt = Ku/T$, where $\varepsilon = 1/T$. It well illustrates the concept of biased derivative since the response to a unit step input is $y(t) = K(1 - e^{-t/T})$ for the zero initial condition $y(0) = 0$ and $t \geq 0$. It results in a self-regulating system in which the inhibiting („moral") mechanism is automatically included.

The concept of the biased derivative, among others, covers the self-regulating scheme of the known logistic equations and predator-prey interactions. Logistic equations are the most popular models for the concept of saturation in the population grow $y(t)$ with the carrying capacity K and multiplicative factor σ. They are expressed by $dy/dt = \sigma\, y(1 - y/K)$. The latter becomes $d\hat{y}/dt = -\sigma y^2/K$ by a use of the biased derivative, where $\varepsilon = -\sigma$.

Similarly, consider the set of coupled double population y_1, y_2 equations of the form (Kahn, 1990) $dy_1/dt = \varepsilon_1 y_1 - \gamma_1 y_1 y_2$, $dy_2/dt = -\varepsilon_2 y_2 + \gamma_2 y_1 y_2$, where ε_1, ε_2, γ_1, γ_2 are multiplicative factors. With a use of biased derivatives it follows that $d\hat{y}_1/dt = -\gamma_1 y_1 y_2$ and $d\hat{y}_2/dt = \gamma_2 y_1 y_2$, where $\varepsilon = -\varepsilon_1$ (first equation) and $\varepsilon = \varepsilon_2$ (second equation).

As for moral agents, it is useful to arrange the feedforward and moral paths of input processing according to their effects and to combine moral agent block factors to an equation. Based on the inherent moral tendency of agents to inhibit, the combination leads to input-output relationship of the form:

$$d\hat{y}/dt = f(u), \qquad \textbf{(4)}$$

where: f denotes a function of the input.

In the single linear form, the model becomes $d\hat{y}/dt = Ku$, with constant K in a role of moral agent „gain". A more complex form of moral agents is expressed by $d\hat{y}/dt = f(y, u)$ where the function f includes two independent variables.

CASE STUDY

Naturally, every society creates chains of variable length, which are difficult to predict. Biased derivatives are aimed at indexing society processes that are inherently

$$P(X = k) = \binom{n}{k} p^k \cdot (1-p)^{n-k}$$

unpredictable. Their indexing (or simply constructing (ε, *K*) graphs) helps to measure effects of rational/irrational decisions in order to model movement of societies, for example. It is based on the fact that the moral path of an agent is associated with irrational activity in a subjective measure. A self-regulating force is needed, for example, in uploading, some „free" however copyrighted information when does not realize it. An opportunity to get or to keep an employment can inhibit moral effects of normally moral agents or groups of them for a short time (Ariely, 2008).

A control group of students was asked to find twins having sum equal just to 10 in a set of number series and to record time spent with searching. An example of such number series is represented by 1.69, 1.82, 2.91, 4.67, 4.81, 3.05, 5.82, 5.06, 4.28, 6.36, 5.19, 4.57.

Suppose searching of 10 twins. Whilst the control group is continuously supervised in their searches, other groups are not supervised. Unsupervised groups tend to overestimate results. They recorded 1.32 times faster searching time on average. This indicates two dynamical models of the form $d\hat{y}/dt = 10u$, first with ε = 1 and the second model with ε = 1.32. Unit step responses of these models are presented in Figure 3. The faster curve represents less moral unsupervised agents. Indeed, no supervision leads to less moral behavior of agents (Ariely, 2008):

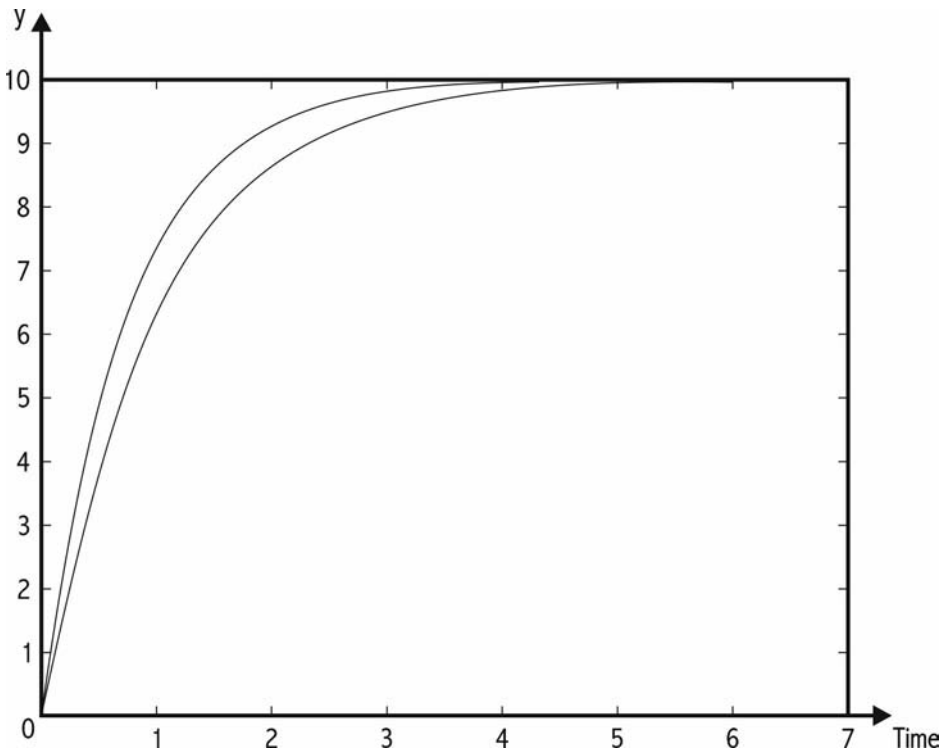


Figure 3 – *Unit step responses of dynamical moral agents: slower – moral, faster – less moral*

Conclusion

In this paper, a specific kind of derivative is used to describe dynamic properties of moral agents. Simple equations applying this derivative are introduced and used. They allow to model moral agents and to investigate their dynamic behavior. The case study illustrates the basic idea of the proposed method.

Information processing and the processing of information content in societies has a dynamic background. The latter is associated with gains and time delays which would lead to unstable behavior or to chaotic oscillations. In this paper, an attempt was made on how to better understand information and moral processes in societies.

The main contribution is twofold. First, the framework for mathematical modeling of the processes connected with information ethics is given. Biased derivatives serve for a description of the moral agent dynamics. Second, a way for indexing information ethics in societies is opened. Without information ethics – based mathematical models, the understanding of moral facts, in general, would be less complete.

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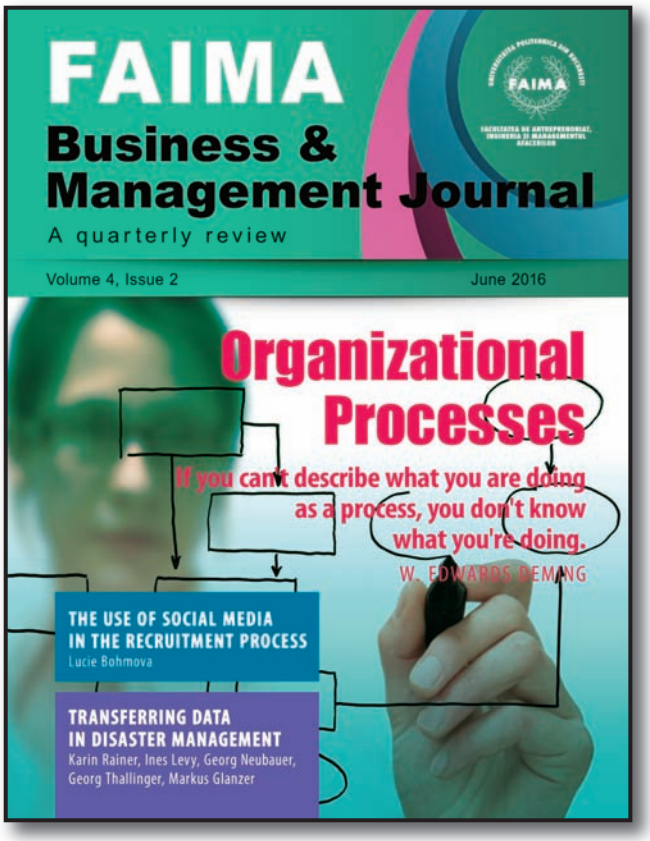
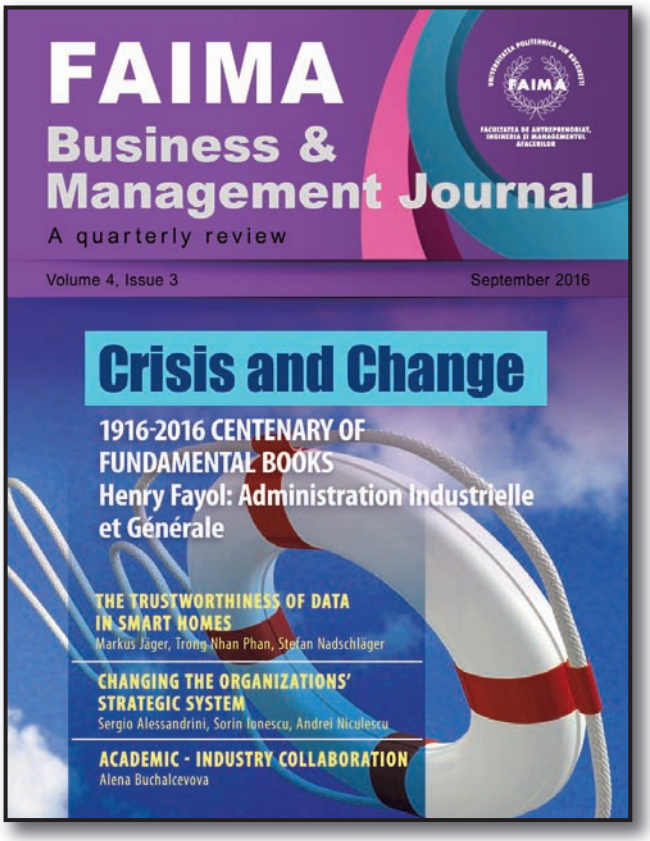
„Those who cannot or will not join us are to be pitied. What we want to do, we can do and will do, together."
Ingvar Kamprad





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