Lt. Col. Győző Csanádi:

SOME QUESTIONS OF MODELLING AND THE SIMULATION OF INFORMATION MANAGEMENT IN MILITARY ENVIRONMENT

ABSTRACT: *Information management is a management process of taking advantage of the potential of the information provided by the right delivery in an organisation. In competitive environment, it may result in information superiority, and all systems can experience overall resource savings while having the right Information Management.*

Although "the proof of the pudding is in the eating", some organisations like military ones cannot afford to make experiments with management processes, otherwise it is easy to pay dearly for a mistake with precious human lives. Modelling is a good tool to describe, understand, and develop a system. Simulation is an activity that gives the possibility to estimate the efficiency of an idea or a new system.

How is it possible to model and simulate an Information Management system? What is the environment like and what kind of factors must be taken into consideration? This paper raises questions about this problem. The author is doing a wider research about the possibilities of Information Management in the Hungarian Defence Forces, supported by information technology and the questions raised in this paper may constitute a significant part of it.

KEYWORDS: *information management, information modelling*

INTRODUCTION

Theodor Roszak gave voice to criticism about over-exaggerated rule of information in his book titled "The Cult of Information" in 1986. Although he considered only a kind of 'suspicious' neo-conservative conspiracy based on „Utilitarian"[1] movements, the so-called "Information Age" finally has come.[2] It is early to balance the advantages and disadvantages of the new era but a citizen of the global village has to face similar challenges like being flooded by unnecessary and irrelevant information while having difficulties in finding important facts. Folders are full of redundant files and when somebody wants to find an important one, it takes time. Meanwhile, it is possible to arrange more and more state or legal issues online

[1] Utilitarianism, is a philosophical view. According to the theory, the ethical value of an act is only dependent on the expected consequences. Source: "Magyar Katolikus Lexikon". (Hungarian Catholic Lexicon.) http://lexikon.katolikus.hu/U/utilitarizmus.html, Accessed on 9 December 2017. (Author's synthesis and translation.) According to Roszak, the theory of information age is a tool to rule people and speed up the economy. In the book "The cult of information", the author finds plenty of similarities between XIX century utilitarianism and the theory of modern "information age" such as ethical neutrality, scientific rigour, and the technocratic wish to rule people.

[2] Roszak, T. *Az információ kultusza (The cult of information).* Budapest: Európa Kiadó, 1990, 266–300.

from the armchair. The world is in a rush and the postmodern man is bombarded with loads of information. The danger of the "big brother" effect is important to bear in mind as a hidden and continuous threat[3], like system ECHELON[4].

Anyway, the use of information is not a new idea or phenomenon, but the new technologies rely on information with dramatically growing percentage. These above mentioned, randomly snapped, postmodern negative feelings are based on erroneous information activities[5], namely:

- over-flood with unnecessary information;
- shortage of important information;
- difficulties in finding relevant information;
- dissipation of resources.

This list is by no means complete. The mitigation of such disorders needs new points of views and new disciplines. If we allow the dethronement of information and pull it down from the mystic height to the level of objects that must be managed, it is possible to consider information as a resource.

To deliver all detailed definition of information is over the scope of this paper. What is more, at the moment a universal definition of information does not exist and it is unlikely that it will. The reason is simple, information as a phenomenon is so universal that every discipline has its own vision about its role and the way it works. Thus, all disciplines create different definitions about information. It does not mean that information itself is incomprehensive in appearance, however, universal things have the value of polymorphism. As for Information Management in various disciplines, the NATO definition can be used consistently:

Information is "any communications or representation of knowledge, such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audio-visual forms"[6].

Concerning the possible management activities, the most important part of the definition is "in any medium or form" whatever the information is. It is paramount to bear in mind that all media and forms of information must be considered as subjects of Information Management even in the narrative form of information exchange.

Information Management (later occasionally referred to[7] with abbreviation "IM") itself is a "discipline that directs and supports the handling of information through its life-cycle ensuring that it becomes the right information in the right form and is of adequate quality to satisfy the demands of an organization"[8] The main purpose of this system is to take advantage of the information provided by the potential of the right delivery. In competitive systems it may result in information superiority, and all systems can experience overall resource savings.

---

[3] Pan out about in the Article, Négyesi, I. "Az információgyűjtés jövőképe" ("The future vision of the information collection"). *Hadtudományi Szemle* 1/3. 2008. 95–100.

[4] ECHELON, a global observation system checking Intelsat satellites. More about the topic, see in the article by Négyesi, I. "A megfigyelés és információgyűjtés múltja, jelene és jövője" ("Past present and future of observation and information collection"). *Szakmai Szemle* 5/3. 2009. 35–50.

[5] Information activity in this context means all activities that characteristically handles information in input and output.

[6] Definition quoted from North Atlantic Council. "The primary directive on information management". C-M(2008)0113, PDIM, Annex C. 1-C-1.

[7] Although I try to avoid abbreviations, sometimes because of stylistic reason or shortage of space abbreviation „IM" will be used in this paper.

[8] Definition quoted from C-M(2008)0113 (INV), PDIM, Annex 1. 1-C-2.

In other words, a properly working Information Management is able to decrease information disorders, and increase advantages that right and timely information delivery can generate. Information Management is not a magic wand and cannot solve all problems within abnormalities of information availability and flow.

Military environment is a special and dangerous milieu, with special needs. Obviously, this fact has several effects on the Information Management.

"A model is a physical, mathematical or otherwise logical representation of a system, entity, phenomenon or process."[9] However, this definition is not comprehensive enough to describe all vernacular meanings. The original Latin verb "Modello" means "figure" or "mould". An artist creates his artwork according to his sitter – called model. A good practice or a new tool can serve as a model of a new procedure or industrial product. The notion "model" on the one hand is an object to be copied, on the other hand the copy itself. The role of the model is different in the construction and the cognition procedure. When the core activity is cognition, the first is the real system or object and it will be created after the representation. When we construct or build things, first there is a "model" (mental or physical) and the real system or object will be created according to the model.[10] In this situation the model represents a plan, or prototype.

The notion of simulation also depends on our point of view. "Simulation is a method for implementing a model over time."[11] In another approach, the model is an embedded category of simulation, because simulation is a special model that describes and imitates the specific behaviour of a modelled system.

As it is mentioned above, the role of information is not a new thing so a basic or instinctive Information Management existed formerly. The novelty in these activities is the institutionalism and scientific foundations. Some nations and organizations have already realized the importance of a purposefully designed Information Management in all governmental institutions – including the defence sector – and some organizations have just started to establish their own version of Information Management. In this process the working examples can serve as models. However, if scientists wanted to analyse and understand existing and working Information Management, it is necessary to create analytic, structural, and functional models. In military environment, the experiments can take a heavy toll. That is why it is necessary to examine the possibility to create a simulation of new investments even for Information Management systems. The creation of different solutions for Information Management must be measured against usefulness and costs.

GENERAL MODEL OF A HUMAN ORGANISATION

Before the military environment is examined, it is necessary to have a look at the difficulties of modelling an overall Information Management. Information Management is a system or a

[9] Definition quoted from US Department of Defence, Under Secretary of Defence for Acquisition and Technology. "Modelling and Simulation (McS) Master Plan". DoD 5000.59-P. October 1995. Appendix A, definitions and acronyms. A-6.

[10] Summary and translation of the author from V. A. Bokarev's book titled *Kibernetika és a hadügy (Cybernetics and defence).* 138–139.

[11] Definition quoted from US Department of Defence, Under Secretary of Defence for Acquisition and Technology. "Modelling and Simulation (McS) Master Plan". DoD 5000.59-P. October 1995. Appendix A, definitions and acronyms. A-7.

process running in human organisation systems. The common value of human organizations is that this system is oriented towards a purpose and can be examined by the following five categories according to Churchman's system approach[12]:

- the total system *objectives* and, more specifically, the performance measures of the whole system;
- the system's *environment:* the fixed constraints;
- the *resources* of the system;
- the *components* of the system, their activities, goals and measures of performance;
- the *management* of the system.

The structure of an overall system can be described by the following structural model:

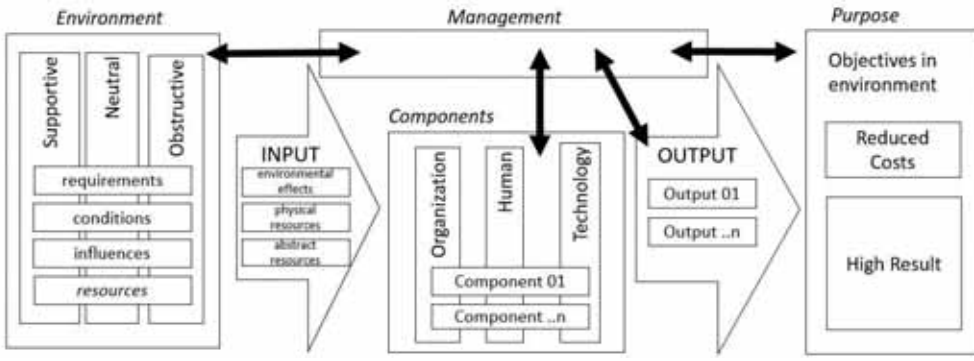

Figure 1: *The overall design of systems inspired[13] by Seres, Gy. with the addendum of element „management" and management an indication of information connections represented by thick arrow. Created by the author.*

Checking figure 1, we can see that all of the Churchman categories can be found (marked by *characters in italic*) except components activities. This must be described with other descriptive language, for example with an activity diagram of UML[14], or textual form.

The *environment* and *resources* are given to the system as input.

The environment can be sorted in various ways. One of them is the intentional relationship with the outspoken or hidden purpose of the system.

We can state that an environmental factor is *supportive* if the factor aims at promoting the system's purpose.

Neutral is the environmental factor if the aims of the factor are not in direct connection with the system's objectives although the factor has an effect on the system and its objectives. This effect can be positive (supportive) or negative (obstructive).

Environmental factors can be *obstructive* if there is a conflicting interest. This type of the environment is to hinder the objective of the specific system in various ways.

It is not always easy to classify a factor according to its intentions since some factors have hidden intentions and aims. Analysing the behaviour and the results of the system often reveals real but secret aims and purposes of a factor.

[12] Churchman, C. W. *The Systems Approach*. New York: Delacorte Press, 1968, 29–30.

[13] Seres, Gy. "Bases of Military Modelling". 11 February 2011. 1. http://drseres.com/ceepus/, Accessed on 9 December 2017.

[14] UML: Universal Modelling Language.

Usually the environment can be realized as

- requirements;
- conditions;
- influences;
- resources

The classification of the categories above is flexible concerning the intentions. For example, cooperative systems less often contain opposing environmental elements than competitive ones.

Requirements consist of legal regulations at various levels and requirements raised by organisations, and technical constrains coming from the necessity to co-operate with other technological platforms.

Conditions are static results of the supportive neutral and obstructive activities, such as acts of organisations and people, which Information Management must consider. Also, there is the overall moral situation that sets the strictness and the level of compulsion of the regulation. The higher the moral level, the less strict regulations must be applied except when the expected damage is high in case of omitted regulations. The user's resistance against new systems should also be considered as an obstructive condition. The availability of training facilities is also an environmental condition.

Influences are dynamic results of supportive neutral and obstructive activities. These are belligerent or criminal activities, or developments of technologies that may support the IM activities.

Objectives are descriptions of status and products that a system should produce as an output. The objective seriously depends on the environment.

Resources can vary in dependence on other environmental factors and the design of the system. Resources can be either material or abstract ones. Material resources are physical materials, energy, facilities, structures, or technology equipment. Abstract resources can be knowledge, information, or leader's willingness. The budget or monetary funds are abstract resources since money is an abstract phenomenon, but it is usual that budget is classified as a material resource.

Components are sub-systems or elements that produce an output in co-operation. Components can be realised as organisation, person, or technology[15]. The relation of organisation and person and technology is n:n:n, which means many organisations can have many people and technologies. One person can be a member of more than one organisations, technology can be used by various people in various organisations, etc. This freedom of relations can lead to a combinatorial explosion[16] if it is necessary to describe all relations in a functional model.

Having a large number of functions makes the description difficult to perceive but the situation becomes even more complex if management is also considered. The management has its own procedures in order to control the whole system. In order to do this, it is necessary to build a two-way information channel among all other elements of the model, namely:

- Information exchange about environment (bi-directional channel).
- Information about the state of components is reasonably detailed and control information is given in order to orient the system in the direction of objective achievement.

[15] Seres. "Bases of…".

[16] Combinatorial explosion in this environment means a sudden increase in numbers of issues that over the limit of system processing capabilities.

- Information about output in order to have feedback. If necessary, it is important to control the output directly that needs control information.
- Finally, the management must be aware of objectives and if necessary, has to have the capability to change objectives – it means bi-directional but asymmetric information exchange.

All four bi-directional information channels transform management information.

Defining, requesting, and handling management information is the task of the management systems.

There are other types of information as well. These ones can be classified as input or output information. Information can appear in the input like raw material, while some components can produce information as a product. The aim of the Information Management is to manage all three kinds (management, input, and product) of information in a standard way as a core resource. Managing information means planning, organizing, and controlling in order to have optimal alignment of information with an optimal value and ensure the preservation of valuable information for further exploitation.

QUESTIONS OF THE OVERALL MODEL OF THE INFORMATION MANAGEMENT

The overall model of Information management can be created with some customization and specification as follows:

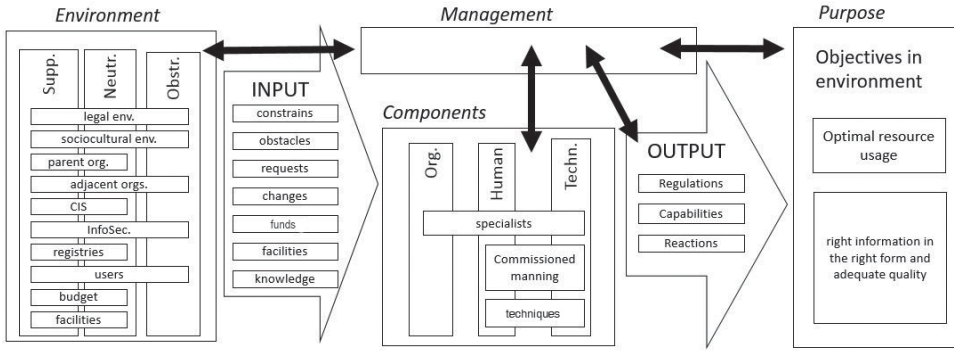

Figure 2: *Structural model of the Information Management System in general with the development and specification of figure 1. Created by the author.*

The structural model of general Information Management is composed of three components:

Specialists are IM crew with dedication to the organisation or their post, with special training and tools and technologies to contribute to the work of Information Management.

Commissioned manning are people that have IM jobs as a secondary job (commission). These people have the necessary knowledge to represent the discipline in their official organisation and they have the mandate to articulate organisational needs. They may have technological tools and techniques to contribute to the work of Information Management. The level of knowledge or capabilities is not definitely lower than a specialist's expertise but the amount of the Information Management work in their organisational position does not allow employing them in a full-time position.

Techniques are all specific procedural knowledge, or tools with which Information Management activities can be accomplished or supported.

The environment of the IM model consists of ten key elements.

Legal environment encompasses all legal regulations that have an effect on the working Information Management. This system has a hierarchy and contains compulsory regulations that must be followed. Legal systems may contain supportive, neutral, or obstructive elements. If a legal rule provides for the establishment of Information Management, this fact must be considered as an abstract supportive resource.

Sociocultural environment determines the overall approach of manning, users and leaders. It has effects on the leadership and management. The sociocultural environment is one of the factors that affect the morale.

Parent organisation is the organisation that hosts Information Management and on which IM will have an effect. Parent organisation can be examined as a system: its objectives, environment, resources, components, and management. A parent organisation contains neutral factors, and it is paramount to consider the management since Information Management is a management process. The positive attitude and the leaders understanding IM are supportive abstract resources. Dismissive leaders belong to the obstructive factor.

Adjacent organisations can be cooperative, neutral, competitive, or obstructive. If an organisation is competitive, it does not mean automatically that it is obstructive. Competition can motivate development. This factor must be analysed as a system.

Communication and Information Systems (CIS) are among the most effective technological tools with which information activities are done. CIS is not part of the Information Management but can help or prevent the execution of information activities. The design of CIS must remain within the responsibility of CIS staff but Information Management must give orders and requirements to this environmental factor. The existence of obstructive CIS systems is a challenge, but *Information Security* is an independent discipline, which is not covered in this paper.

Registries are responsible for traditional documents, the role of registries is similar to that of CIS systems.

Users comprise a wider category than CIS users. In this context, users are people who are interested in information activities, and must follow Information Management regulations.

Budget is a dominant resource since it can easily be converted into other resources. There are budgetary resources not available for Information Management, but they can foster other important factors like CIS or training facilities. These budget elements are considered as neutral budget factors.

Facilities are capabilities that are necessary to have manning and technical equipment. The availability of this factor is a resource.

As the cumulative effect of all environmental factors, and according to the needs of Information Management system, the following *inputs* will feed the system:

Constrains are factors that limit IM, like legal rules about security, limitations coming from the parent or adjacent organisations, all actual rules that create a frame of the management.

Obstacles are objective, unchangeable situations that stop one or more components' operation.

Requests can be even orders to orient Information Management into a specific subject that a leader or requester considers important and specific information management actions may solve.

Specific *changes* are an important input for Information Management especially when a new structure of organisation, or soma changes are in progress, because the new setup may require changes in the information flow.

Money is needed to cover expenses of manning, trainings, support material, maintenance of facilities and equipment under the financial responsibility of dedicated Information Management organisations.

The availability of *facilities* is important for organising meetings, trainings or all other activities that are necessary for manning.

Knowledge is the basis of success, it can be procured, or built up by a working system.

The *purpose* of an overall Information Management system is two-fold. The working of the system must deliver right information in the right form and adequate quality meanwhile it must ensure and promote optimal resource usage. These two necessities need different approaches, concentration on the result, and concentration on expenses.

Information Management can solve this task with the following outputs:

Regulations are normative rules, suggestions, or orders that IM as a discipline can prepare by properly trained manning with its organisation and techs. Regulation can be strategies, master plans, plans, annexes, suggestions, standards, procedural descriptions, manuals, or even oral or textual commands in order to keep the system on track. Regulations have long-term effects and usually set negative feedbacks in order to keep a chosen direction.

Capabilities are desirable abilities that can affect the environment in order to achieve aims.

Reactions are occasional activities or changes in order to react in an unexpected situation that regulations cannot prepare for.

QUESTIONS ABOUT MODELLING INFORMATION MANAGEMENT IN MILITARY ENVIRONMENT

Establishing Information Management in a military environment means other constrains must be considered. The final purpose of a military organisation is to successfully accomplish a military achievement in an armed adversary situation.

An armed conflict intentionally aims to annihilate one or more components or management of a specific military system. It is important to note that adversary or conflicting factors are much more than just enemy armed forces systems. In the case of a wrong operation, a military system can convert a neutral or even a friendly environmental factor into enemy, or vice versa. For example, people in an area of military operations can change their attitude, and "winning hearts and minds" is one of the key factors in the success of counter insurgency operations.

Concerning the intensity of adversaries, it is possible to divide military activities into two main types of operation and structure: peacetime establishment and wartime establishment. The difference between them is that wartime establishment participates in the armed conflict in harmony with available capabilities and is determined by harsh environment. Meanwhile, peacetime establishment means the preparation for an armed conflict.

The final measurement of properness is the success in an armed conflict. But in peacetime such an assessment becomes difficult because in this situation the measurements are based on estimations of capabilities. These are indirect procedures, for example using models and simulations deputizing precious or dangerous elements.

The model of the Information Management in peacetime establishment is quite similar to the overall IM model. The differences are in the environment specifications, and the objec-

tives affected by the peacetime establishment achievements (preparation) and the specific hierarchical leadership.

The components and the outputs are the same as in general Information Management, but to be accurate, all regulations have military style, which means the terminology should be in harmony with military phraseology.

Management can be specific, because to the contrary of other organisations, military organisations always have a hierarchical leadership. Thus, it is an important factor that the regulations must be signed at a reasonably high level in the hierarchy in order to ensure their effect on all subordinated organisations.

It has a rising importance to consider the belligerent cyber actions in the environment, especially as the cyber space is often busy with attacks even in peacetime. Although cyber defence is not the task of an Information Management, the system must be "aware" of such dangers.

Wartime establishment is different. During warfighting activities there is no way to play around a crucial factor like information, the organization and manning of Information Management are overshadowed, and the technology gets more emphasis. When an armed conflict commences, it is necessary to have mature and well-practiced methods, and technical solutions *integrated in the military procedures and equipment* and generally in the structure and working process of the military system. As a consequence, the wartime Information Management becomes a built-in logic into the military system rather than an independent organisation. However, dedicated specialists and also some extra positions are needed, but the system should be prepared to have *war-dynamics,* continuous changes, stand and survive *enemies*' kinetic and non-kinetic strikes. All burdens of the *battlefield* affect the physical and mental preparations and personal equipment as well as the necessary durability of technology. During fight, we cannot speak about procurements so the Information Management depends on either *National or Host Nation support.* In order to develop the system, experience will be available as *Lessons Learned* and it is important to frequently produce output Lessons Learned reports as well even about subjects that are not directly tied to Information Management.

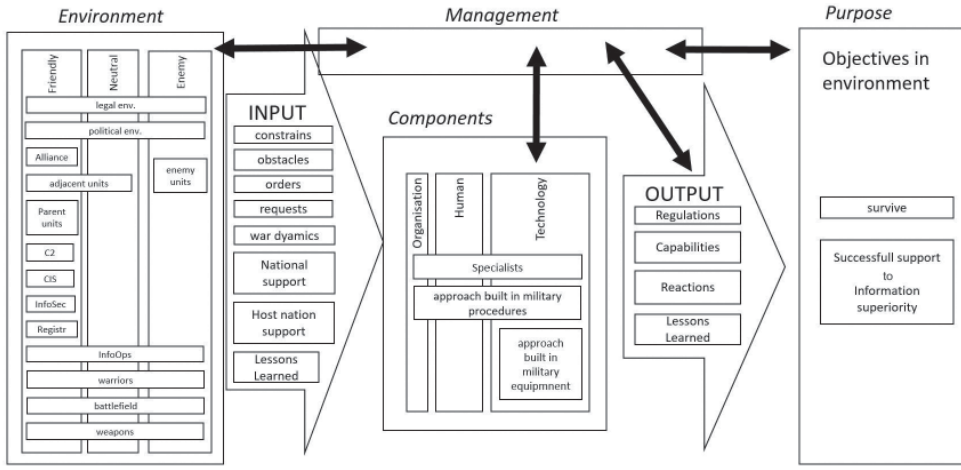

Figure 3: *Structural model of Military Information Management. Created by the author.*

The main purpose of efficient military Information Management is to establish *information superiority*[17]. It can be realised by enlarged capabilities and enhanced reactions.

Among components, the importance of "Technology" and "Human" enlarges while the number of Information Management organisations is limited. During a war, only a narrow group of *specialists* are working on IM. The biggest change is in the environment, *weapons* and *warriors* become important constrains while Information Management becomes an applied tool subordinated to the *Information Operation (InfoOps).*

The wartime establishment of the military system by nature depends on the enemy that is why the *survival* of the system becomes an objective.

The difficulty in case of military Information Management is also in the measurement of performance because the enemies are continuously striving to take advantage of surprise and they use all means to destroy or paralyse our systems. A new point of view in the war environment is the durability of friendly systems. One solution to improve durability is redundancy, which makes another difference between wartime and peacetime approaches. During peacetime, the optimal usage of resources is an objective while in armed conflicts it is the results and survival which are vital. It is not simple to make a model where the potential of components decreased by the effect of enemy weapons can change easily.

QUESTIONS OF SIMULATION IM IN ORDER TO TEST CONCEPTIONS

Perhaps it is not the best idea to test a new system or approach like Information Management in a military environment by creating a system without any evidences about a minimum efficiency. To reach a definite minimum capability right after the introduction of a system, it is necessary to analyse the estimated efficiency of the system. It was mentioned that Information Management is not a system without any ascendants. To measure the estimated advance of a systematised and organised Information Management, a preliminary condition of initiation is necessary. Information Management aims can be reached by diverse methods in various systems.

A successful simulation depends on the methodology and the accuracy of the effect calculations in the factors of the model. The measurement of performance is sometimes difficult to express in a numeric way because of the abstract nature of the factors and the indirect effects of outputs.

If the numeric quantification is not possible, it is a good solution to express relations and tendencies.

In the case of estimation, it is better than nothing to express subjective relations like "better – worse" or "more" – "less" or three- or more-level logical or textual evaluations or estimations:

three level estimations		
low	medium	high
decreasing	stable	increasing
worse	the same	better
less	the same	more

[17] More about information superiority, see Munk, S. "Az információs fölényről" ("On information superiority"). *Hadtudomány* 11/3. 2001. 43–52.

As it was described above, Information Management is a product that creates management information since it is a management process in the form or language of regulations. This nature of the management makes this system similar to the legal systems because the product is an abstract, normative, mostly text-based order, plan, or description. There is research to support the formalisation of legal rules and regulations. One of the examples is the usage of logical programming languages like PROLOG. Also, there are research projects. Among others, in the Hungarian Budapest University of Technology and Economics at the Department of Automation and Applied Informatics, there is a project called "Jogsegéd",[18] aiming at developing the formalisation of law codes. The formalized logical description or object-oriented modelling can help to model the legal texts and create simulation in order to estimate effects. The commonly shared value of these projects is that this model has to interact with the environment as an effector, and systems must be modelled as well. Normally, the project can check possible contradictions with other modelled law codes. If somebody wants to simulate the effects on a specific organisation, such a structure must also be modelled with several possibilities of reactions. Consequently, the simulation must have a certain number of dimensions to ensure degrees of freedom, if some of the important dimensions are omitted, the simulation will produce false results. Therefore a possible reaction will not be taken into consideration since the possibility to happen is not provided. For example, if one simulation does not consider the user's resistance against new software, it will never prove that even a whole project can fail because of the user's negligence.

In order to have the minimum dimensions of reaction for the simulation, it is necessary to weigh the following dimensions:

awareness – unawareness is a dimension to estimate how big the probability is whether the regulation is received and processed. For estimation, it is important to examine the position in the structure and the state of existing information management channels because in the case of deeply subordinated units and narrow or noisy communication channels, it is possible that some components will not receive normative messages.

acceptance – negligence is the dimension of the components' compliance, how specific rules and regulations it can follow. This parameter is a derivative of moral state, and users' resistance against the specific rules.

flexibility – rigidity can measure the flexibility of accepted regulations. This value depends on the design, size, task and manning of a component.

speed of reaction is a dimension that can estimate the rate of reaction in time, may derive from all three dimensions above.

Looking at only the description and simulation of *management information channels,* it is difficult to describe or abstract the work of channels because it needs to describe information to be sent. When the model refers to any kind of information, it is not possible to refer to the specific content of information. The only possibility to describe the information is using meta-description like "this is information about this" and "this fact", or "phenomenon".

In management information, it is not possible to consider all potential meta-descriptions of information because of the stochastic nature of human organizations. There are always unpredicted appearances, thus it is necessary to consider information with unknown metadata. This situation can be solved by introducing the following category: "any other important

[18] "Model-based handling of law" ("Modell alapú szabály-kezelés"), the short Hungarian description in the Budapest University of Technology and Economics, Control Engineering and Services Department project description. Translated and summarized by author.

information about the status of this or that component". This approach is similar to an old Roman custom that they dedicated a sanctuary to the not-yet-known goddess.

The possibility of potential combinational explosion was mentioned above if a model is too detailed and the minimum number of management information channels is calculated by the following formula:

$$C = \frac{(n+1)!}{2!(n-1)!}$$

In this formula[19],

C=number of possible bi-directional management information channels

n=number of components

This calculation does not consider the information that appears as input and product. The existence of this kind of information depends on the design of the specific components. It is possible to measure the minimum amount of channels since each component has its own input and output. It is sure that either input or output opens minimum one unidirectional channel in order to receive information about input and output process.

The final proceeds of a system simulation is the test of its performance. To measure the performance of a simulated IM is really difficult since the aim of the information management is to foster the system's performance by setting plans, directives and orders. The efficiency of a normative system is not easy to measure. Particularly, the measurement of information value, which comprises the main subject of the Information Management, is difficult as well. To assess whether any information is in a right quality and quantity in a right position needs multi-dimensional measurement. The quality criterion of the information is determined by the component. The description of information is in an abstract meta-formula.

The realization of Information management can be classified by three following notions (organisation, human, technology).

The Information Management organisation must not over-press or -stress the system. If a management system has too many resources and too much power while it is not controlled, it can easily convert itself to be art for art's sake. It is pity if the Information Management system becomes a kind of "dictator" system instead of helping management and core processes. The estimate of the threshold depends on the socio-cultural environment and the design of the host organisations. This value can be expressed with a level of sufficient power.

The *human* component in other approaches can be a *resource.* "Human Factors may be defined as the technology concerned with the analysis and optimisation of the relationship between people and their activities by the integration of human sciences and systems engineering in systematic applications and working environment frameworks"[20] Concerning Information Management simulation, human factor is important but creating a human behaviour simulation is too ambitious. To measure and estimate human factor, it is necessary to express attitudes with a simple model possibly based on attitude research, measure level of training, moral status and percentage of manning.

Technology can be divided into two parts: procedural knowledge – know-how and technical equipment. The "know-how" can be modelled by the availability rate of user's

[19] Formula created by the author.

[20] Cacciabue, P. M. *Modelling and Simulation of Human Behaviour in System Control*. Berlin: Springer, 1998,2.

guides and important regulations. The technical equipment can be measured by the usage rate of automation.

To measure the performance of a specific variant, it is necessary to compare the result with the resources used in various ways.

A simulation proper model can have the capability to measure the possible achievement. Variants of the system design can be different according to five system categories:

- objectives;
- environment;
- resources;
- components;
- management.

The main aim in a military information system is the support of armed struggle with its capabilities. Information Management can support the system with a better delivery of information. In practice it means the elaboration of management capabilities and development of components' performance via the establishment of a better input distribution and product information. It is an obvious requirement for Information Systems to be as cost effective as it is possible.

In order to measure the improvement in management capabilities, we need to check the informational factors of management.

The management needs to be informed about all relevant statuses of the system in order to make decisions based on correct and timely information. This status information can be measured qualitatively and quantitatively.

The factors of the information quality are the following[21]:

- accuracy;
- relevance;
- timeliness;
- usability;
- completeness;
- safety;
- reliability;
- consistency.

All factors must have an own system to measure in the military environment. Making the specifications of measurement of information quality can be the subject of another research because it is out of the scope of this paper.

The quantitative measurement is the other face of the measurement of management information delivery. The quantitative measurement of information is well documented and elaborated by the followers of Shannon's school.

It is important to realise that the principle "the more the better" applies only with certain limitations. If the quantity reaches the processing capability threshold of the process, the rising flow of information decreases productivity. This limitation depends on the organizational components of design, manning (training, health and moral status) and technologies of information processes.

[21] Munk, S. *Katonai informatika I.: A katonai informatikai alapjai (Military information technology I., basics of military information technology).* Budapest: Zrínyi Miklós Nemzetvédelmi Egyetem Egyetemi Kiadó, 2003, 26.

Determining the capabilities of components needs experiments to make. The techniques of Queuing Theory are sufficient to estimate the possible information capacity of components.

Having the various parameters reviewed, it is high time to make suggestions how it is possible to make simulation of Information Management variants.

Concerning the high level of human factor that makes the modelled system stochastic, and the significant level of improbability, in order to measure specific components' behaviour it is recommended to make a stochastic mathematical model. The model has to have rate estimations with a specific time period.

Since the system is a process strictly controlled in a military organisation, it is not practical to make steps shorter than a workday. If the simulation is to measure longer periods, it can be a month. With regard to the high level of uncertainty in factors, longer-run deviation of the simulation will drastically increase as the time goes on.

SUMMARY

Our present era heavily depends on information. This fact determines our life and has an effect on human organisations as well. Military organisations are human organisations with a specific purpose and set environment. Information can fulfil three different roles in the aforementioned systems: it can be the subject of management information, can appear in input, and can be a product. Information Management is one of the management processes to foster the functioning of human organisations. Information management in military environment during peacetime is quite similar to IM solutions of other organisations with slightly different specifications coming from terminology and management processes. During wartime the emphasis is placed on built-in technologies and the survival will be part of the system objectives. This complex system is not easy to understand and describe, that is why proper modelling is necessary to be used.

If it is necessary to establish or elaborate Information Management in military environment, it is safe and cost-effective to create sufficient models and run a simulation in order to compare the efficiency of different designs or results of changes. Since in Information Management the human factor is strong and other components and environmental factors have a stochastic behaviour, it is really complicated to make numerical measurements of specific values. It is especially true when it is necessary to estimate the effects of normative rules of the main output of a working Information Management. That is why the simulation of the system must be based on a stochastic mathematical model that has estimated rates in time. In order to prepare this model and simulation, further research on some parameters need to be done.

BIBLIOGRAPHY

Bokarev, V. A. *Kibernetika és a hadügy (Cybernetics and the defence)*. Budapest: Zrínyi Katonai Kiadó, 1970.

Cacciabue, P. C. *Modelling and Simulation of Human Behaviour in System Control*. Berlin: Springer, 1998.

Churchman, C. W: *The Systems Approach*. New York: Delacorte Press, 1968.

"Magyar Katolikus Lexikon" ("Hungarian Catholic Lexicon"). http://lexikon.katolikus.hu/U/utilitarizmus.html, Accessed on 9 December 2017.

"Modell alapú szabály-kezelés" ("Model based handling of law"). Budapest University of Technology and Economics, Control Engineering and Services Department. https://w2w.iit.bme.hu/onallo-laboratorium/modell-alap%C3%BA-jogszab%C3%A1ly-kezel%C3%A9s, Accessed on 9 December 2017.

Munk, S. "Az információs fölényről" ("About information superiority"). *Hadtudomány* 11/3. 2001. 43–52.

Munk, S. *Katonai informatika I.: A katonai informatikai alapjai (Military information technology I., basics of military information technology).* Budapest: Zrínyi Miklós Nemzetvédelmi Egyetem Egyetemi Kiadó, 2003.

Négyesi, I. "A megfigyelés és információgyűjtés múltja, jelene és jövője" ("Past present and future of observation and information collection"). *Szakmai Szemle* 5/3. 2009. 35–50.

Négyesi, I. "Az információgyűjtés jövőképe" ("The future vision of the information collection"). *Hadtudományi Szemle* 1/3. 2008. 95–100.

North Atlantic Council. "The directive on information management". C-M(2008)0113(INV). 18 December 2008.

Roszak, T. *Az információ kultusza (The cult of information).* Budapest: Európa Kiadó, 1990.

Seres, Gy. "Bases of Military Modelling". 11 February 2011. http://drseres.com/ceepus/, Accessed on 9 December 2017.

US Department of Defence, Under Secretary of Defence for Acquisition and Technology. "Modelling and Simulation (McS) Master Plan". DoD 5000.59-P. October 1995.