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# METACYBERNETIC MODEL FOR THE INTEGRATION OF PLANNING PRODUCTION/SERVICING KNOWLEDGE FLOW

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**Abstract**. *Bearing in mind the ever-increasing development of the needs of this civilisation, the necessity of production capabilities development (as well as the education required for production/servicig planning) is all the more pronounced. There is a global concensus about Education expectations (but perhaps not so much about its valuation). The relationship between Science and Education is exerting an ever-stronger influence on Science – to make it more effective and efficient in "transmitting/producing" of applicable knowledge – entry into the Educational System (and through it, the industry). Having in mind the "pressures" which "educational workers" are under, they need help in developing (creating and distributing) knowledge (and skills). Therefore this paper points to the possibility of linking the following systems: research, education and knowledge application (implementation) by metacybernetic system (MCS) and metamanagement – which takes place in MCS. (Illustrations are regarding the concept of linking up practise, education and science – in the area of "Production/Servicing planning").*

**Key Words**: *Practice demands, Producting/Servicing planning (P/SPP), Knowledge, Education System (EdS), Science (Sc), Educational workers, World knowledge, Metamanagement (MM), Metacybernetic system (MCS).*

## 1. INTRODUCTION

At the beginning of the 21th century there are around 6 billion people on the Earth. Material needs (the desired levels of living standards) are now beyond the means to satisfy them – with the current way of resource usage and allocation. (Did T.R. Malthus was right after all...)

Humanity needs a new "revolution". Changes in IT and ICT, the so-called "information revolution", have brought about an incredible rise in the speed and ease of data ma-

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nipulation. However, that has not reduced the number of the poor, the hungry, the ill.. The Earth, it seems, is not becoming a place more suitable for life.

It is therefore necessary to effectively and efficiently find or discover the trajectories (aims, ways and means) which could stop the current unfavourable trend (insufficient creation of new value) and then focus joint efforts in the desired direction. Bearing in mind the production capabilities structure, it seems that (Drucker, P.F. [3, pp.129-154]), at the moment, the greatest chance in increasing work efficiency (creation of new value) rests with knowledge – well designed and implemented knowledge.

## 2. KNOWLEDGE AS A PRODUCT

Although knowledge can imply different sorts of terms (at least until that also becomes standardised), in this context knowledge will be used to mean a concept which includes:

- The ability of differentiation of a particular occurence and the ability to identify its entities;
- Being informed about the theoretical interpretations of the relationship between the different entities of the given occurence;
- Understanding the nature of relationship between the entities of the occurrence in question and the rules of their changes;
- Understading the practical aspects of the relationship between the aspects of the occurrence in question, as well as relationship between different occurrences;
- Personal experience with the occurence in question, its entities and their relations.

Bearing in mind the complexity and significance of knowledge, its generation, distribution and application are taken care of by numerous subsystems of the human world. These subsystems are:

- Science (the "production" of knowledge[1]): occurrence research, solution generation and knowledge coding);
- Education ("distribution" of the knoweldge of all sorts and on all levels);
- Informing, ie. the transport of information – as well as knoweldge (publishing, ICT, media...);
- Culture (for motivating to get educated and to create value);
- Practice – the application ("using" or "engaging") of knowledge (organisational systems which make use of the knowledge: companies, institutions and all other forms of practice).

Many participants, many different expectations and – many goals (often opposing) which, by using knowledge, need to be integrated (and satisfied).

Everyday life, pragmatic in its being, has decomposed the process of knowledge manipulation (working with knowledge); further, there are three most important social func-

[1] The theme is illiustrated by the prodution/servicing planning knowledge example, hence this paper, deliberately, uses terms found in Operations Management. Professional language is used a great deal, showing, amongst other things, that professional knowledge becomes a part of the over knowledge of its user, even part of every-day speech.

tions on the "knowledge flow": Science, Education, Economy... (The transport of knowledge/data, for the purposes of this paper, is not the most important.) Every one of them has its own view of knoweldge – which it uses and to whose general flow (its inception, application and development) it contributes. Also, knwoledge which is used by a certain human function has, in part, come into existence in the overall flow of knowledge and, in part was created and is developed by that specific human function (and its eponents – companies, institutions). The transfer of this specific knowledge – the knowledge of social functions – partly becomes amulgamated in the "general flow of knowledge", partly stays within the function limits and a large part remains in the frame of the particular function "exponent".

As far as practice (value creation) is concerned, it seems that every company and institution is, simultaneously, both a "user" and a "producer" of knowledge: both general knoweldge and knoweldge specific to the social function in which it functions, and knoweldge about itself. A role this complex, in the flow of knoweldge, even the largest systems can not do on their own.

General knoweldge is "produced" at the level of national and global function (Science, mainly), but it is distributed en mass and, as a rule, with no direct payments. Knoweldge which represents core competency of national economies and/or companies – they try to keep in "their own hands". However, the new economy and business networking make even such knowledge accessible.

Like specialised social functions, within a company there are also different functions: Marketing, Production/Servicing (P/S), Finance, R&D, HRM... Every one of these uses both general and functional knoweldge, as well as knoweldge about the company in which it is taking place (Figure 1).

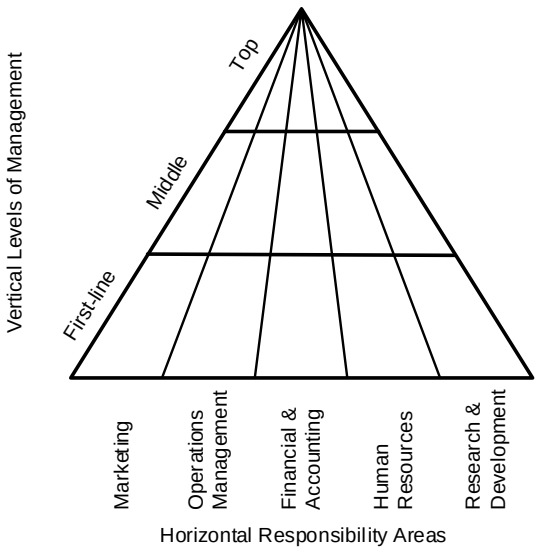


Fig. 1. Functions and management levels in a company
*(Like Figure 1-3 in [2, p.21])*

Problems regarding knoweldge occur in the following areas:

- Quantity and quality of knoweldge required in the particular function and its exponents;
- Generation and manipulation of knoweldge which was created in a particular social function;
- "Availability" of knowledge of the particular social function for further distribution;
- The efficiency of knoweldge manipulation (communications and "blips" on the line);
- Knoweldge application (how well it is adapted to understanding, transport, adoption, application, checking and measuring);
- The ability of the immediate production/servicing to acquire the knoweldge for value production;
- Knoweldge valuation and motivation for work in that area (including scientists, teachers and trainers, as well as the users themselves)...

Many problems demand their solving – partially (in the frame of the function and its exponents) and intergrally (in the generall flow of knowledge).

## 3. THE NECESSITY OF KNOWING ABOUT P/S PLANNING IN PRACTICE

There was a time when problems with knowledge occurred within the area of resource manipulation technology, later – within the area of capacity to achieve the required scope of P/S, and more recently within the area of sale, availability of resources and, again, on the technologies for their "shaping" – based on ICT and other actual knowledge.

This time, managerial "reserves" are being used, and competativeness is therefore being achieved through management quality (see [8], [9]) – using resources[2] in the creation of new values.

Current business making takes the following as given: competativeness, competency, team work, networking, creativity. Directly linked to this is the relation towards the resources too: minimizing the offsetting of the balance in Nature[3] – whilst satisfying human needs, saving, recycling... (And, more than that, the new organisational culture demands loyalty to the buyer, customer and results, so that the whole of the business system and all those partaking are subservient to the market demands [6].) New production capabilities must be efficient and, therefore, supported by the appropriate production relations.

As value is created, as a rule, in companies, it makes sense to re-evaluate the production relations at the company level (Figure 2). Double managent pyramid shows how one manages (in the wider sense), ie. how "the system is taken from the current state into a state closer to the desired one". The above "pyramid" shows the company owner/shareholder's

[2] At the same time, the very term resource gets a new meaning : resources are all phenomena which can aid the "creation" of value: business idea, organisational principles, information, management knowledge, technology knowledge and other..., surroundings, market, business opportunities, material resources (equipment and tools, meterials, space, energy, water, fluids), time... and, of course, people (educated, experienced, motivated).

[3] By getting to know the limits of Naure, perhaps it will be possible to synchronise man's appetities and the Earth's "production power".

level of being organised, whose managerial responsibility it is to work with the "highest aims". ie. defining: of mission, of strategic goals, as well as strategically significant limits in business-making. Therefore, the above pyramid defines the planning of the future states of significant business entities or "makes decisions". As management quality is viewed both as a function of decision quality and efficiency of its implementation [1, pg. 10], the lower pyramid is then given the task of realising the decision that have been made by the upper.

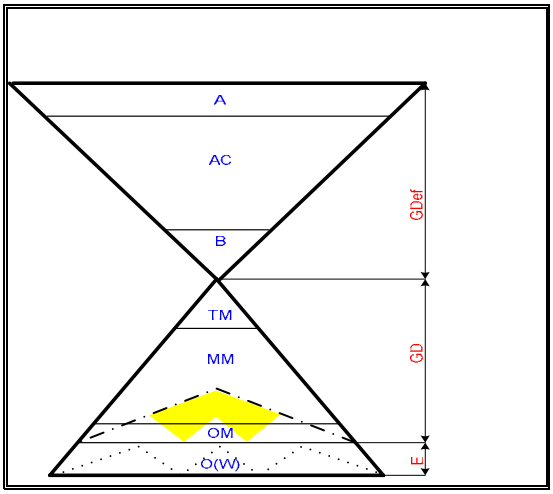


Fig. 2. Double management pyramid
Legend: A – Shareholders; AC – A's meeting; B – Bord of A's representatives;
TM – Top management; MM – Middle management; OM – First-line management;
O(W) – Workers-Executors of operations, Gdef – Goals defining,
GD – Goals disassembling (decomoising), E – Executing, performing

In the lower pyramid the following roles can be discerned:

1. Preparation to achieve the company owners' decisions, ie. working people (management in the narrower sense):
   a) Professional decomposing of the aims into more manageable, operative aims – to the levels of work tasks and
   b) Delegation – by distribution of:
      - responsibility for achieving aims
      - authorisation to engage the right resources necessary to achieve the required goals
2. Realise the decisions of the compay owners' by the immediate engaging in the realisation of the work tasks, ie. resource transformation – in the process of creating new value.

Viewed in this way, it can be noticed that at every level of management, widely speaking, something is managed:

- Owners manage the company – using goals: missions, visions, strategic aims (as well as in the choice of management);
- Managers manage the running of the business – decomposing the goals and allocating the aims to those responsible (HR);

- Human resources manage the material resources which they have to transform (both the means for work and the things being made) – in creating new value.

Every participant of management must posses the required knowledge to properly do his managerial role. Moreover, the level of aims about which one is deciding requires special knowledge, which becomes obvious if one looks at the jobs completed by the managers of the top and medium operational levels (Figure 3).

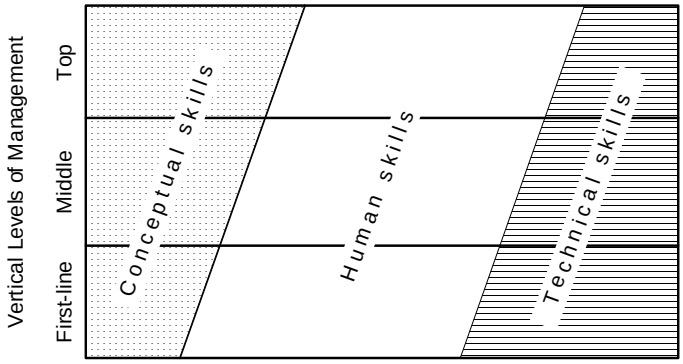


Fig. 3. Use of key management skills at different hierarchical levels
*(From [2, p.24])*

At every one of the 3 above-presened management levels (setting goals, decomposition of goals and their actual realisation), one goes through the following management process phases: Planning, Organising, Realising (Executing) and Control.

According to the above, the management process is manifested through:

1. Model planning (goals and limits) and trajectories planning;
2. Organisation (delegation of aims, ie. delegation of responsibility and authority);
3. Realisation (achieving actual goals – aims by the transformation of the resources and adding value);
4. Control (level of success in achieving the right circumstances, activities and results, as well as the justification of the plans and their changes).

Every management phase above has its own use, content, aims, tools and those who make it happen.

As can be seen, planning is the initial and, by its very nature, the most creative managerial activity. It is distributed to all the participants of the business enterprise:

- Owners – who create the vision and long-term goals, as well as the more significant organisational changes and projects for their realisation;
- Managers of all levels – who decompose the vision of the aim, given to them for safe-keeping, and "entrust" these to individuals or groups for further decomposition or realisation (if one is talking about operations managers), whilst planning the necessary processes and activities, as well as resource needs;
- Those who undertake the actual (realisational) aims – tasks for the actual operational time frame, the actual task, the actual operation... which they plan at the level of the actual resource transformation level.

Managerial efforts (the focus of attention, invested time, work, enabling workers for the job) of the efforts of different levels vary (Figure 4). The higher the level of the manager, the greater the attention given to planning and the necessary knowledge in the specific area of planning. If one looks at the area of P/S, then, within P/S function the managers' jobs, and therefore the required knowledge too, in the area of planning – differ.

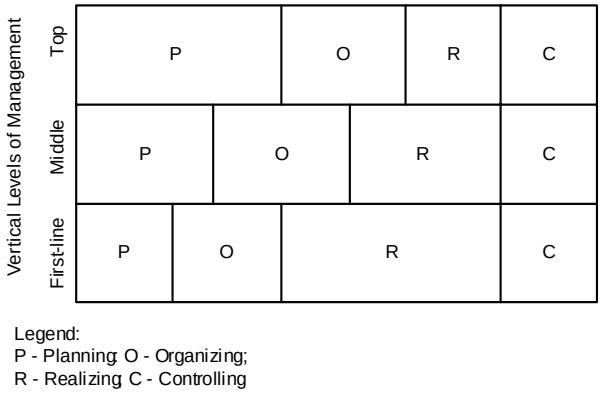


Fig. 4. Use of management functions at different hierarchical levels
*(Adapted – from [2, p.24])*

Therefore:

- Operations (First-line) manager needs to know and be able to (have the right skills and abilities): assign right jobs to right people, to deal with the job-shop problem, to plan for the "closing" of work-space (their supplying with the necesary resources, documents, special tools) etc;
- Middle manager needs to understand and be able to: make yearly plans, to plan material needs (or other resources), to plan: supplying materials, engaging of the facilities, P/S innovations realisation, to make operational plans etc.;
- Top production manager needs to be able to: plan aggregatively, plan HR for the function of production, synchronise production plans with the Marketing and Finance functions, make strategic production plans and decompose them;
- Top manager needs to, in the area of P/S planning, be able to know and appreciate the value of prouduct innovation, savings in the process, production cycle length, assortment optimisation, minimising stores etc.

What problems can occur with the knowledge (above all – P/S managers) in the area of P/S planning? It is possible that they:

- Have no formal knowledge, collecting it instead as they go along, which results in a relatively poor choice of models and planning methods, and therefore leads to poorer results in planning and subsequently in result realisation... The fear of failure even further represses creativity in planning, resulting in the working atmosphere often not being supportive enough. In a competative fight this can be a serious disadvantage.
- New knowledge and ideas – which can be obtained by employing younger, educated employees – are sometimes "quelled" by their immediate superiors (scared

that the younger, more enthusiastic colleagues will "overtake" them), resulting in falling behind in the development, a bigger lack of skilled staff and therefore even greater falling behind.

- Getting promoted at work (and the ever-increasing and more complex planning roles) is not accompanied by innovation, briging about the proof of The Peter Principle that "managers yearn promotion according to their level of incompetence".
- The departure of a manager leaves a position "open" – as the proper system of keeping evidence, keeping and ascertaining knowledge about planning in that company was not established;
- P/S planning knowledge, generated in the company in question, stay within its limits (without being integrated in the general knowledge flow)...

## 4. "DISTRIBUTION" OF P/S PLANNING KNOWLEDGE

Sources of knowledge are all aroud us, but, just like according to Murphy's Law, what is desired can be "invisible"; the reason for that "hiddenness" can be the intention (not yet been licenced) or accident (difference in the language between the desire and storage of the knowledge), but it can also be that it is supposed that there is a formal meaning of something – but that no-one has yet taken the trouble to formalise it. Knowledge bases can be found in literature, on the Internet, in the media, in the companies, ..., but, bearing in mind its social function, it is most likely to be found in the Education System.

The educational system as a social function which is supposed to enable knowledge distribution, uses the genral *fundus* of knowledge, specialist knowledge and didactic knowledge, psychology etc. to "portion" out the knowledge (of different applications, sorts and degrees and complexity) for the education of a specific sort and degree of a job. Thereafter the "knopwledge packet" is distributed to the pupils, students, adults who are revising their knowledge, "older" people...

P/S education, as a rule, begins in the high-school, although there are cases[4] where even in the very beginnings of formal education there are elements of education for professional direction.

High-school prodessional education prepares students for the job of P/S in the workplace – in shops, agencies, bakeries, restaurants, printing presses, buses, laboratories... (with the chance to continue their education.)

Universities, during 3-4-5 years of education, enable students to go into engeneering (design), consulting and P/S management in different technologies: building, chemistry, energy, agriculture, tourism, IT... P/S planning is taught also at engeneering universities, as well as the ones for management. At "engineering" universities , students learn (in the subject of planning) about planning for engineering projects, ie. they learn about Project Management, spending norms, bill of materials, critical path method, tools... At management colleges planning is taught as a phase of business management (and P/S) – how to:

[4] The Centre for Education and Development, Halifax, Nova Scotia, Canada, has a programme for the preparation of secondary school schildren for entrepreneurship in summer camps. In Yugoslavia from the 60s til the 80s secondary school children were taught to plan their food, to make things – for sale exhibitions, to create "student unions" - growing vegetables, making celophane wrapping paper.

decide on the selling potential of a company, optimise the assortment, decide on the necessary sorts and amounts of resources – and get them supplied in the first place, how to define jobs and get them done – on time, agreed on or standard quality and – at an acceptable price... Everything that is necessary about P/S planning is taught at the departements or colleges for managemetn and/or engineering. There are also numerous post-graduate studies in Productions and/or Operations management, Industrial Engineering, Organisational Engineering, Organisational Processes Engineering etc.

The founder of the "company for knowledge distribution" can be a state, as well as an individual (one or more). Amongst the educational institutions, bearing in mind that they cover the same "market of knowedge" there is rivalry. The good side of that is that the quality of education on offer is increasing, the bad – in "keeping specific knowledge" although that knowledge, because of the "transparency" of education, quickly becomes a known fact anyway.

On the other hand, practice (with a certain delay) is discovering how much the past education "offered" to the students and also how much of what was on offer was assimilated, how much was understood and accepted, how much is applicable. Only practice can "judge" previous education. As a rule, there is a gap between "the educational system knowledge" and "knoweldge necessary for accomplishing actual jobs". The cause is:

1. The impossibility of the educational system to educate every individual for every job (but specialisation for a certain job or a group of jobs is possible and therefore education whilst working);
2. The personal interests and abilities of the students, as well as in the learning styles ([7], [3, pp.6-7], [4, p.12] applied during schooling;
3. The difference in the types and levels of management organisation (and planning) in actual planning – so the beginner needs time (experience) to become a "productive memeber" of the work place;
4. The speed of knowledge development – so much so that a significant part of the student-acquired knowledge becomes obsolete during the education process;
5. The delay of the "education distributing network" (school, universities) in relation to the newest advances and discoveries (planning methods, organisational principles, software etc.) bearing in mind that the traditional education system merely passes on "portioned", goal-formulated knowledge.

## 5. P/S PLANNING KNOWLEDGE PRODUCTION

Traditional sources of knowledge are higher education institutions – univerities and institutes (which can also act outside of univerities). State universities have financial backing – above all, from the state, and also from big companies as well as certain individuals. Private universities have their founders and stakeholders. So do institutes.

As univeristies and institutes act on the knowledge market, they start creating their own income – by offering their "products" (dicoveries as well as expert knowledge, consulting etc.) Therefore, knowledge is being exchanged at the market. Its worth depends on the potential for increasing business success of the "knowledge users": it depends on exclusivity, being up-to date, applicability... In case of P/S planning knowledge, the "producer" of the knowledge has at their disposal a "production program": managerial –

planned engineering (making plans for or with the customer), consulting in the area of planning, experts, books, excercise books, lectures, trainings...

The law, as a rule, protects (as intellectual property) a pratical item (software package for the application of a method for example) but not so philosophical, conceptual solutions, methods etc. (ideas about innovations in production plan creation, plan linking or decomposing principles...) – although they, by "directing" the planning system in the original direction (modelling) can significantly contribute to the business succes. As the actual P/S plans are behavioural models of the company in question in the future – according to the time frame which they refer to, they have a value, primarily, to the specific customer.

The form of knowledge depends on its application. One way is required to "package" knowledge for those in high-school, another for professionals in a company; one way to transfer knowledge to colleagues (eg. scientists), another to company management... It is already supposed that one is talking here about exacly the same knowledge. As different auditoriums are "open" differently to the same knowledge, and as one wants to efficiently transfer the koweldge, the "package" needs to be "user-friendly".

Knowledge about P/S planning is a "product" of the previous generations of "knowledge producers" (both general and specific ones – about planning). The knowledge was created in different processes, under different circumstances, with differing levels of efficiency... A great deal of work and sacrifice has been put into the existing knowledge. There are relatively few historical sources which show how big the investement was in "a grain of knowledge". Artistic imagination visualises stories about the creative efforts of the most significant scientists of the past.

Reality – en mass (relatively) working in science – does not present very different facts: a great deal of sifting through sources of knowledge (literature in "paper format", electronic format, audio and video, field research...), strong principles of scientific work, practical side of research, scientific work product formalisation, solution implementation and problems with changes... and – "problem" valuation of scientific results (especially those whose applicability is not readily apparent)...

Bearing in mind that traditional sources of knowledge (higher education institutions – universities and institutes) act as "producers of knowledge" – on the knowledge market there is a possibility that their "products" – new knowledge – gets kept (as a leverige point against competition) for the "priviledged" (financially more able buyers/clients). The law (the country) removes this danger by forcing the "knowledge workers" to publish their discoveries/work, so that new knowledge does, after all, become available for the "general good". Knowledge in the area of actual technologies, which can lead to actual "objects" are protected by law (such as: laws, licences etc.).

Apart from that, as the quality of work of "producers'" and "distributers'" of knowledge results in social standing too and similar values, their desire to "earn" such values makes new knowledge come around faster and become more easily available.

## 6. Integration of Knowledge Production with its Distribution and Application

The reason for considering the links between production, distribution and application of knowledge is the great significance of knowledge and the need for it to be increasingly used in practise; that means – for it to be even more accessible, more present, to have everyone included in some activity of knowledge application and creation. For such a

society – a Knowledge-oriented society, it is necessary to create work on the knowledge flow easier, more attractive... Bearing in mind only the vast effort of researchers (often disheartening) eg. in defining a theme (the subject of research) and the direction of that research, it is necessary to link it more directly to the "source problem" – practice, as well as with the already achieved degree of solving the same and/or similar problems, which represents a cause for taking into consideration links about knowledge flow.

Whether the research has been commissioned (made precise: the theme and the expected results), or whether one is talking about a spontaneous research of a certain phenomenon, the researcher has a great deal of "preliminary" work to do. He has to research all (easier and harder to access) available sources – which show results of the research in that direction up to date. Not even the internet (yet) guarantees that everything has been researched, and there is always the communication barrier (eg. langugage). Also, there are different ways of formalising (ways of finding) and formatting (ways of "packaging") results, different "accents" within the results, different understanding of the terms (especially of terminology), different aims and directions of research...

Except for the idea about the theme and the directions of its research, a great deal of effort (enthusiasm) gets spent on merely checking if the desired results have already been achieved somewhere and published. This is followed by creating a solution and then its eventual publication. After that there is: application (verifying) and accrediting. To illustrate this process, let us hear the words of Goethe's friend (and secretary), German writer L.P. Eckermann (1792-1854): "Just how much effort and spiritual strength a man needs to take an area, understand it and come to terms within oneself, and how much infinitely more so is required, as well as calm, undisturbed dreams for that to be expressed well, in one breath". (He would probably concurr that to this description of a knowledge worker the other mentioned phases could also be cojoined. A perfunctory glance could lead one to conclude that it is easier to invent than to check wherther someone has, at some point in history, somewhere, somehow – already done it).

Hence the need to establish links between the actors in the knowledge flow: producers, distributers and users. And the need that the existing corpus of knowledge should be accessible – in terms of accessibility, structure, way of access and usage.

Basic transformations in the knowledge flow (Figure 5) relate to:

I - Realising the need in practise (A) for the knowledge to solve a particular problem;
J - Finding the solution amongst available solutions – which are all contained within the educational system (B);
K - Engaging the knowledge producers (C);
L - Application of the knowledge.

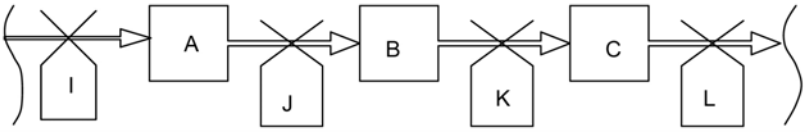


Fig. 5. Flow of knowledge

Detailed study is not necessary here. The idea is to show the process of transformation on the flow of missing knowledge – action and accumulation, as well as the interdependence between those acting on the flow.

If one looks at the participants in the knowledge flow in pairs, one notices the need for feedback, and that way they act as a cybernetic system. That is the way that production subsystem and knowledge distribution work, as well as the system of distribution and knowledge application.

Like all partial views on a phenomenon or a group of phenomena, the cybernetic systems on the knowledge flow give somewhat wider-reaching, but still only partial solutions. In the case above, the Education System – in the double role, "held tightly" by production and knowledge application, should be the one to initiate standardisation of communication, tools, as well as aims (creating the "knowledge chain").

## 7. METAMANAGEMENT CONCEPT OF INTEGRATION ON THE "KNOWLEDGE FLOW"

By joining up two cybernetic systems in question, a third is created with three subsystems. The first (Pratice) works the way it was taught by the Second (Education), and the Second works the way the Third (Science) directed it to. This creates the "Pyramid" of knowledge, ie. a metacybernetic system ([8], [9]) of knowledge (Figure 6). Its participants are aware that they create a whole, that in their mutual exchange they should be led by the interest of value creation , so that the quality of interchange is measured by their combined effect – the development of users – business systems which use the end product (knowledge). At the same time, the "application" and the "distribution" of knowledge pass to the systems above them useful suggestions: about the effects created by their "products", about things they missed, errors... and their causes. The subsystem of a higher level accepts the feedback and uses it to improve its own outputs. Circulations within the metacybernetic system of knowledge make it more flexible, better integrated and more successful, and the end user – happy.

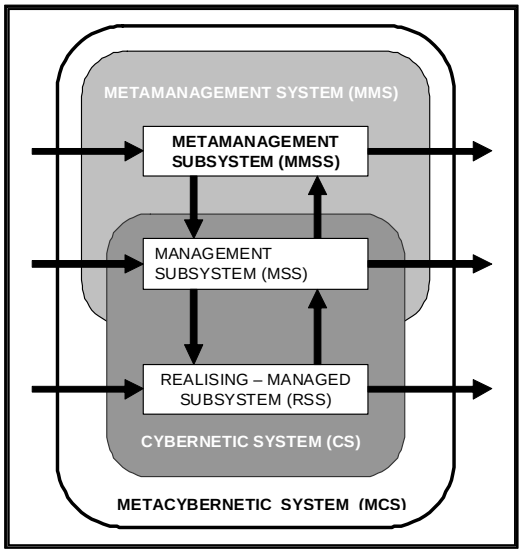


Fig. 6. The Structure of the Metacybernetic system

In the case of the metacybernetic system of P/S planning knowledge, participants of Science and Education exchange knowledge about the methods of education management in the areas of P/S planning, and participants of Education and Practice exchange knowledge about models, methods and techniques, tools etc. – applicable in actual practice.

The pratical side of the links of metacybernetic sybsystems can be seen in improving work quality – in every one of those subsystems.

The realisation subsystem (Practise, RSS) gets a combination of general and specialist knowledge taylored to it, because it regularly "demands" solutions for its business problems from its metamanagement system MMS (Education MSS and Science MMSS) (Figure 6). Moreover, it gets a dynamic knowledge packet – which gets (like a cure for chronic disease) gradually "injected" in the business organism, with occassional (timely) checking of its being up-to-date; this ensures permanenet education by (the appropriate) scientific achievments.

This subsystem (RSS), concurrently, regularly (when it spots the need for change, for improving the solution) sends its MMS "reports" about the effects of applied solutions, about errors and their causes (as far as that is obvious there, in practice).

Educational system (MSS), on the basis of experience, tradition and noticed trends, together with Sceince (as well as the other stakeholders – above all, with the state) formats knowledge, prepares condition for "delivering knowledge packets" and does the actual "delivery" of them. For the sake of deeper understanding of its metacybernetic partners, Education keeps active links with them:

- With the "client" (Pratice) it keeps close ties: in practice, with practice, by pratice, for pratice;
- With the "Supplier" (Science) it also keeps close ties – by participating together in scientific and professional projects, by joint research (and inventions, innovations, publishing), by including experts from the institutes in the required professional field, exchanging people, capacities and ideas.

Science as a subsystem of the metacybernetic system makes sense if its results help improve the quality of life. To get to Pratice, it engages Education as a knowledge distributor. (Anyway, they reached a number of the results together.) There is also the direct link between Science and pratice, but – its effect is limited by the resercher capacity to solve actual problems. (By this, one also means their emotional capacity to solve the same problems several times, as well as missing out on new challenges, new discoveries etc.)

Feedback information in the Science sunsystem is obtained from:

- Education – in terms of suggestions for supplementary or differently formalised documents, explanations, suggestions for pratice etc. – which would make them clearer and more acceptable to the ones who "collect" knowledge;
- Practice – as effects of the application of scientific solutions and/or (experimental) research, things noticed about the possibilities and needs of improving accepted solutions, as well as "demands" for new solutions. (Frequently, Practice is not happy, but is not able to solve the problem, so Science must give itself the task.)

In the case of P/S planning, Practice can, for example, employ P/S planners who are capable of making plans of optimal assortment of sales. If these planners then get their solution using the ABS method (Paretto selection), then the pratice will note that their rivals (whose planners are using Simplex method for optimising sales assortment) are

more successful and will in turm ask its own Education system to initiate the planner training programme (or they will employ a planner who has already undergone the right training). Education, in any case, is not given much time to change, to update its program (knowledge on offer) and to call those using its knowledge for an update of knowledge regarding assortment optimisation.

Education will, instigated by the demands of the Pratice with which it co-operates, demand from Science the missing solutions, if Science does not yet "see them". eg. Science can be exhausting itself over the variants of optimal solutions for the Job-shop problem and about three-dimensional assignation, and Pratice shows that those are merely partial solutions, that there is a need for integral solutions for the problems of operational planning.[5]

From the system in question - Science, Education and Pratice, one expects both effectiveness and efficiency. As they are of different nature, the solution can not be the same. According to the nature of things, more productive results are expected on bigger projects, where more has been invested. On the other hand, the demand for efficiency limits investments in research projects. Therefore the task of a country which, for example, is allowing (financing) the suggested projects, is a complex (and risky) one and demands criteria for the evaluation of the expected results and for evaluating competing projects. Even when a specific financier is ordering a problem solution, it is not easy to choose a project.

The question of defining the project task is, actually, the question of giving priority to the questions in certain areas of science. It implies a thorough understanding of the problem area and its existing solutions (so that one is not looking for already exsisting solutions, or ones which can be obtained). However, on the global front, scientific and educational centres are distributed and relatively conected. Even with the Internet, the mobility of reseqrchers etc. many things are still "corporate secrets" . Or they can not be seen clearly at least, because of their great numbers, or barriers (linguistic, lexicographic, ones of standard...).

There is an idea to construct, on a global level, a clear, transparent and open Space of Knowledge ([8], [9]). Its dimensions would encompass all the branches of knowledge and each one would then be "decomposed" into narrower areas – all the way down to actual facts/solutions. Within the area of Management, for example, a Space of Management Quality would be constructed ([8], [9]). Its dimensions would encompass the significant areas of management – according to the phases (Planning, Organisation, Realisation, Control) and, within those, according to the metamanagerial tools (models, methods and techniques, tools, technical means, experience...).

The description of that space would be similar to Mendeleev's Periodic Table of Elements (in its source format), with spaces for knowledge which has not yet been acquired as ideas for further exploration). By introducting a Measuring System into the Space of management quality it is possibile to assure a gradual development of solutions for certain problems. That would save scientists time in searching the existing solutions, and enthusiasm could be saved for problems which demand patience and sacrifice; those in Practice would find it easier to find the necessary knowledge and could more precisely order

[5] These past few months there has been a great deal of (this author's) work on intergrating the problems of assignation and Job-shop.

"knowledge packages" from Education. At the same time, the Space of Knowledge would be open to being filled up with new knowledge.

The pratical side of this idea alreay has a base – in the hard-copy of the knowledge variants (in libraries, on the Internet); it would be necessary to make them systematic – define the Space of knowledge and make it available to the general public. (Naturally, actual Pratice will, for a long time yet, guide its specific knowledge, as a sign of competativeness.)

Problems for realising this "cost-saving" variant of research organisation, knowledge presentation and knowledge access are:

- Agreement about "communal ownership" regarding the knowledge acquired to date (giving everyone who wants to the right to use them );
- Medlling of the Space of knowledge (open to new discoveries);
- Financing the buiding and maintaining the Space of knowledge;
- Communication in building and using the Space of knowledge...

For the last one of those, it seems, there are not too many obstacles: the English language has become the "international language". (This does not mean that those interested can not, for themselves, make a similar space or, better still, to translate the World Knowledge Space into their own languages.)

As far as access, usage and filling up of this space is concerned, current software tools give enough supprot. Amongst others, one would like to point to Edutella[6] project here, or, better still the ADMIS[7] [11].

## OUTCOMES/CONCLUSION

For a better world, people should accept the old saying "G*ens una summus*"[8], and get over the narrow, selfish interests and integrate themselves into the human community. There is a chance (not only in the given case) to use the power if knowledge to improve the quality of life. That is why it is pointed out that there is a need and possibility of a "Knowledge revolution": shaping World Knowledge as an output of the metacybermetic system of knowledge. This would "open the door" for a mass involvement in science/knowledge, for a Knowledge Society.

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[6] Edutella project. The Edutella project has the goal to design and implement a schema-based P2P infrastructure for the SemanticWeb. Edutella relies on the W3C meta-data standards RDF (Resource Description Framework) and RDF Schema (RDFS) to describe distributed resources. The main application area for Edutella is the exchange of learning resources, though the Edutella infrastructure is general enough to cater for any RDF-described digital resources on theWeb.

[7] ADMIS project. An solution of the ontological heterogenic textual resources search problem on the Web which is applied in a distributed version of general system for administrative business ADMIS which is developed in the Laboratory for Information Systems, Faculty of Organizational Sciences (Belgrade, Serbia and Montenegro). Developed system solution is based on an abstract model, its corresponding abstract query language and on P2P ("peer-to-peer") architecture which allows users to query using their local ontology and schemas, whereas searching is performed across available peers no matter the ontology or model used for storage and description of resources in peers. The abstract query is represented as an XML document according to the appropriate XML schema.

[8] "We are one species", lat. saying.

From the standpoint of Pratice it is necessary to divide knowledge and the general contribution to its development. Both already exist. This also brings up the question of its accessibility, price, currency, applicability… A joint effort to developing knowledge also exists, but, on one hand, it begs the question of the possibility of knowledge application – especially in P/S ("brain drain", poor material base for using the newest knowledge…), and, on the other hand – there is the need for more effective an more efficient generation of knowledge.

The case is pleaded here for the global integration in the formalization of already existing knowledge – in order to 1) more efficiently approach knowledge and to 2) more efficiently spot the missing knowledge. It is therefore expected that the building of a "Metacybernetic knowledge system" (Pratice – Education – Science) would lead to a faster development of Science, World knowledge and even quality of life.

From the standpoint of "knowledge producers" – scientists, it would make more efficient "preliminary work" possible (and finding existing solutions) for solving the problems of the Pratice. In such a scenario it would be possible to direct all the enthusiasm and creativity of a creator directly into creating value – into generating solutions for their inclusion (through the "Metacybernetic system of knowledge") into World Knowledge.

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Perhaps this story has already been told (and/or there are better solutions) but, that only goes to prove the hypothesis World knowledge needs to be adequatly structured, made more transparent and then accordingly directed following research.

Simultaneaously, it is necessary to develop the education system too – to use the existing knowledge, as well as to point out to Science the missing solution and prospective deirections for research. Pratice would have 1) more chance to find (and follow) the newest scientific results and 2) the task of (to the other participants of the knowledge flow) actively supplying information about results of application of specific knowledge (by including experience in the World Knowledge).

The realisation of the above idea would require global networking: getting involved in the standardistaion of research result forms, creating a transparent global knowledge base, engaging people for the maintenance and checking of the Space of knowledge and – allowing access (perhaps even actively suggesting) to World Knowledge to everyone – or free use.

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*There is the hope that the ideas will come to pass and in so doing help decrease the number of the victims (of sacrifice) amongst the "workers of knowledge" , to make science into a game – creating, so that many more people (everyone who so wishes) can join in (even with the smallest of contributions). That would really create a true "Society of knowledge", whose motivation and efficiency in contribution to the World knowledge would be bigger, the effects of the effort – also great and the world – a better place.*

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# METAKIBERNETSKI MODEL NAMENJEN INTEGRISANJU TOKOVA ZNANJA U OBLASTI PLANIRANJA PROIZVODNJE/USLUŽIVANJA

**Jasmina Omerbegović-Bijelović**

*Uzevši u obzir stalni rast potreba ove civilizacije, neophodnost razvoja proizvodnih kapaciteta (kao i obrazovanja potrebnog za planiranje proizvodnje/usluživanja) je sve više izražena. Postoji opšta saglasnost o potrebi obrazovanja (ali verovatno ne toliko i o njegovom vrednovanju). Veza između nauke i obrazovanja ističe sve jači uticaj na nauku – učiniti je efikasnijom i delotvornijom u prenosu/proizvodnji primenjivog znanja – ulaz u obrazovni sistem (i kroz njega, u industriju). Imajući na umu "pritisak" pod kojim su "obrazovni kadrovi", potrebna im je pomoć u razvoju (kreiranju i distribuciji) znanja (i veština). Zbog toga se ovaj rad fokusira na mogućnost povezivanja sledećih sistema: istraživanje, obrazovanje i primena znanja od strane metakibernetskih sistema (MKS) i metamenadžment – koji se koristi u MKS (ilustracije se tiču koncepta povezivanja prakse, obrazovanja i nauke- u oblasti planiranja proizvodnje/usluživanja).*

Ključne reči: *nedostatak prakse, planiranje proizvodnje/usluživanja, znanje, obrazovni sistem, nauka, obrazovni kadrovi, svetsko znanje, metamenadžment, metakibernetski sistem.*