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ON QUALIFIED USE AND APPLICATION OF KNOWLEDGE

Ladislav Tondl*

Abstract

The new topics in the spheres of science and/or technology policy, i. e. the knowledge management, was influenced by problems connected with great and complicated technological projects. The paper presents the main motives and sources of knowledge management, of qualified use and application of knowledge, especially the selection and integration of adequate data and knowledge, the selection of relevant knowledge sets and their integration.

Keywords: *knowledge management; application of knowledge; problem situation; integration of knowledge and values*

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By way of introduction

Since the early days of his studies on communication processes the author of this article has been interested in what is perceived as an active role of the recipient of statements and the related topics pertaining to the reduction of data and messages, and the issues of data relevance. His first work devoted to these subjects, co-authored by the distinguished mathematician A. Perez, was published by P. Bernays in a highly prominent book on information and prediction in science as early as in the 1960s. Of considerable significance for the purpose of an information-based evaluation of the rate of relevance, a topic also discussed in some other works by the author, has proved to be recipient's level of training and overall competence, his ability to select and apply adequate data and knowledge. This is also concerned with some specific restrictions in data and knowledge applications, notably in connection with technical solutions. This, in turn, is closely associated with the theme of all-round evaluation of prepared or planned technical artefacts and their impacts, hence a domain traditionally called "technology assessment". It was T. Kotarbiński who encouraged the author to write his first work on these issues. The topics of qualified as well as responsible use of knowledge are also bound up with problems relating to the boundaries or conscious restrictions imposed on some applications, and also to value-related and primarily ethical requirements. (One of the first meetings on these topics to which the author of this study had been invited was convened in 1991 by the Royal Academy in Canada and immediately afterwards by the Toronto University.)

1. Motives and sources of knowledge management

Acting somewhat automatically, we presume that many terms, expressions and kindred concepts are thoroughly understandable to all and sundry, that everybody understands their meaning and that, therefore, there is absolutely no need for their interpretation. This assumption is

definitely fully justified in an ordinary conversation and interview held within a small group and when using common parlance, when talking in a professional group whose communication revolves around generally comprehensible themes etc. Much less justified is this assumption especially in case of the mass media, which usually conceive and formulate their messages tailor-made for a "universal recipient" whom they expect to be able to guess quite easily the actual meaning of newly coined words and terms, assuming that he is capable of grasping the meaning from the context or through frequent repetition. In spite of this traditional and long-repeated practice, what really holds true in this context is an analogy to the well-known Latin formula: "si duo accipiunt idem, non est idem," i. e. the finding that each communication process has not only its own source, its originator or author, but also its recipient who, as a rule, is not equipped with a universal competence to be in a position fully and adequately to grasp the meaning of the message received, including its full comprehension and use of the knowledge thus obtained. That is also why, a specific – usually previously acquired – knowledge competence is essential for receiving, comprehending as well as using newly acquired knowledge. After all, the sequence of specific thematic areas in the education process is adjusted to this particular goal to a large extent. It is common knowledge that in lifelong education programmes and courses, relationships between the terms delineated a priori, and those appropriated a posteriori must be respected. These contexts, too, are known to apply the well-established principle of cognitive activities: We tend to view everything newly acquired, newly discovered, newly emerging or newly unveiled through the prism of our existing knowledge and experience, as corroborated by the means used to denote or name newly learnt objects, processes or situations associated with those previously learnt or utilized semantic spaces.

While those particular spheres of action conducive to new discoveries and new knowledge are undoubtedly challenging, and require highly

qualified, creative and inventive subjects, no less demanding are those domains of management and decision-making connected with fruitful, efficient while responsible use of knowledge and the methods of possible solutions of newly emerging problem situations. Looking back at the corpus of experience amassed by science and development in the past century, we may single out two personalities who coordinated research and development efforts, while managing the process of application of the results of such endeavours in major projects.

During World War II it was Vannevar Bush, a scientist at the famous technical university MIT, who was commissioned to coordinate research and development projects carried out by large teams consisting of leading US scientists, joined by dozens of European émigré scholars, who were expected to contribute to Allied victory in the war. This applied not only to the development of nuclear weapons and to the Los Alamos laboratories, but also to fire control and to the well-known issue of prediction, application of antibiotics, use of the radar, to the breaking and interpretation of secret codes, and many other tasks V. Bush was in charge of as the Director of the Office of Scientific Research and Development.

The other personality who succeeded in coordinating and integrating America's scientific, research and development projects was Alvin M. Weinberg, head of the President's Science Advisory Committee and Director of the vast National Laboratories in Tennessee. A. Weinberg participated in the programs designed to offset the so-called sputnik effect, and conceived a program of what was characterized as the "information society". (As a matter of record, the author of this study met A. Weinberg at a European-American seminar on the prospects of science held at what was then the Yugoslav nuclear centre Herceg-Novi in 1968; after the Soviet-led invasion of Czechoslovakia A. Weinberg exerted efforts, though eventually unsuccessful, to invite the author to the United States.)

In actual fact, the topics tackled by those teams as well as the programs and projects pursued by groups of specialists active in many differ-

ent branches that were coordinated by the personalities mentioned above almost half a century ago, and, undoubtedly, also many other research teams and projects, had not been limited solely to the issues of the past century. Also at present, we have to deal with many other – no less serious – problem areas, such as e. g. climate change, environmental problems, issues pertaining to new sources of energy, and their limits and risks. One may also consider the nature of the current and perspective level of our civilization or a civilization facing a high level of risks. The task of reflecting the actual nature of such comprehensive and multidimensional problem areas is inconceivable only on the basis of the knowledge of a single branch, a single discipline or a single thematic field. There arises the need for pursuing such activities, challenging in terms of their intellectual and knowledge requirements, which are sometimes described as *knowledge management* or *knowledge mastering*.

Knowledge management makes it imperative to ensure at least the following substantial steps, including subjects competent enough for their reliable implementation:

- Well-defined knowledge areas essential for a reliable attainment of delineated goals, including involvement of qualified and competent subjects for their application.
- Necessary, accessible or available means, including prerequisites in terms of capacity, personnel and other preconditions.
- Vital measures aimed at integrating and coordinating applicable knowledge as well as means, while determining their relevance and rate of participation in the individual constituents of an overall solution.
- An overview of advantages and disadvantages, usefulness as well as losses or risks posed by alternative procedures and solutions.

- Well-defined boundaries to the usability of the individual methods, approaches and solutions, and their secured compliance within a plan of inevitable and necessary procedures.
- A course and sequence of individual stages necessary for finding a solution, vital checkpoints or phases for monitoring and assigning responsibilities.

Naturally, knowledge management may also comprise some other components, which may concern some other conditions as well. In specific situations, one may view as significant reflections of the prevailing prerequisites and feasibility terms, other phases on the time axis, other shapes or forms of applicability of the existing results etc.

The actual content of most components of knowledge management is shaped by the prevailing nature of those types of action in which specific knowledge will be used or to which it will be applied. Seen in this light, it is definitely crucial to distinguish the main spheres in which the acquired and available knowledge will be employed. The well-known and oft-repeated formulas claiming that knowledge will serve purposes of practical life, that it will be duly applied, actually say very little of the genuine aims, failing, as they do, to take into consideration the quality or level of such practical use, failing to respect the target orientation of such application, what and whom it benefits, and other possible contexts. Of equally low informative value is the phrase claiming that science and research "serve the people," as proclaimed, until quite recently, by the totalitarian power in this country and its ideology whose representatives made use of such claims as a smoke screen to cover up their own partial interests. After all, the entire complex of "service" or "serviceability" has always been more or less a hindrance and obstacle to any real upswing in creativity and initiative, and in cognitive activities as well. What appears more acceptable in this particular context is the thesis that the gist of knowledge application lies primarily in incorporating hitherto known and time-tested findings

into decision-making processes, into procedures of reasoning, which constitute starting points for selecting goals, means and conditions of different types of human actions, primarily those types of action in which knowledge is inevitably engaged.

But man applies knowledge virtually in all his steps, in all his decisions, notably because he is endowed with a memory, that he is capable of accumulating experience, that he is able to make ample use of the conditioned reflex. Nevertheless, we can single out some areas of human rational actions in which the systematic engagement of hitherto accessible and available knowledge is a *conditio sine qua non*, i. e. an absolutely inevitable condition. These areas cover primarily organized cognitive activities themselves, i. e. the sector of science and research, including processing, designing and presenting the results of cognitive activities. This, in turn, is connected with the issue of qualification requirements for such activities and, therefore, with the fact that acquisition of new knowledge presupposes that these procedures invariably involve both specific hypotheses concerning what was unknown or what is newly discovered, based on the hitherto available knowledge, as well as linguistic means and means of expression, terminology, time-tested and already known methods, empirical and experimental tools etc.

Another major sphere of application and use of hitherto known and verified knowledge and experience are procedures and methods associated with schooling and the educational process in general. After all, it is a matter-of-course that only people who themselves are endowed with the light of vision, who are capable of conveying and presenting knowledge in an interesting and convincing fashion can educate and edify others. Furthermore, the ways and means of diffusing knowledge are also governed by some specific rules, and not only those involving the need of respecting the age and maturity of pupils, but also rules regulating the contexts and especially the sequence of different thematic fields, according to which entry into new domains, i. e. areas novel to the recipient, calls

for mastering and appropriating other fields. It is, therefore, quite evident that the disciplines involving the processes of upbringing and education require an integration of many important insights and contexts, including recipients' intellectual and competency levels, contexts pertaining to the thematic fields being disseminated.

Probably the most closely followed domains of human activities, in which acquired knowledge is applied, and this pertains primarily to knowledge of a different nature or – to put it succinctly not only "the knowledge that" but also "the knowledge how" (know-how) – are spheres of creative activities. These are pursuits enabling man to satisfy his needs, including the elementary and essentially intrinsic needs as well as needs for his self-fulfilment, while attaining acknowledged and required values. A pride of place in these domains is held by those activities through which man creates various sorts of artefacts, and hence also technical artefacts, cultural artefacts and works of art, and, undoubtedly, also artefacts of social, political, organizational or economic nature. Quite evident in this respect is the role of knowledge, both previously acquired and verified by experience, as well as new findings obtained in the sector of technical artefacts, as spelt out by their designation coming from the Greek word "techne", which originally denoted a skill or an ability to perform a specific action. Seen in this context, one can hardly fail to notice that, in addition to knowledge, participating in the fields of technical artefacts are also recognized and acceptable values, taking part in their genesis, development, innovation procedures as well in decisions through which certain types of artefacts are discarded, replaced by others – more perfect or better suited – to satisfy the existing needs.

The actual share of such values in a sequence of changes, in innovations or in the emergence of new patterns, models and their preferences is, however, still more pronounced in those spheres of artefacts, which are generally characterized as works of culture, works of art or artefacts of intellectual or social nature. This also holds true of actions, pursuits

and measures geared to satisfy specific interests, needs associated with self-fulfilment and entertainment, applying all the more so because such interests or needs are – to a considerable rate – generated by the media, the advertising industry or by artificially created models, which, in turn, may cause doubts about the actual values applied in such activities, and – at the same time – about an absence of a more serious kind of knowledge. (This, however, is a different topic pertaining to the issue of ignoring knowledge or not respecting available knowledge.)

2. Structure of knowledge application

Procedures in which specific knowledge is applied may appear as "one-off" acts. In actual fact, practical application of specific knowledge invariably proceeds in a whole series of interconnected steps, thus having a specific structure, where the elements of such a whole are mutually dependent or contingent and where the relations and interconnections of those elements must be respected. We presume that knowledge, and – as we should stress – always adequate knowledge as regards the other elements of the whole and in view of the goals of the selected action, is applied in a decision-making process. This is associated with a choice of objectives and means of that particular action that is being – or is to be – started to effect a desirable change, eliminate identified shortcomings or risks, or – to put it in other words – participate in solving a specific problem situation. One may readily agree with the view expounded by K. Popper that goal-directed rational actions filling human life are, essentially, solutions of problems.

As a rule, each solution of a problem situation is preceded by a stage that may be described as problem identification, as recognition or awareness of the situation in hand, for which a change is desirable, in which a specific shortcoming or anything that has to be eliminated, surmounted or replaced by something else, by something we perceive as more suitable, perfect or profitable, has been duly identified. In this way, we create

an image of a desirable state or situation, which has to replace the actual situation. Such an image then constitutes the core of a considered target orientation. We then tend to associate certain positive anticipations with the target orientation of such a considered or planned action. A case in point illustrative of such a problem situation is the process of identifying a source of disease on the basis of ascertained physical or mental problems, and related need for medical intervention and thus for a pattern for shaping a diagnosis and subsequent therapy. The actual pattern or structure of such a situation comprises the following significant elements in particular:

- identification of an unsatisfactory state, for instance pain, specific troubles – etc.;
- determination of the main signs or manifestations of such a state, i. e. symptoms;
- identification of the patient's overall situation, his medical history;
- primary hypothesis of a diagnostic decision;
- confirmation of the primary decision through additional evidence or tests.

This particular pattern has the nature of a judgement, whereby its premisses are formed by known generalizations, i. e. medical knowledge making up a corpus of findings expressing interdependence of specific sets of symptoms and diagnostic decisions, available empirical records encompassing identified symptoms and patient's known case history, and – in conclusion – a diagnostic decision itself. It is only natural that such a pattern may be expanded and supplemented, both by extending empirical records, i. e. by means of further tests, for instance through laboratory testing, by engaging further knowledge, for example by inviting other specialists to form a medical council.

The pattern given above for solving a problem situation is based on contexts of *generalizations*, i. e. formulations characterized as scientific

laws, hypotheses (usually confirmed hypotheses), empirical generalizations or generally valid formulas similar to laws involving delineation of a thematic or problem area, actual *empirical evidence* describing identified states or situations, a known sequence of changes of those states, certain specific *human actions* or interventions and their known or verified impacts. In decision-making, a problem situation is usually accompanied by a specific *expectation*, i. e. anticipation of possible states that occur without human actions or interventions, and expectations of possible impacts or effects coming in the wake of such interventions. Incorporation of the element of expectation into the pattern of decision-making about a problem situation, whose result is a decision on the start-up of a specific human (practical) activity or intervention, means that this particular decision-making has its own prognostic dimensions based on the knowledge of an actual situation, the knowledge of a specific thematic or problem field to which this situation belongs and the knowledge of effects or impacts of possible or practicable interventions in the given problem area.

The backbone of the decision-making procedure given above and, at the same time, of analogous procedures operating with generalizations or with rules pertaining to a specific domain or a well-defined thematic field, with singular data concerning states or situations in the same area, are deductive procedures (often characterized as logical deduction or inference). Such inference has the character of deterministic or merely probabilistic deduction, displaying the nature of a solution of a justified recommendation, i. e. substantiated by the level and quality of the knowledge employed as a premiss used in that particular reasoning. Hence, it is not a command but a recommendation given to the subject of such activities, which are selected for the purpose of tackling a relevant project situation and for the purpose of meeting its outlined objectives.

Therefore, the procedures of knowledge application while searching for or determining the nature of a problem situation are known to have the nature of argumentation for a selection of an identified project situation.

This also means that they do not relieve of responsibility that particular subject who has found a specific solution of the given situation or who has initiated such a solution through his instructions or commands.

3. The quality of the solution of a problem situation

We usually give most of the credit – and usually also assign the main deal of responsibility for a successful solution of a problem situation, its quality and usefulness – to the subject of the solution concerned. Such a subject may be a physician in case of a therapy applied to cope with a medical problem, a designer and author of a technical project conducive to safeguarding desirable measures or functions, or a guide who succeeds in leading us through a difficult terrain to our planned destination. Credit is undoubtedly due to the subject of the process of solving a problem situation, provided that subject is, indeed, endowed with necessary and adequate knowledge, and has at his disposal essential technical instruments, needed capacities etc. Seen in this light, is it crucial for a physician to acquire an extensive corpus of knowledge and command specific practical skills and thus prerequisites requiring long and demanding studies, practical experiences, which are being constantly supplemented as well as checked, as confirmed by existing systems of certification, accreditation, attendance at meetings and conferences that report on new findings and methods and introduce an ever expanding and ever more complex array of diagnostic technologies, knowledge on new operating and therapeutic procedures and information on latest medical risks. Even though current medicine does develop the age-old traditions going as far back as to ancient Greek medicine, doing so primarily in terms of its ethics, the present-day curative procedures have been developing and improving very fast indeed. In a similar vein, contemporary designers or technicians working in most technological branches have to cope with new requirements and knowledge prerequisites. They have to operate with a greater extent of data and

knowledge, using more extensive databases, usually in digitized forms, complete with application of information technologies and computer graphics. They have to be able to depict simulations of the actual operation of a planned and designed equipment, taking into account eventual, albeit probable, risks. Indeed, the threat of possible risks, accidents and adverse – mainly health and environmental – impacts has grown to be an organic component of today's creative technological thinking.

It is only natural that each successful action, each solution of a problem situation, each package of measures focused on attaining specific goals or desirable results makes it imperative to engage specific knowledge. This knowledge, however, usually does not lie in the centre of general attention. More often than not, attention is concentrated on the subject of such activity or on representatives of the powers that be who decide on the start-up and implementation of those creative pursuits. This eventually leads to such general statements claiming this or that king or prince built a certain palace, created a highly praised cultural monument or another grandiose work. If those in power had, indeed, given an impetus to a project or decided about its implementation or taken some credit for the achievement of some specific results which have managed to retain their permanent value, this attests to their good level of knowledge or the high standards of knowledge of those whose advice they had followed. But we also know quite opposite examples, when overly self-confident holders of monopoly power mistook the possession of power with the possession of adequate knowledge, focusing their decisions and commands in keeping with their ideology based on the visions and values anchored in the past, e. g. in the 19th century and in the early days of the industrial revolution. (A well-known outcome of this particular focus in our country was an upswing of its heavy industries and the material- and energy-intensive branches that polluted the environment and virtually amounted to nothing else but an extension of the hitherto known processes and procedures.)

Having said that knowledge is a substantial prerequisite for selecting the most suitable goals, for finding the best solution to a problem situation, surmounting serious obstacles or dangers, choosing adequate instruments, resources and capacities, we mean knowledge in the broadest possible sense, i. e. not only written or verbal knowledge but also any findings incorporated into a body of confirmed experiences and skills, knowledge of anticipated benefits and possible risks, knowledge taking into account the existing value, cultural, human and social aspects, and thus, also those dimensions of knowledge collectively known as "wisdom." This also means that a sophisticated and wise knowledge application, as part of a package of goal-directed activities or a solution of an acknowledged problem situation, proceeds with full responsibility, with regard to those who are to benefit from – or who are eventually jeopardized by – this application and related action, with regard to the consequences or impacts it may have. (This is also spelt out by the ancient rule formulated in Latin as "Quidquit agis, prudenter agas et respice finem," i. e. whatever you do, do it with the knowledge of and regard for its consequences.)

It is usually insufficient to have only the command of available knowledge for effecting a desirable change, for tackling an identified and acknowledged problem situation or for attaining outlined goals; it is likewise crucial to have at one's disposal a well-justified and competent decision, usually motivated by other reasons as well, for instance by the conclusion and conviction that a planned change or a considered project is, indeed, necessary, indispensable, that vital means, resources and capabilities are really available, that such a required or planned work will be positively received and appreciated. To put it in other words, there is a need for what can be characterized as a *value atmosphere* or value situation. Expectation of a project's predominantly positive reception and appreciation is usually also involved in the process of starting up a real action or making a necessary solution. This also means to say that a corpus of knowledge, engaged in and applied to solving such a problem situation,

is used primarily for assessment and decision-making on the conditions, prerequisites as well as *feasibility* of a specific solution, of a certain goal-directed action. However, implementation proper or solution itself are stimulated by other factors as well. This may be aptly demonstrated by an historical example. The knowledge that the Earth is round confirmed expectations that a westward journey from Europe could offer a shorter way to India or, in other words, to the sources of highly demanded Oriental spices, but the decision itself to set out on such a journey was also stimulated by ambitions to find a faster and easier path to those resources.

Even though the share of a specific set of knowledge in rational actions and especially in the quality of their results, whether this involves a solution of a problem situation, production of desirable artefacts, attainment of stipulated goals or whether other dimensions of such activities happen to be in the centre of attention, is quite indisputable, one cannot and should not question the specific role and impact of values on the overall focus of such rational actions either. Furthermore, the impact of values and a value-related atmosphere, of value-shaped models, preferences and expectations need not be expressly spelt out, it may be perceived as a matter-of-course or something generally acknowledged or anticipated. Indeed, the share of values and assessment will come out into the fore especially in those stages of decision-making and organizing activities, where available or applicable knowledge offers alternatives, namely alternatives comprising available and practicable goals as well as alternatives to suitable methods, approaches and available resources.

4. Knowledge application, selection and integration of knowledge

The start of the process of solving a problem situation, of a package of goal-directed activities aimed at achieving outlined targets and desirable states or effecting changes or eliminating specific obstacles or risks usually stems from a decision-making process. This particular procedure not only

outlines goals and stipulates applicable methods and means, but also applies specific knowledge, while evaluating its adequacy and relevance with regard to the given objectives. It is necessary to create at least the following sets of knowledge and related singular data for decision-making on the start-up of target-oriented action in the given general sense:

- knowledge of the domain or thematic area where changes are considered, where specific solutions of problem situations are planned or where achievement of specific desirable target states is envisaged,
- knowledge of the initial or problem states and knowledge of planned changes of such states, new and desirable or envisaged states,
- knowledge of the necessary resources, capacities and requirements of material, energy as well as personnel nature that are vital for the attainment of a target situation and requested states,
- knowledge of the feasibility of necessary procedures or measures, complete with an awareness of potential advantages and risks posed by such procedures, including possible, anticipated or merely probable impacts, and not only actual or just temporary ones, but also impacts likely to emerge in future stages.

But this is only a very general description of human goal-directed action, which may be characterized as natural human efforts to reduce the rate of indeterminateness or risks within our immediate as well as wider surroundings, to upgrade the qualitative or cultural level in those environs. It is only natural that such sets of knowledge and structures of their relations considerably differ in form, content and functionality, when efforts to alleviate pain and eliminate difficulties accompanying treatment are involved, when diagnosis and therapy are employed, when a project

and subsequent construction of a transport link between two parts of a large city are planned. Framework of relations among individual sets of knowledge in view of the target orientation of a specific type of rational action is identical or partly analogous.

Seen in this light, knowledge application is primarily an entry of individual knowledge corpuses into a framework of relations of the individual types of knowledge in decision-making procedures that decide about the start of a series and sequence of action whose implementation as well as succession also guarantee the direction and attainment of a planned target state. Moreover, some major rules, such as primarily those guiding the consistency of the individual types of knowledge, the rules of correspondence of various types, rules associated with the relevance of some kinds of knowledge and empirical findings or other important rules regulating relations or dependence of different sorts of knowledge, must be respected. The consistency rules presuppose that data containing empirical evidence and generalizations or other general rules are related to the same semantic space. The correspondence rules lay down the extent of dependence of the conceptual terms used in generalizations, and the terms used in expressing empirical evidence.

Of great importance for efficient utilization of various data and knowledge offered for decision-making procedures is that special quality of data and knowledge, which we usually characterize as data relevance and knowledge relevance. Relevance describes the information value of a specific statement and its content in view of the task in hand, in view of the knowledge to be employed to solve a given assignment, a specific problem situation or other target orientations pertaining to an action being pursued. But relevance is invariably a relative phenomenon, i. e. a specific statement yielding new data, and new knowledge is perceived in view of its consistency with certain generalizations or rules, in view of its applicability in decision-making on possible measures or interventions. In a similar vein, we consider the relevance of known or verified knowl-

edge in the shape of generalizations or rules in view of the tasks being solved and the procedures or means planned to be used therein. Data and knowledge relevance may have either a greater or smaller extent, it may, therefore, have the nature of a specific rate or measure. As an instrument of qualification, this particular rate appears – quite undoubtedly – best suited for different information rates that have been developed in mathematics and the semantic theory of information. This particular solution of quantification is based on probability attributes of all the elements of such relativization. This is usually quite difficult and not always sufficiently reliable. Problems seem to lie in the fact that – as a rule – we tend to operate with different sources of values of probability characteristics of the applied data and knowledge, for example values identified in differently reliable and variously representative sets, ascertained only from estimates or expectations based on experience. Only a final set of prerequisites may be taken into consideration in case of identifying such characteristics. In many instances, even adequately representative sets are prone to fast and often unexpected changes. Seen in this light, it is vital to emphasize that the rates of semantic information, and hence, thus constituted rates of relevance are invariably relativized towards the status of our "hic et nunc", i. e. here and now. That is also why a critical and restrained approach to the hitherto available rates of relevance as well as to estimates, anticipations and forecasts dependent on them is both necessary and useful.

Restraint and critical thinking are vitally needed in assignments that have to take into account data and knowledge of different types and of various domains. Most challenging issues and related tasks can hardly make do with a single type and a single source of knowledge engaged in a given situation or when solving a specific task. We take it for granted if a physician, while diagnosing a patient and determining a subsequent therapy, takes into consideration not only the symptoms that have been established empirically, but also asks for a battery of laboratory tests to be made and experimental findings to be supplied. What usually turns out

to be less obvious is when an experienced and well-qualified physician considers the patient's age, his overall case history, his psychic condition, social status and many other circumstances. A designer of a transport link connecting two localities will naturally take into account the nature and diversity of the terrain, anticipated traffic intensity, requirements for terrain adjustments, and a long series of other conditions. A designer, well aware of all the contemporary and current requirements, will also respect the distance of residential areas, anticipated noise and exhalation impacts, availability and connection of other transport systems, and other types of knowledge as well as anticipated forecasts. One may, therefore, say that the knowledge requirements laid on contemporary well-qualified and challenging projects can hardly be "accommodated" by a single knowledge discipline or a single scientific or technical branch. This gives rise to a situation where even manipulation with knowledge of different types and domains, and its expedient utilization and engagement in demanding comprehensive projects should be efficiently controlled and managed.

As things stand, the process of integrating different knowledge domains working and operating with different means of expression, with different terminology as well as diverse scales is definitely no easy or simple matter. This holds true especially of the mutual relations and integration efforts in natural science and technical branches on the one hand, and the disciplines dealing with humans, traditionally – but not very aptly – described as "social" (possibly better called "humanitarian") or "spiritual" on the other. However, it is, likewise, more than evident that all the issues, difficulties and notably conflicts and risks posed by the contemporary society have their own "human", "spiritual" as well as "value-related" dimensions. Furthermore, the task of reviewing the role, the relative weight and the function of the individual dimensions, while always doing this in the light of the particular task in hand, is neither easy nor simple. One can hardly ignore that many narrowly specialized experts have a tendency to overestimate the role of their own professional subjects and their related

insights and criteria. When tackling these assignments, which we call "knowledge management", the ultimate task does not involve solely an expedient integration of various types of knowledge and criteria related therewith, but also an integration of different approaches and views as well as an assessment of the rate of relevance of the individual insights, approaches and criteria. When solving such assignments, there are many values and interrelated human rights and freedoms, as well as our own global responsibility for ensuring and preserving those values, that come ever more strongly into play – in addition to various types of knowledge associated with a broad gamut of contemporary issues, prevailing civilizational and cultural standards, and with sustainable development of the human race.

5. On the significance of the subject of knowledge application

The topic of knowledge application and the key issues of "knowledge management" also encompass the matter of caring for – or rather keeping an eye on – the subject of knowledge application, or rather those human subjects who decide about the use of specific knowledge in a bid to attain or secure certain major goals. This is primarily concerned with the fact that some of the targets may eventually prove to be beneficial solely for a limited section of the human society, involving inhumane methods or procedures, posing serious threats to human lives, health and supportable living environment. Voices expressing – and frequently openly clamouring for – the attainment of such goals have not only persisted, even following the blood-curdling experience of the 20th century, but we are now hearing them coming from the lips of proponents of fundamentalist ideologies, heralds of racist nationalistic or religious violence or various forms of terrorism. (Seen in such contexts, we can hardly avoid posing the cardinal question: how long are we going to tolerate such voices, to what lengths are we prepared to go while looking on and conniving such abuses of the prin-

ciples of tolerance and the freedom of action and expression, which are jeopardizing our liberties and the security of other sections of the human community.) Indeed, there is a danger that the results of human learning, new products of science, research and technological development may be abused as well.

We may take it as quite natural that people in many professions utilizing extensive and often demanding knowledge are required to meet relatively considerable knowledge requirements. Judged by the actual nature of these professions, such requirements may be divided into several different groups, of out of which the following may be seen as particularly significant:

- A method of checking the application of knowledge and also skills, reproduction of the application procedures by means of a package of practical operations which, in their entirety, are geared to confirm the application of previously acquired knowledge, especially the type "knowledge how", may probably be perceived as an old traditional group of instruments designed to verify compliance with those requirements. A case in point is the set of procedures known from what used to be called journeyman's exams. Indeed, elements of checks of this kind have retained their significance as part of certificates issued to teachers, physicians and some other types of professions.
- Another kind of checks of competencies possessed by different subjects and their capacity to make ample use of their acquired knowledge lies in various tests, testing texts, written assignments. These forms are traditionally used at vocational schools, at higher-level schools. The importance of not only correct and apt reproduction of pertinent knowledge but

also its contextualization in various assignments or problem situations is emphasized in this context.

– Some demanding professions have in recent years witnessed stringent checks of the level of competency and professional qualification, making it possible not only to verify the actual quality of the results of such activities but also their effects and impacts in broader contexts as well as over a longer period of time. These involve various forms of certificates or certifications.

Even though we ought to welcome an extension of these and similar forms of assessments and checks of competence prerequisites for some challenging activities, the actual field of their operation still leaves much to be desired. It is limited primarily to the work of medical specialists and teachers, while other demanding and highly responsible professions stay more or less on the sidelines. There can be no doubt that members of some other professions should also be made to apply in their operation analogous requirements in terms of checks and evaluations of their crucial competencies. The author deems it necessary to offer here yet another recommendation relating to the operation of demanding and responsible activities. In addition to requirements for knowledge, experience and other competency prerequisites it is impossible to omit personal value prerequisites, notably moral integrity, an impeccable moral credit and a sense for personal and social responsibility. This applies primarily to activities involving managerial, normative or legislative roles in charge of larger social, economic and administrative units.

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