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Table of Contents

Editorial

(by ***Jing Tian*****)**

As Prof. Wierzbicki said in his speech at JAIST Forum 2006, "we are living in times of an informational revolution and this revolution leads to a new civilization era, in which knowledge plays a more and more important role than just information. We might say a new knowledge civilization era is starting". It is clear that, in order to keep sustaining competitive competencies, new knowledge and technologies appear to be faster required by individual, organizations, even nations in this new era. Along with knowledge creation and technical innovation, social innovation also takes place as either known or unknown ways. Social innovation refers to new strategies, concepts, ideas and organizations that meet social needs of all kinds and that extend and strengthen civil society. Thus, in the knowledge civilization era, we have to understand well how knowledge is created in hard sciences and technology, and its relationship and interaction with social innovation. For this purpose, we hold a forum on Knowledge Creation and Social Innovation at JAIST on Nov. 10-11, 2006. Prof. Andrzej P. Wierzbicki, Robert Kneller, Nico Stehr, Michael C. Jackson and Ikujiro Nonaka (listed in the speech order) were invited to present on the first day of forum papers on the topic of knowledge creation and social innovation. This was followed on the second day by discussions of detailed projects and recent developments of the COE Program. This issue represents the main content of the lectures on the forum, which are published here in the speech order, with one exception. Prof. Wierzbicki gave two presentations on these two days of the forum. Since the content of his first speech—"*Knowledge Science and Nanatsudaki Model of Knowledge Creation Processes*"—was already presented in previous COE Newsletter (Vol.2, No.4), here we publish his presentation from the second day.

Knowledge Creation and Application in a Local Context: Cooperation with Local Industry and Creation of New Companies

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Prof. Nakamori, thank you very much for inviting me to come to the charming town at this beautiful time of the year. My talk will focus on knowledge creation and its application in a local context, for example, Tokyo regional context. In the first part of this talk, I want to give a micro picture that would show the challenges facing regional universities in terms of knowledge

creation and transfer. The second part will deal with the steps needed to be taken to address such challenges based on the experience of JAIST. I also want to say that I am not a knowledge expert; my background is medicine, bio-medical research, and more recently, technology transfer and startup formation. So, it is more about bio-science, science policy and business, rather than knowledge science.

I would like to start by the practical point, i.e., what is knowledge creation and exploitation in terms of career opportunities and career incentives as well as the financing of R&D. With respect to these factors, there are two questions I want to discuss: how do peripheral regions in Japan compare with Japan's major metropolitan centers? And how do Japanese ventures compare with ventures in US?

Do you know what "Kakenhi" is? "Kakenhi" can be translated as grant-in-aid and is the main funding source by MEXT (Japanese Ministry of Education, Culture, Sports, Science and Technology) for university research. Roughly, it accounts for about 40% of all government aids for university research, so it is a big part of funding. Table 1 shows the distribution of this funding over ten-year period. The University of Tokyo (UT) has a really large share both in 1995 and 2005. The same you can find for Kyoto University and Osaka University. You also see the same universities appear across the ten-year period. The funding is very exclusive for few universities, and the order has not been changed very much, if you compare these 12 universities in 1995 and 2005.And if you look at all these research resources, it includes COE programs, national funds and so on.

	1995			2005		
Rank	University	Amount (10^8yen)	%of total	University	Amount (10^8yen)	%of total
1	U of Tokyo	125.5	13.6	U of Tokyo	201.2	11.7
2	Kyoto U	72.7	7.9	Kyoto U	131.1	7.6
3	Osaka U	61.3	6.6	Tohoku U	94.8	5.5
4	Tohoku U	41.6	4.5	Osaka U	89.8	5.2
5	Nagoya U	34.9	3.8	Nagoya U	64.6	3.8
6	Kyushu U	30.0	3.3	Kyushu U	56.8	3.3
7	Tokyo Inst. Tech	30.0	3.2	Hokkaido U	56.1	3.3
8	Hokkaido U	28.5	3.1	Tokyo Inst. Tech	45.4	2.7
9	U of Tsukuba	22.2	2.4	U of Tsukuba	30.2	1.8
10	Hiroshima U	13.2	1.4	Riken	26.3	1.5
11	Okayama U	9.5	1.0	Keio U	24.9	1.5
12	Keio U	9.1	0.9	Kobe U	24.7	1.4
Total		924.0	100		1714.4	100

Table 1. Monbusho/MEXT Grants-in-aid (all types, new and continuing projects)

I do not want to put America forward as a good alternative model. Nevertheless, I think it is helpful to compare the situation in USA. I am sorry I do not have data for two different years. This is the most recent data from 2003, showing university ranking by government funding (Table 2). There is almost equal share between private universities and national universities. And it is also a good geography mix between east coast, west coast, and central section, between private and state universities.

Now I put all of these contexts (university grants-in-aid, joint research, startup and population) into Japanese regions. I divided Japan into three regions in terms of metro area analysis (see Fig. 1). The first three largest areas are Kansai, Kanto, and Nagoya areas. In this case, Kanto area includes Tokyo, Yokohama, and Saitama; Kansai area includes Kobe, Osaka, and Kyoto. The next four areas are defined by Sapporo, Sendai, Hiroshima, and Fukuoka. The mauve is population; the blue is "Kakenhi" (grants-in-aid); the yellow is joint research finding from private companies; and the light-blue is startup companies. You see that the big concentration (of university grants-in-aid, joint research, startups) in these three largest areas is also over concentration in terms of population of these three areas, and then with the other parts, less, especially less with respect to the government funding, not so much with respect to startups.

All source rank and university name	All sources	Federal gov't	% total Federal	State/loc gov't	Industry
1. Johns Hopkins U. incl. APL (private)	1,244	1,007	4.47	3	20
4 U. of Washington–Seattle	685	566	2.29	12	48
2 U. of Michigan all campuses	780	517	2.09	17	36
8 Stanford U.(private)	603	484	2	4	31
2 U. of California–Los Angeles	849	421	1.7	67	30
9 U. of Pennsylvania (private)	565	416	1.68	2	27
6 U. of California–San Diego	647	400	1.62	24	29
3 U. of Wisconsin–Madison	721	396	1.6	41	16
23 Columbia U. (private)	438	386	1.56	2	5
24 U. of Colorado, all campuses	437	378	1.53	8	10
6 U. of California–San Francisco	671	372	1.5	27	37

Table 2. US academic institutions ranked by 2003 Federal R&D funds ($ million)

Figure 1. University Grants-in-aid, Joint Research, Startups and Population by Metro-area-defined Regions

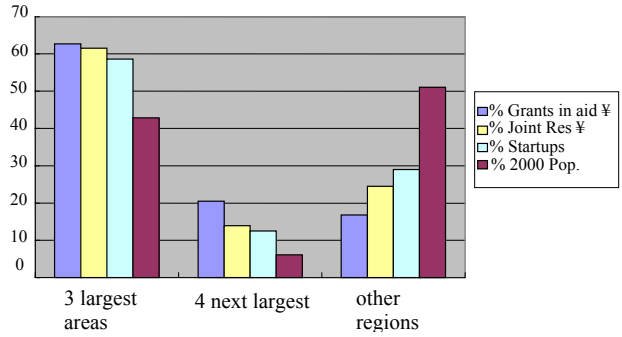
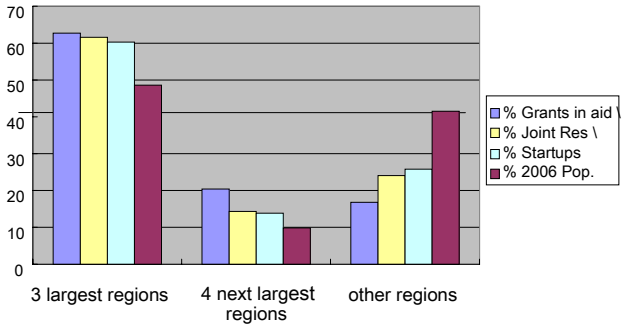


Figure 2. University Grants-in-aid, Joint Research, Startups and Population by Prefecture-defined Regions



I also tried to divide Japan into three regions by prefecture base and got the similar pattern (Fig. 2). The three largest areas are Kanto, Kansai, and Aichi. Kanto area consists of Chiba, Saitama, Tokyo, and Kanagawa (Yokohama). Kansai area consists of Shiga, Hyogo (Kobe), Kyoto, and Osaka. Aichi area includes Nagoya. The next 4 largest regions are defined as all of Miyagi Ken (Sendai), all of Hiroshima Ken, all of Fukuoka Ken, and also Sapporo. I do not want to include all of Hokkaido. Again, you still see the similar result with Fig. 1. *To sum up, over 80% of government funding for university R&D, and 70% of entrepreneurial activity are concentrated in seven population centers that account for about half Japanese population.* Thus, there is an imbalance, higher than US.

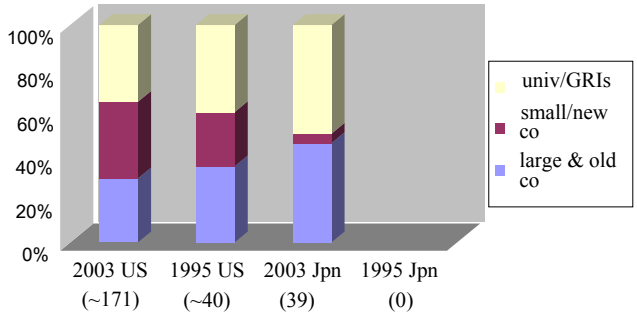
Now I want to talk a little about startup in general, because I think startups are a part of issue and also a part of solution. I think the startups might be especially important for regional universities, as a means to explore university power. This is because:

- Few existing local companies can develop regional university discoveries.
- Even if university discoveries are picked up by regional companies, such as the big companies in Tokyo or Osaka, the controls of those discoveries always are simply away from the region. There are few high value added jobs created locally and there are reduced opportunities for technological development in region.
- Reflecting on previous slides (Fig. 1 and 2), entrepreneurial drive may be more evenly distributed than governmental or corporate R&D support.

Here I would like to read a comment from the director of the university-industry liaison office of a major Canadian university: "Canada has no large [pharmaceutical] companies, The only alternative to licensing our university's [biomedical] discoveries to US companies is to create our own startups and to help them grow. This is the only way to keep good jobs and value-added development in our region." If you change Canada here to any of prefectures, for example, Ishikawa, the situation is same. In Japan as a whole, the role of high technology startups is more limited than in the America.

Fig. 3 shows the nano patents issued by USPTO (U.S. Patent and Trademark Office) and JPO (Japan Patent Office) in the year of 1995 and 2003, and their domestic applications. The yellow is the ventures from universities; the mauve is the ventures from small or new high-technology companies; and the blue is the large and old companies. When we look at Japan, we see that almost all of the ventures come from universities or research-supporting organizations and big companies. Compared with America, there is small difference between universities, and big companies, but small or new companies are clearly underrepresented in Japan.

Figure 3. Nano patents issued by USPTO and JPO to domestic applicants



What are the challenges facing ventures in Japan? I think the big challenge is the recruitment of skilled managers and R&D personnel for Japanese high technology ventures. We found the most numerous and successful startups are in biomedicine, but the total employment in therapeutic-oriented ventures in 2005 was less than half in US bio ventures of equivalent age in 1987 and 1998. And the average employment per company in 2005 is about one third that in equivalent-age bio ventures in US.

What are the options for strong regional universities, such us JAIST, to increase knowledge creation and exploitation? One is to increase core academic capabilities, the other two are to increase cooperation with existing companies as well as to increase and nourish startups. The isolation of regional universities may paradoxically be an advantage for startups.

What are the practical steps for regional universities to increase knowledge creation, and in particular knowledge transportation? I just listed five steps. These steps are independently conceived by JAIST faculty. Much of the following reflects the ideas and actual accomplishments of JAIST as a part of the JAIST COE project.

A. Outreach to industry

Industry-university cooperation center has been established in JAIST. Two staff members work as an industry coordinator from prefectural government and a businessman. Their work focuses on linking material science faculty with the local business. There is at least one on-going collaboration related to ceramic dyes.

B. Streamlining joint research administration

Intellectual property (IP) office has been established within the industry-university cooperation center as JAIST TLO (Technology Licensing Office) or TTO (Technology Transfer Office). It also manages personnel & financial aspects of joint/collaborative research contracts. One staff member works here. JAIST has already applied for a patent on at least one invention (ceramics related), which is in the process of licensing now.

C. Internships in industry for students

With 80 joint research projects (mainly with private companies) at JAIST, I supposed the most professors who maintain Ph.D. students are in one or two joint research projects and I believe that most of the Ph.D. students do work in somebody's projects, which broadens their research perspective. The collaboration between universities and companies is not only helpful for companies but also usually very helpful for education of graduate students. As for the master students, about 10% of them do internships each year. The length and location of the internships vary; about half of them may be outside local region. Of course, it is very helpful, especially for the master students, in job matching.

D. Business Administration (BA) and MOT programs

Most students of MOT programs at JAIST are in 40s and from local businesses. They are interested in R&D management, including management of university collaborations and management of patents and intellectual property (IP); interested in use of software and related business management tools; and interested in the issue how to deal with globalization. BA and MOT programs could not only educate students and local businessmen, but also promote links between local companies and improve local businesses.

E. Facilitate startup formation and support

JAIST has about 10 startups currently, which puts JAIST in top one third of national universities. The government backed regional banks and credit institutions have been important sources of finance. This is actually continuing in a long (and probably successful) historical practice. JAIST also has Venture Business Laboratory (VBL) established under COE Program, which currently focuses on new business opportunities in forestry and related industries/technologies, especially renewable resources. There is one forestry researcher who works closely with the VBL.

Except for the above five steps, there are some possible supplemental steps as follows:

- Strengthen existing industry-university cooperation center, IP center, and internship programs
- Encourage guest lectures from industry researchers & craftsmen
- Intensify entrepreneurship training for faculty and students (it could be developed as branches of BA/MOT programs.)
- Work with local leaders to
  - Facilitate equity investments in startups
  - Increase cooperation with outside venture capital
  - Maybe establish a pool of investor/managers
- Intensify training and recruitment of managers for startups
  - Begin to build this into BA/MOT programs
  - Use links with financial institutions and other businesses

There are just some suggestions for supplemental work. My impression is that the steps have been already taken here indicate a good progress in trying to ensure that discoveries made in this university are developed for the development of society.

Worlds of Knowledge and Democracy Is Civil Society a Daughter of Knowledge?

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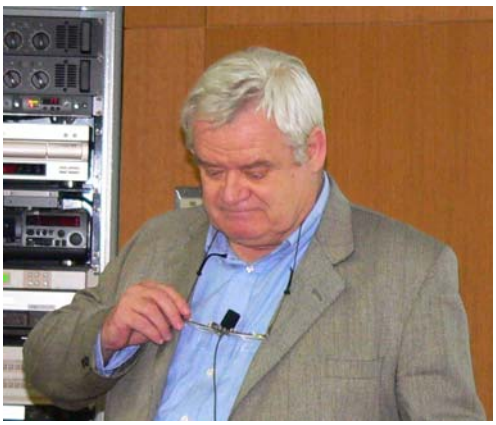

Introduction

There are of course a large number of more or less rival hypotheses that refer to the reasons for the emergence and persistence of democratic regimes and the strength

of civil societies within such social systems; for example, Francis Fukuyama explicates his thesis about the end of competing ideologies in the last century by stressing, "there are fundamental economic and political imperatives pushing history in one direction, towards greater democracy." But other scholars argue that democracies can take a hold in countries that are poor and that democracy therefore does not follow economic development. But as claims for the war in Iraq have shown, democracy is also expected to follow from the barrel of guns.

In contrast to these modern claims, John Stuart Mill, in *The Spirit of the Age* (1831), published after his return to England from France, affirms his conviction that *the intellectual accomplishments* of his own age make social progress inevitable. But progress in the improvement of social conditions is not, Mill argues, the outcome of an "increase in wisdom" or of the collective accomplishments of science. It is rather linked to *a general diffusion of knowledge*.

Mill's observations in the mid-nineteenth century, a period he regarded as an age of moral and political transition, and in particular his expectation that increased individual choice (and hence emancipation from "custom") will result from a broad diffusion of knowledge and education, strongly resonates with the notion of present-day society -- the social structure that is emerging as industrial society gives way -- as a *knowledge society*.

John Stuart Mill was a great admirer of the classic study of American Society by Alexis de Tocqueville; as a matter of fact, Mill wrote a review of *Democracy in America* (1835-40) that was published almost at the same time as his *The Spirit of the Age*.

But there are decisive differences between Mill and de Tocqueville in their judgment of democracy, especially of the role of knowledge of its citizens for and in democratic regimes.

De Tocqueville closes his observations about American society by observing that the educational attainment of its citizens is an influential force in the maintaining democracy in America. While Mills has considerable confidence in the independent capacity of enlightenment, education and knowledge and intellectual skills as the *necessary* condition for the strength of democratic regimes, for De Tocqueville knowledge is the *sufficient* condition for democracy.

From Mills assumption it follows that intellectuals and scientists play a significant political role in democracies; in the case of De Tocqueville, it is the ordinary citizen and his or her immediate political practice that strengthens democratic political systems. Without taking side abut the specifics of the dispute between de Tocqueville and Mill, I generally concur with their general observation about the importance social role of knowledge for democracy.

I therefore reject the microphysics of power as elaborated by Foucault. As is well known, in his genealogical work, Foucault describes the one-sided shaping of the individual by scientific disciplines such as penology, psychoanalysis etc. and the enormous, micromanaged power of regimentation and measurement in major social institutions. The observations by Foucault are based on a view of knowledge that assigns much power to knowledge or to the agencies in which it is embedded. Foucault underestimates the malleability of knowledge, the extent to which knowledge is contested and capacity of individuals and civil society organizations to deploy knowledge in order to *resist, oppose and restrain* major social institutions in society.

There are various societal restraints that affect the wide dissemination of knowledge in society and therefore hinder the effective role of knowledge for democracy. I will refer to three barriers under the heading of the following questions: (1) it is possible to reconcile democracy and expertise, (2) it is possible to reconcile democracy and knowledge as property and (3) it is possible to reconcile democracy and the knowledge divide?

Reconciling democracy and expertise

Many observers are convinced that the gap between expertise, that is, powerful agencies that harbor expert knowledge and the knowledge of laypersons in modern societies have dramatically and irreversible widened. On the other hand, it is evident that the social deference, the unquestioned respect and the taken-for-granted authority based on knowledge of the major professions (teachers, doctors, lawyers) at least in modern Western society has declined since at least the 1960s. Nonetheless, there is still widespread support for the "scientist" perspective of nature of knowledge claims, namely that knowledge is universal and universally useful. The acceptance of a scientist conception probably enhances the power of those who are seen as representing authoritative scientific knowledge.

Yet, the rising tempo with which knowledge is added has the opposite effect, instead of enhancing the universality of knowledge, a massive cleavage between those who directly participate in the process of knowledge production and those who are not part of the same process can be noted. The same observers therefore argue for the presence of a deficit model among different publics and stress the serious consequences the asymmetry between expert knowledge and the public has for the nature of civil society.

I will describe the deficit model in somewhat greater detail: The ease with which one delegates, of course aside from one's own specialty, judgment to the expert is seen to have hardened in all social institutions in modern society, not only in science. At the same time, it is widely assumed, for example, in the field of the "public understanding of science" that scientific illiteracy decreases the public's democratic capacities.

As a result, the "loss of contact" between science and the public emerges as one of the salient attribute of the interrelation between specialized knowledge and society. Large segments of the public have become disenfranchised and disabled from effective involvement in democratic processes that increasingly require a certain level of scientific literacy. This loss of

contact is not only the result of a growing cognitive distance between science and everyday knowledge; it is also affected by the ever increasing speed of knowledge expansion based on a growing division of labor in science and by the deployment of knowledge as a productive capacity. The decreasing cognitive proximity increases the political distance from science, for example by restricting public reflection on both anticipated and unanticipated transformations of social and cultural realities resulting from the application of new knowledge. The scientific community shares responsibility for this diminishing intellectual proximity, since the preferred self-image of science as a consensual, even monolithic and monologic, enterprise is increasingly in conflict with both its public role and its own internal struggles about research priorities, as well as the generation of data and their interpretation.

However, on political and moral grounds many groups, constituencies and institutions must be consulted before decisions are made about issues that affect the regulation of knowledge and indirectly the development of science and technology. It would be misleading to think that the distance from and the loss of contact with science, or the considerable scientific illiteracy in modern societies, is somehow a 'potentially fatal flaw in the self-conception of the people today' (as Gerald Holton suggests) and/or signals the possibility of a dramatic collapse in public support for science.

It is more accurate to speak of a state of precarious balance affecting the autonomy and dependence of science in modern society. A loss of close intellectual contact between science and the public is perfectly compatible with both a diffuse support for science in modern society and an assent to legal and political efforts to control the impact of science and technology. In another sense, however, the loss of cognitive contact is almost irrelevant, and highly controversial; for example, when 'contact' is meant to refer to *close cognitive proximity* as a prerequisite of public participation in decisions affecting scientific and technological knowledge. Such a claim is practically meaningless because it almost requires public engagement in science-in-progress.

In arriving at judgment about expertise and civil society, one needs to take specific contexts into account. The conditions under which different publics may make sense of specialized knowledge vary considerably. Rather than treating the relations between expertise and the public as a series of relations that involve individual, isolated actors, we need to think of the interaction between expertise and the public as mediated by cultural identities and the resourcefulness of civil society organizations reconstructing science and technology in distinct ways.

Moreover, without some element of trust exhibited by ordinary members towards experts, expertise would vanish. Nonetheless, experts today are constantly involved in a remarkable number of controversies. The growing policy field of setting limits to the presence of certain ingredients in foodstuffs, of safety regulations, risk management and the control of hazards has had the side effect of ruining the reputation of experts. As long as an issue remains a contested matter, especially a publicly contentious matter, the power and influence of experts and counter-experts is limited; once a decision has been made and a question settled, the authority of experts becomes almost uncontested as well. The work required to transform a contested matter into an uncontested issue is linked to the ability of experts to mobilize social and cultural resources in relevant contexts.

From the point of view of the scientific community, the lack of cognitive proximity to the general public has advantages and disadvantages. The loss of contact between science and the public can perhaps explain, at least in part, why the scientific community, in view of its attractiveness and usefulness for corporations, the military and the state, has been able to preserve a considerable degree of intellectual autonomy. Such autonomy, however, is contingent on a host of factors within and without the scientific community. The loss of contact is a resource for the scientific community. It signals a symbolic detachment and independence that can be translated into an asset vis-à-vis the state and other societal agencies. Science becomes an authoritative voice in policy matters; or it represents, in ideological and material struggles with other political systems, the openness of society. But the cognitive distance also limits the immediate effectiveness of the "voice of science" in civil society organizations as well as in policy matters, and extensive autonomy and independence of science may result in an excessive celebration of "normal" scientific activity and lead to a lack of innovativeness.

Reconciling democracy and knowledge as property

In testimony before the U.S. Congress more than a century ago, John Powell, a pioneer in the field of the earth sciences, put his finger on one of the most intriguing features of knowledge, namely "the possession of property is exclusive; possession of knowledge is not exclusive". In spite of Powell's thesis, some forms of knowledge are exclusive and become private goods as the result of legal restraints such as patents or copyright restriction attached to knowledge.

Whether knowledge is treated as a public or private good has many noteworthy consequences; for example, it is most likely incremental or new knowledge that is protected. In the context of economic systems but also science, this raises a serious dilemma: The basis of the growth of knowledge is knowledge. If knowledge is protected the growth of knowledge is hampered. But if knowledge is not protected, economist will argue, the incentive to invest in new knowledge disappears; monopoly rights are essential for the growth of knowledge and inventions.

In contrast to incremental knowledge, the general mundane and routinized stock of knowledge consists mostly of knowledge that is non-rival as well as non-excludable, that is, these forms of knowledge may very well constitute public goods.

Scientific knowledge constitutes one of the most important conditions for the possibility of

modernization in the sense of a persistent extension and enlargement of social and economic action that science and not any social system in modern society generates.

I do not want to discuss the contentious issue of trade-offs that may exist between assigning proprietary rights to knowledge and the gains in the overall welfare of society or the trade-offs between treating knowledge as a public good and the loss of welfare for those that cannot reap the benefits from their inventions and discoveries.

Economists, legal scholars and major international organizations such as the World Bank make the case that knowledge must be a (global) public asset. From an economic viewpoint this means that knowledge should lack the characteristics, otherwise typical for economic assets, namely rivalry and excludability. That some forms of knowledge are public goods *is least likely* the case for additional, that is, new knowledge. And it is additional knowledge that turns a profit.

Thus, the age-old dilemma whether property generates power and thereby fashions human relations or whether it is the other way around continues to be played out even in knowledge societies.

Reconciling democracy and the knowledge divide?

For almost a decade, the State of New York and the City of New York are embroiled in a legal battle over whether the state is paying its fair share toward New York City's public school system. The contested issue is less about money although in the end it also is about money, it is about the minimal obligation governments have to educate its children. The dispute revolves around the intriguing question what exactly is meant by the constitutional promise of a "sound, basic education" for the children in the state.

The very first sentence in the June 2003 decision of the appeals court affirms, "we begin (our ruling) with a unanimous recognition of the importance of education in our democracy. The fundamental value of education is embedded in the Education Article of the New York State constitution by this simple sentence: 'The legislature shall provide for the maintenance and support of a system of free common schools, wherein all the children of this state may be educated."

The plaintiffs of course contend that the State fails to afford New York City's public schoolchildren the educational opportunity guaranteed by the constitution. But what exactly is the constitutional human right to education, what is a sound basic education? State schools, a previous court ruling suggested, are "obligated by the state Constitution to do nothing more than prepare students for low-level-jobs, for serving on a jury and for reading campaign literature, that is the equivalent of an eighth- or ninth-grade education. And in this respect, New York City, however troubled its schools, met that standard, however limited that standard. The court decision did not please the plaintiffs and they appealed. A subsequent 2003 decision of the Court of Appeals held that as one judge put it, "a high school education is now all but indispensable."

The lengthy New York court cases were mainly about state responsibilities toward the *collectivity* of children, it does not address its responsibility toward individual pupils, especially in as much as such responsibilities may arise from what I would call the "knowledge divide." Thus, in stark contrast to the ruling of the New York Appeal Court, courts in other US jurisdictions have tackled the "knowledge divide". The New Jersey Supreme Court for example takes the view that state schools should be responsible for remedying educational deficits that might have their roots in larger problems, such as social inequality, ethnic or family backgrounds.

Public policies that follow from these different approaches are significant. In the latter case, redistribution of property-tax is in order and affirmative actions programs are justified while in the case of the former approach enormous inequalities in outcome of schooling standards are acceptable.

Concluding remarks

My presentation concentrated on questions concerned with how to gain knowledge in modern society and less on what to do with it. That is the topic of another lecture. The basic claim for the moment however is that democratization in modern societies as knowledge societies increasingly extend to the democratization and negotiation of knowledge claims.

I assume that scientific knowledge is much more malleable and accessible than is suggested in the classical perspective of the relations between science and society. The new sociology of scientific knowledge has familiarized us with the perspective that the production of scientific knowledge is in many ways very similar to other social practices. The boundaries between expertise and everyday knowledge are much less fixed and robust than is often surmised, especially in observations that lament about a growing distance between expert knowledge and the public's knowledge. Knowledge ability has social externationalities through the production a more participatory democracy or citizenship from which civil society organizations benefit most.

This produces particular challenges, for example, in terms of access to knowledge but also in the form of new modes of participation. And here civil society organizations will be challenged.

(A complete list of references is available electronically on request via the COE Center's email addresses.)

Reflections on Knowledge Management from a Critical Systems Perspective

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1. Theoretical Reflections

Critical Systems Perspective (CST) employs a variety of devices to unearth the theoretical assumptions underlying different systems approaches. For example, Jackson (1991, 2000) uses Habermas' work on knowledge constitutive interests, Burrell and Morgan's classification of sociological paradigms, Morgan's enumeration of various metaphors or models of organisation, Jackson and Keys' 'system of systems methodologies' and the distinction between modernism and postmodernism. Lehaney et al. (2004), following a critical systems agenda, have already sought to apply the schemas provided by Habermas and Burrell and Morgan to understand KM from a theoretical perspective. For the purposes of this paper, I will try to understand KM better in terms of the 'models of organisation' on which it is based. The reason for this choice is that both Nonaka (1991) and Takeuchi (1998) frequently relate different forms of KM to different organisational models, and so we have a good starting point for our analysis.

We begin these theoretical reflections, therefore, by considering three common models of organisation, as defined by Ackoff & Gharajedaghi (1996). The KM literature is then related to each of the three models in turn, and particular strengths and weaknesses in KM are identified as being due to adherence to different models. The section concludes with an argument, based on CST, that KM should embrace an even wider range of models of organisation than the three specified by Ackoff and Gharajedaghi, and should adopt a pluralist stance.

Three models of organisation

Ackoff & Gharajedaghi (1996) recognise three basic kinds of model that are commonly applied to organizations – 'deterministic', 'animated' and 'social'. To view an organisation using a deterministic model is to see it as like a machine. It is set up to pursue purposes which are external to itself, those of its creators, owners or controllers, and neither its parts nor itself are purposeful. Animated models picture organisations as being like organisms. The organisation itself is seen as being purposeful (like a human being) but, again, the parts (equivalent to the heart, liver, lungs, etc.) are not. Socialsystemic models represent organisations as being purposeful at three levels. They are themselves purposeful systems and have their own goals, objectives and ideals that should be taken into account. However, they also contain, as parts, other purposeful systems, individuals, whose aspirations need to be met. And they exist, themselves, as parts of wider purposeful systems whose interests also should be served. Ackoff and Gharajedaghi have no doubt that, in modern society, it is harmful to treat organisations as if they were machines or organisms, and only social-systemic models are legitimate and beneficial: *Our society and the principal private and public organizations that it contains have reached a level of maturity that eliminates whatever effectiveness applying deterministic and animalistic models to social systems may once have had.*

KM and the machine model

According to Nonaka (1991) and Takeuchi (1998), Western management thinking is dominated by the model of the organisation as a machine for information processing, a model originally derived from Taylor and Simon. Individuals require information from the environment to be broken down into pieces relevant to the tasks they are performing as parts of the machine. Nobody needs to know what anyone else is doing because these tasks are carefully co-ordinated by the machine to ensure that the organisation as a whole achieves the purposes of its designers.

The dominance of the machine model leads KM theory and practice in the West, Nonaka and Takeuchi argue, to concentrate almost exclusively on 'explicit knowledge', on measuring and managing existing knowledge, and to seeing KM initiatives as the preserve of a select few (Takeuchi, 1998). Explicit knowledge as defined by Nonaka & Takeuchi (1995), following Polanyi, is codified knowledge that is transmittable in formal, systematic language. It is seen as 'hard', 'objective' and 'static' knowledge that can be expressed in words or numbers and shared with others in, for example, the form of manuals, data or scientific formulas. It can be processed by computer and so easily transmitted to appropriate individuals in a mechanical and systematic manner. In the West, therefore, it is the information technology aspects of KM that are emphasised – matters such as knowledge capture, storage, retrieval and distribution. The limitations of KM in the West derive from the machine model of organisation that it implicitly embraces.

KM and the organismic model

By way of contrast, Nonaka (1991) and Takeuchi (1998) argue, Japanese managers are more at home with a holistic approach, which pictures the organisation not as a machine but as a living organism: *Much like an individual, it can have a collective sense of identity and fundamental purpose (Nonaka, 1991).*

Attention is devoted to developing a shared understanding of the nature of a company, what it wants to achieve in the world and how it is going to achieve it. In order to deal with the complexity of their environments, organisations conceived as organisms should reject hierarchy and adopt flat and flexible structures.

Because of the dominance of the model of the organisation as an organism in their culture, Japanese KM specialists emphasise 'tacit knowledge' and the involvement of all in the creation of new knowledge (Takeuchi, 1998). It is seen as 'soft', 'subjective' and 'context-specific'. There are two kinds of tacit knowledge. One derives from bodily experience and encompasses the sort of know-how or skills passed down by a master craftsperson to an apprentice. The second, 'cognitive' dimension, consists of the 'beliefs, perceptions, ideals, values, emotions and mental models' (Takeuchi & Nonaka, 2004b) that we find hard to describe but which shape the way we perceive and act in the world.

In Japan, therefore, it is the 'people' aspects of KM that are emphasised. Knowledge is highly personal, derives from beliefs and commitments, and is forged dynamically in purposeful endeavour. Organisations should encourage the kinds of actions and interactions, particularly involving relations between tacit and explicit knowledge, which give rise to a 'knowledge creation spiral'. They should be structured not as information ― processing machines but as organic configurations of ba – spaces where people interact with each other at a specific time and space and create knowledge (Nonaka & Toyama, 2002).

So how much more useful is this organismic model than the machine model? Takeuchi & Nonaka (2004b) are, in fact, well aware of the dangers of over-emphasising the organismic model and the reliance on tacit knowledge that it promotes. The dinosaur is cited as an example of a living organism that, because of over-adaptation to past success, could not adjust to changes in its environment. They fear that cultural traits that have benefited Japanese companies in the past might give rise to a 'group think' mentality, which is inappropriate in today's diverse global economy. Nor can Japanese companies afford to fall behind in the race to develop and exploit advanced information technology, which can enhance the combination, storage and distribution of explicit knowledge. In their view, successful companies in the future need to synthesise the best of the Western and Japanese approaches to knowledge creation and management.

KM and the social-systemic model

In fact, most of Nonaka and Takeuchi's formulations regarding the future shape of organisational knowledge creation fit more closely with Ackoff and Gharajedaghi's social-systemic model than they do the organismic model. The importance of recognising and responding to diverse purposes at the individual, organisational and environmental levels is fully recognised. Asking the question, 'What is a firm, and how does it function?', Nonaka & Toyama (2002) argue that, in a knowledge-creating company, knowledge is dynamically created out of contradictions in a dialectical process. In industrial society managers, influenced by Taylor's 'scientific management' theory, sought to eliminate contradictions. In today's knowledge society, however, paradox is something to embrace and cultivate because it is the fount from which new knowledge is derived. This is true at the levels of the individual and group, and organisation and environment.

According to Nonaka & Takeuchi (1995), knowledge begins with the individual and is subjective, deeply rooted in individual beliefs and value systems. It is developed actively, in a specific context, through social interaction in groups. In their relations with others, individuals came across alternative viewpoints, stemming from the diverse backgrounds and experiences of those involved. Dialectical debate can ensue in which individuals confront their own most cherished assumptions and a synthesis of different perspectives emerges. This synthesis represents a fusion of mental models, which goes beyond what is currently known. New social knowledge is created which can spread throughout the organisation. In describing these processes, Nonaka & Toyama (2004) refer to the phenomenological method of 'letting the reality emerge', and Nonaka & Takeuchi (1995) draw on the work of the phenomenological sociologists Berger and Luckman, and the hermeneutic philosopher Gadamer. The worlds of phenomenology and hermeneutics are much more closely related to Ackoff and Gharajedaghi's social-systemic model than they are to any organismic model.

At the organisational level, too, firms must manage the rich interplay between thesis and antithesis, whether enacted internally or with their environments, if they are to survive and succeed. Summarising their account of knowledge creation as a synthesising process, Nonaka & Toyama (2004) conceptualise it *as a dialectic process, in which various contradictions are synthesized through dynamic interactions among individuals, the organization, and the environment.*

There is little that is biological about this. Rather, it fits perfectly with Ackoff and Gharajedaghi's preference for the social-systemic model that sees organisations as necessarily having to overcome conflicts between purposes at three levels.

It seems, therefore, that having recognised some of the limitations of the organismic model, Nonaka, Takeuchi and their followers are willing to explore alternatives. In all but name, the formulations they employ in their knowledge creation theory fit more comfortably with Ackoff and Gharajedaghi's social-systemic model. This is good news, but it would no doubt assist further progress if such a change in orientation was more clearly signaled and explained by them.

2. Methodological Reflections

Drucker (1999) has argued that the most important contribution management can make in the 21st century is to increase the productivity of knowledge work and knowledge workers. There have been attempts in the

literature to elucidate approaches to achieve this, for example, brainstorming and the use of metaphor and analogy (Nonaka & Takeuchi, 1995), employing sketching designs, visual analogies and diversity enhancement techniques (Leonard & Sensiper, 1998), and providing computerised support for group argumentation (Tang & Liu, 2004). Most commentators, however (e.g. Cole, 1998; Leonard & Sensiper, 1998), still regard KM as being in its infancy here – a long way from developing explicit methodologies and methods that can consistently deliver knowledge creation. In this section, we argue that CST, because of its historical emphasis on the importance of methodology, can help enrich KM in this respect. To illustrate the point, we take four of the more practically orientated recommendations proposed by KM – namely, the knowledge-creating spiral (SECI), knowledge-enabling characteristics, ba and dialectics – and demonstrate how various systems methodologies and methods can help realise them in practice. In making this case, I draw upon earlier suggestions in the work of Gao et al.(2002a, b).

The knowledge-creating spiral (SECI)

Takeuchi & Nonaka (2004a) define KM *as the process of continuously creating new knowledge, disseminating it widely through the organization, and embodying it quickly in new products/services, technologies, and systems.* This process is operationalised by facilitating four types of interaction between 'tacit' and 'explicit' knowledge (defined in the previous section). These interactions involve conversions from tacit knowledge to tacit knowledge ('socialisation'), tacit to explicit knowledge ('externalisation'), explicit to explicit knowledge ('combination') and explicit to tacit knowledge ('internalisation'). Taking the first letter of the name given to each type of conversion gives rise to the SECI mnemonic (Takeuchi & Nonaka, 2004b).

In 'socialisation' individuals share their tacit knowledge through direct experience. If the process is successful, their technical skills and/or mental models become aligned. 'Externalisation' is perhaps the most important but least understood form of knowledge conversion. It requires an individual to articulate their tacit knowledge through reflection and dialogue in a manner that makes it comprehensible to a group. This means turning difficult to articulate, subjective beliefs, values and emotions into explicit concepts. Nonaka & Takeuchi (1995) argue that taking individual perceptions and elaborating them progressively, through the stages of metaphor, analogy and model, can be of help. Once explicit concepts are created, which can be brought together in logical models, a group can make use of them to compare and contrast different viewpoints. In 'combination', different bodies of explicit knowledge, held by groups, are systematised, perhaps on computer databases, so that they are available for use by the whole organisation. 'Internalisation' sees individuals making the explicit knowledge of the organisation their own; they learn and acquire the organisation's explicit knowledge so that it becomes their own tacit knowledge, and they are able to use it, without thinking, in their day-to-day activities. Thus, if the SECI process is operationalised successfully, knowledge 'spirals' up from the individual, to the group, to the organisation and back down again. An iterative cycle should always start over at a higher level and is never ending.

Enabling conditions for knowledge creation

Nonaka & Takeuchi (1995) and Ichijo (2004) recognise a number of difficult individual and organisational barriers that need to be overcome if the SECI process is to proceed. In order to overcome these barriers, managers should ensure that various enabling conditions for knowledge creation are put in place. It is remarkable just how many of these conditions can be realised and supported using existing systems methodologies and methods. Let us take, as examples, 'instilling a knowledge vision' (or 'intention'), 'creating the right context' (or 'autonomy') and 'fluctuation and creative chaos'.

According to Nonaka (1991), and Nonaka & Toyama (2002), the desire to create the world according to a particular ideal is at the heart of innovation. A knowledge-creating company, therefore, must be about ideals as well as ideas and should develop and communicate a knowledge vision based upon its conception of an ideal state of being. This vision should be widely endorsed by members of the organisation. It will clearly be valueladen and so can provide guidance on what knowledge is useful and true, and a clear direction for individual and group action. Of course, it should not be so inflexible that it prevents change in values or makes the organization unresponsive to it environment. Ackoff's (1981, 1999) 'interactive planning' approach, based upon his socialsystemic model, has as its core component the notion of 'idealised design'. An organisation that wants to develop and be innovative should prepare an idealised design that captures the vision of its diverse stakeholders. This vision, of a desirable future, focuses the attention of stakeholders away from petty differences onto the ends they would all like to see their organisation pursue. It unleashes creativity as people seek to invent ways of bringing about the desirable future. The idealised design is 'ideal seeking', not a utopia, and can, therefore, adjust as values shift or the environment changes.

Both Ichijo (2004) and Nonaka & Takeuchi (1995) insist that creating the right structural context is crucial to the success of the SECI process. Knowledge appropriate to the modern world will not be produced in organizations designed like machines, with rigid hierarchies. Flat and flexible structures are necessary, with a diversity capable of matching the variety of their complex environments ('requisite variety'). Such structures must allow for 'redundancy' of information and facilitate appropriate conversations among organisational members. To ensure that the organisation generates sufficient variety, individuals must be allowed as much autonomy as circumstances permit. They

should be grouped in self-organising teams as part of a holographic structure.

Finally, we consider Nonaka & Takeuchi's (1995) enabling condition of 'fluctuation and creative chaos'. Fluctuation may be introduced into an organization naturally, through change in the environment, or internally as an attempt to bring about 'creative chaos'. If handled appropriately such fluctuation can be positive because it threatens existing habits and mental models, and leads to a redefining of problematic issues and possibly of the organisation's relationships with its environment. Nonaka and Takeuchi consciously use the language of chaos theory and cite complexity theorists (e.g. Gleick), but they may not be aware just how much progress has been made, in the systems and complexity tradition, in terms of specifying the nature of the high creativity, 'edge of chaos' state; determining the 'control parameters' necessary to achieve that state; and conceptualizing how changes in 'attractor patterns' can be brought about (see Stacey, 1996, 2003). Again the opportunity for a rich dialogue between KM and CST emerges, with CST taking the lead on matters of methodology and method.

Ba

The concept of Ba, which roughly translates as "space", is defined by Nonaka & Toyama (2002). Ba is a shared context where meaning creation and knowledge conversion take place. It can embrace a physical space, like a meeting room, but must be conceived much more broadly to include the interactions that take place in working groups, project teams, informal meetings, e-mail groups, with customers, etc. The key is that interactions are occurring at a specific time and place, and that knowledge emerges in the form of 'a stream of meaning'.

Many of the things that are necessary for good ba echo the enabling characteristics for knowledge creation that we have already discussed. It follows that the systems methodologies and methods adduced as means for facilitating knowledge creation can also be used to provide energy and quality to interactions in a ba. For example, Ackoff's interactive planning can provide intention and mission; SSM can facilitate multi-viewpoint dialogue; the viable system model demonstrates how enterprises can be configured as organically connected ba, with various ba structured in fractal relationships. Here, we simply want to draw attention to another remarkable correspondence between the idea of a ba as a 'moving sphere' and Beer's (1994) approach to democratic dialogue, known as 'team syntegrity'.

In searching for rules that would promote democratic dialogue, Beer made use of an analogy to Buckminster Fuller's geodesic dome, based upon the icosahedron. He recognised that no structure could be less hierarchical than a regular polyhedron, of which he regarded the icosahedron as the most interesting type. Using this analogy, he thought, democratic dialogue and the robustness and effectiveness of debate could be guaranteed by organising discussion according to this particular democratic structure. The process of team syntegrity, developed by Beer, integrates, through democratic dialogue, the ideas and experiences of participants, promotes effective synergy and translates the outcomes into social knowledge. It is a perfect mechanism for generating a good ba.

Dialectics

In the KM theory of Nonaka, Takeuchi and their collaborators, the notion of dialectics is crucial. Dialectics involves opposing a particular 'thesis' with its opposite or negation, called the 'antithesis', and in the process demonstrating that both thesis and antithesis are limited or inconsistent. It then becomes possible to postulate a 'synthesis', which incorporates the thesis and antithesis but goes beyond, or transcends, them as well. This becomes a thesis to be challenged by another antithesis in a never-ending process.

Dialectic dialogue is essential in successful ba because it allows participants *to see things and themselves from viewpoints that are rooted deep in their own beliefs and values, and from others' viewpoints at the same time (Nonaka & Toyama, 2004).*

As we saw earlier in this section, the knowledge-creating, SECI-spiral, also depends upon the dialectic relationship between tacit and explicit knowledge. This is just one of the pairs of opposites that have to be reconciled and synthesised if new knowledge is to be created: others are body/mind, individual/ organisation, top-down/bottom-up, hierarchy/task force and East/West (Nonaka & Takeuchi, 1995). We additionally met the even more all-embracing idea of the firm as a dialectic being, synthesising the manifold paradoxes and contradictions that arise in the knowledge age – for example, between short- and long-term, global and local, efficiency and creativity, flexibility and control, continuous improvement and disruptive innovation, operational effectiveness and strategic positioning, etc. (Nonaka & Toyama, 2002; Takeuchi & Nonaka, 2004b). In all these cases, and at all these levels, dialectics offers a way of creating knowledge in pursuit of truth: *The absolute truth may never be found. It may never exist. However, dialectic tries to approach the elusive 'absolute truth' through the process of examining and denying the series of 'relative truth'. It is this process that is important, rather than whether one can reach the absolute truth or not (Nonaka & Toyama, 2004).*

According to Churchman (1968), the philosopher *par excellence* of systems thinking: *The systems approach begins when first you see the world through the eyes of another.* This aphorism, which makes subjectivity central to systems thinking, could equally stand, surely, as a motto for Nonaka and Takeuchi's version of KM.

The case that CST can supply KM with useful methodologies and methods, to help implement its insights, has surely been made. CST harnesses practices and procedures from across the spectrum of systems approaches and seeks to employ them appropriately to assist application (see Jackson, 2000, 2003, 2005). Only some of the main links between system methodologies and methods and KM have been highlighted here –

much more work needs to be done to bring all the possible, fruitful interconnections to the fore.

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The Strategy of a Knowledge-creating Company: Management by Distributed Phronesis

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Strategy-as-phronesis

Phronesis is inherent in the SECI process. It is knowledge guided by an ideal and an understanding of how that idea might be put into practice. *Phronesis* has been translated roughly as, prudence, ethics, practical wisdom, or practical rationality. It is the virtuous habit of making decisions and taking action that serves the common good. It is the practical knowledge used to make the best decisions and take the best action in any particular context, based on values and ethics. *Phornesis* takes into account contextual circumstances, addresses particulars, and shifts arms in process then necessary (Eisner, 2002). It serves to integrate the practical knowledge of making things, which is *techne*, with theoretical knowledge or *episteme*, which arms to achieve objectivity and universality true beyond any particular context. If *techne* is to know how to make a car well, *phronesis* is to know what a good car is and to know how one could actually build such a car. To create values, *techne* is not sufficient since a firm has to know what a good car is in order to offer value to customers. Episteme can't answer the question either, because there is not only one right answer or general rule that determines that is good. It depends on the context, or who is perceiving that goodness, and the answer continuously changes. In short, *phronesis* is the practical wisdom that enables one to find a "right answer" in a particular context, and to realize that answer through action.

In leadership, *phronesis* is manifested in the capacity to choose the appropriate goals and to successfully devise means to reach them (Halverson, 2004). Phronetic leaders use their sense of the details to "see" or "feel" the problems of their organizations as solvable within local constraints, and they are able to develop successful plans to address identified problems. In decision-making, phronetic leaders must be able to synthesize contextual knowledge accumulated through experience, with universal knowledge gained though training.

Halverson, working in educational theory, states that leaders in organizations with collective *phronesis* create organizational structures that help them to shape the problems they are able to identify and the solutions they offer (Halverson, 2004). As a consequence, the organization develops shared practices through which it can detect and process various problems and solve them. The seemingly effortless integration of political and personal phronesis in expert practice is a characteristic of virtuoso performance (Hubert and Stuart Dreyfus, 1986).

Abilities to Constitute Phronesis

What constitutes phronesis, and how can an organization foster it? We have observed at the relevant companies that phronesis is composed of the following six abilities.

1. Ability to make a judgment on goodness

This is an ability to exercise moral judgment on a practical level concerning what is "good" in a particular situation. Every sort of expert knowledge and every inquiry, and similarly every action and undertaking, seems to seek some good. Because of that, people are right to affirm that the good is "that which all things seek". Judgment of goodness is based on an individual's values. If a person does not have their own values or philosophy, they cannot make decisions on what is good, and hence, cannot make a "good" car.

As Honda founder Souichiro Honda insists, philosophy is absolutely essential to developing technologies and utilizing them. He once wrote, "Philosophy is more important than technologies. Things like money and technologies are merely a means to serve people…There is no meaning in a technology if, at the base of it, it does not consider people…Philosophy is what drives a firm's growth…A true technology is a crystal of philosophy."

The values or philosophy that is the basis for judging "goodness" has to be one's own. It cannot be given by others. At Honda, the most important question that everyone must consider is: What do YOU think? Honda recognizes that the company's value is a product of the values or philosophy of each individual in the company. Honda's management principle - *Respect for the individual* – acknowledges that every human being is different and these differences are an important source of the values Honda creates. However, what is required is the phronetic ability to make "goodness" for the common good. If that goodness is only good for one individual, it cannot be a common good. Phronesis relies on a higher viewpoint that enables one to see what is good for the whole, even though that judgment of goodness stems from one individual's values.

It is this kind of value of the common good that gives a firm an absolute value to pursue that is a goal in itself. It is not simply a means to achieving profit maximization, which is the goal implicitly set by conventional management scholars in their theories of the firm. In the *Nicomachean Ethics*, Aristotle states: "Every sort of expert knowledge and every inquiry, and similarly every action and undertaking, seems to seek some good." In short, man pursues good for its own sake, and not because such good leads to profit or advantage over others. It is an absolute, self-sufficient good.

The ability to make a judgment on goodness is fostered through life experiences. The importance of experience as a source of knowledge has been discussed, but the experience needed to foster phronesis goes beyond experiences at the workplace. According to Aristotle, phronesis is the character embodied in a good man. To foster goodness in a man one needs experiences as a human being in every aspect of life. Especially important are aesthetic experiences and a culture of philosophy, history, literature, and the arts, which foster insights into historical and social situations.

2. Ability to share contexts with others to create ba/shared sense.

This is an ability to create ba or a space where emotions can be shared with others. Ba roughtly means "place" in Japanese, but we define it as a shared context in motion, where knowledge is shared, created, and put to use. Knowledge is context-specific, and therefore, needs a physical space where it can be created. When individuals empathize in a shared context, their individual knowledge is shared so new knowledge is created.

Ba as a shared context means that individual, subjective views are understood and shared. To participate in ba means to get involved and transcend one's own, limited perspective. In ba, one can see oneself in relation to others and accept others' views and values.

To create ba, one needs an ability to empathize, to understand others' emotions and see things from other viewpoints. To understand what customers want, one needs an ability to empathize with customers. To do this, one needs an ability to "read" a situation and adapt to it, impromptu.

The ability to share emotion is not just an ability to understand others' emotions. It is also an ability to communicate your own emotions in a way that others are able to understand. To do this, one has to cultivate social capital, through love, care, trust and commitment.

3. Ability to grasp the essence of particular situations and things.

This is an ability to perceive and grasp intuitively the essential meaning of particular situations. Since phronesis is the ability to make a decision that is suitable for each situation, one has to be able to quickly recognize a situation and understand what is required in that context. Although each situation is different, one can still attain universality or absolute value through a grasp of the essential meaning of what is going on in each situation.

By recognizing the situation correctly and grasping the essence, one can envision the future and decide on the action to be taken to realize that future. To do this, one has to be able to see at both the micro and the macro levels simultaneously. One does not observe idly, but with intent, and an ability to hypothesize about what is perceived. Souichiro Honda says: "When I look at a motorcycle, I see many things. I see that I should do such and such to maneuver past the curve. And I think about the next generation machine: I think, if I do this, it will have more speed … I move naturally into the next process." When one is able to perceive universality through experience, to see the forest and the trees, that is a phonetic experience.

4. Ability to reconstruct the particulars into universals using language/concepts/narratives

This is an ability to illustrate a concept originating from the insight of one individual by placing it into a larger vision, scenario, or historical context. As stated earlier, phronesis requires more than just practical knowledge of a particular situation. It requires the ability to sense a universal "truth" from the particular in order to determine the best way to act for the common good. Hence, it requires continuous interaction between subjective insight and objective knowledge.

Souichiro Honda stressed this interaction between subjectivity and objectivity: "Action without philosophy is a lethal weapon; philosophy without action is meaningless." He also states: "Just to be hard working has no value. Rather, working hard in the wrong way is worse than laziness. The right theory is the necessary premise for working hard." While stressing the importance of seeing the actual situation or thing, Hondo Motor Co. also urges a *Respect for Sound Theory*. People at Honda are expected to go beyond the mere experience of particular situations and find the universality that enables them to realize the future they envision.

It is also important to be able to use language that is understandable to everyone so that concepts can be transferred. In order for phronetic knowledge to become collective, leaders have to be able to articulate their

phronetic insights in language and concepts that others can comprehend. Phronetic leaders must have imagination, especially historical imagination, to create and communicate concepts effectively using metaphor, analogy, or simple story-telling.

5. Ability to use any necessary means well to realize concepts for common goodness

This is the ability to mobilize others to attain the common good. It is not enough to simply communicate concepts to others. Concepts can only be realized by mobilizing their own knowledge and efforts because strategy here is not just a written plan. It is something that is actualized through practice. To do this, phronetic leaders have to choose and utilize the means suitable to each particular situation, including sometimes Machiavellian means, where shrewdness and determination can help to achieve "the good" result (Badaracco, 1997).

The reality of the strategic process is dynamic and full of confusion and contradictions. Traditional management theories have tried to resolve there contradictions through the design of organizational structures, incentive systems, routines, or organizational culture. But in the knowledge-creating entity, contradictions are not obstacles to overcome but are necessary to the creation of knowledge. Rather than seeing and optimal balance between contradictions, knowledge is created through their synthesis. By accepting contradiction, one is able to make the decision best suited to the situation without losing sight of the goodness to be achieved. This dialectical process is a political process to achieve the goal through social interaction. What drives the political process is the ability to make political judgments. Phronetic leaders exercise political judgment by understanding others' emotions through daily communication and by giving careful consideration to the timing of their interaction with others (Steinberger, 1993).

6. Ability to foster phronesis in others to build a resilient organization

Unlike the traditional view of strategy as a plan, strategy as phronesis is not planned nor implemented by the few leaders in an organization. Phronetic leadership is embedded and distributed in an organization, where various members of the organization take up the role of leader according to the situation.

To make distributed leadership possible, it is necessary to transfer the phronesis embedded in individuals to others, and foster phronesis throughout the organization. It is this distributed phronesis that makes a resilient organization possible.

To make phronesis a distributed phenomenon, one has to present the issues to be worked out, to constantly ask the question "what is the good", and provide examples in each situation that can teach the phronetic way of thinking in practice. It is an ability to enable people to understand what phronesis is through practice, and it is taught through face-to-face interaction.

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The Integrated Episteme of Evolutionary Constructive Objectivism

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(This is the shortened account of Prof. Andrzej P. Wierzbicki speech on the second day of JAIST Forum, discussing recent developments in the COE Program)

Episteme means the prevalent way of creating and justifying knowledge, characteristic for a given historical era or a cultural sphere, see (Foucault 1972). However, the episteme of the industrial civilization, called sometimes the *modern* episteme, was subjected to a destruction process, particularly visible in the last fifty years. This has lead to a divergent development of separate episteme of three cultural spheres, see (Wierzbicki 2005): that of social sciences and humanities, that of hard and natural sciences, and that of technology. Thus, (Snow 1960) correctly pointed out the development of *two cultures,* but today we should rather speak about *three cultural spheres* and identify that their main differences are epistemic: they use different languages, but more important is the fact that

they use different fundamental epistemic concepts and different ways of constructing and justifying knowledge. In (Wierzbicki and Nakamori 2007), we presented an attempt to propose a new integration of the episteme, much needed in the beginning era of knowledge civilization; here we describe it shortly.

We are aware that, after the divergence of epistemic principles at the end of industrial civilization era, in the beginning of the knowledge civilization era a new integrated episteme should emerge; but the formation of a new episteme will take its own historical time. Nevertheless, we presented an attempt and an outline of such an episteme – to be criticised and modified by future research.

Let us begin with three basic principles that we believe will be decisive for the change to the new episteme of the knowledge civilisation era. These are the (extended) Popperian *evolutionary fasification principle,* the *emergence principle,* and the *multimedia principle,* see also (Wierzbicki and Nakamori 2006, 2007).

The first basic principle is related to *falsificationism,* see (Popper 1972), where the best recent description of objectivity in science along with a mature version of falsificationism was presented: knowledge and theories evolve and the measure of their evolutionary fitness is the number of attempted falsification tests they have successfully passed. Falsificationism was sharply criticized, especially from the postmodern subjectivist position of sociology of science, mainly along the line of argumentation that scientists are interested in validating and promoting their theories, not in disproving them. We agree that falsificationism might be considered only a prescriptive requirement in the short term development of science, certainly not a descriptive theory; however, it is descriptive of the long term evolutionary development of science and – what distinguishes technology from science – it is dominant even in the short term and descriptive sense in the development of technological knowledge, see, e.g., (Wierzbicki 2005). In its criticism of Popperian falsification, sociology of science did not note that tools are not theories and technology follows falsificationism in its everyday practice: technological artefacts (e.g., cars) must be submitted to destructive tests in order to determine their safety and reliability. In what follows, however, we use the concept of falsification in the possibly broadest sense admissible also for social sciences, including intersubjective falsification through critical discussions:

Evolutionary falsification principle:
hypotheses, theories, models and tools develop evolutionarily, and the measure of their evolutionary fitness is the number of either attempted falsification tests that they have successfully passed,
or of critical discussion tests leading to an intersubjective agreement about their validity.

The second fundamental principle is related to the emergence of new concepts and properties at higher levels of complexity, which was noticed long ago in philosophy, then evolved with the empirical evidence of the concept of punctuated evolution in biology (see Lorentz 1965), noted also by (Popper 1972); then it was rationally reinforced by the concept of order emerging out of chaos (see Lorenz 1963, Prigogine and Stengers 1984, Gleick 1987). In parallel, it was pragmatically substantiated by technology, in hierarchical systems theory (Findeisen et al. 1980), as well as in the concept of seven layers of telecommunication protocols (see, e.g., Wierzbicki and Nakamori 2006). Thus, the *reduction principle* of the industrial episteme – that the behaviour of a complex system can be explained by the reduction to the behaviour of its parts – is valid only if the level of complexity of the system is rather low. With very complex systems today, we should use instead:

Emergence principle:
new properties of a system emerge with increased levels of complexity, and these properties are qualitatively different than and irreducible to the properties of its parts.

This is a fundamental conceptual and intellectual change. Even if it might seem that the emergence principle logically results in the principle of synergy or holism ─ that the whole is more than the sum of its parts (see Bertallanfy 1956) ─ this is not necessarily a correct interpretation. The principle of synergy or holism does not say that the whole should have essentially different properties than its parts. Thus, sciences of the 20th Century, accustomed to the atomistic or sub-atomistic reasoning of physics, continued to believe in reductionism: a whole might be slightly greater than, but is still reducible to its parts. This is precisely how the sociology of science – e.g., (Latour 1987) - attempts to reduce objectivity to power and money. However, information technology had already provided a counterexample to such reasoning in the middle of the 20th Century, but its importance has not been widely noted: this is the distinction of *software* from *hardware*. Software cannot function without hardware, but its functions cannot be explained by analysing hardware; it is simply a quite different level of complexity. Thus, the emergence principle stresses that with an increased level of complexity, the concepts of synergy and holism are still applicable, however, the whole is then not only greater than, but qualitatively different from and irreducible to its parts. In this sense we are saying that *the emergence principle expresses the essence of complexity* and means much more than synergy or holism.

The third fundamental principle is related to an evident trend in web communications and in the recording of our intellectual heritage: to include more multimedia messages and records. It might take a few more decades for this trend to fully mature. However, an understanding of its full significance is related generally to the issue of *"the other" of reason* or to preverbal, emotive and intuitive knowledge, see, e.g., (Rorty 1980), and specifically to the rational theory of powerful but fallible intuition (Wierzbicki 1997, 2004; Wierzbicki and Nakamori 2006a). This theory explains why visual and generally preverbal information is much

more powerful than verbal: images require at least ten thousand times more processing capability, and while the human mind has such capability it has been suppressed to the subconscious by verbal reasoning and, for the lack of words to describe it, called intuition. The multimedia principle combines these arguments:

Multimedia principle:
words are just an approximate code to describe a much more complex reality, visual and preverbal information in general is much more powerful and relates to intuitive knowledge and reasoning; the future records of the intellectual heritage of humanity will have a multimedia character, thus stimulating creativity.

This is perhaps an even more fundamental conceptual and intellectual challenge than the emergence principle, since almost all philosophy of the 20th Century attached a great role to words, concentrating on communication to such an extent that it tried to reduce humanity to discourse. All logic can be interpreted as rules for correctly using words. On the other hand, all tool-making was originally intuitive and preverbal; hence the roots of technology are preverbal.

The multimedia principle is perhaps even more important than the emergence principle, also more important than other trends such as digital intelligence (which was originally understood only in the verbal sense), and implies that we should use as much multimedia content as possible in order to more strongly stimulate creativity. This will have impacts comparable or exceeding those resulting from the development of printing technology, thus becoming the essence of the new civilisation age.

Based on these three fundamental principles, we can give now a detailed description of an epistemological position that might be called *constructive evolutionary objectivism,* closer in fact to the current episteme of technology than to that of hard sciences.

(1) People are not alone in the world; in addition to other people, there exists another part of reality, that of *nature,* although part of this reality has been converted by people to form human-made, mostly technological systems. There are parts of reality that are local and multiple, there are parts that are universal.

(2) People developed both *language* to communicate with others and *tools* to convert various aspects of nature according to their needs; in both these developments, people have been supported by *curiosity,* which is not necessarily helpful for an individual's evolution, but is essential for the evolution of a group, and has lead to the evolution of science. Humanity can be defined only when taking into account all these three (language, tools, curiosity) basic human faculties.

(3) According to the *multimedia principle,* language is a simplified code used to describe a much more complex reality, while human senses (starting with vision) enable people to perceive the more complex aspects of reality. This more comprehensive perception of reality is the basis of human intuition; for example, tool making was always based on intuition and a more comprehensive perception of reality than just language.

(4) The innate curiosity of people about other people and nature results in their constructing hypotheses about reality, thus creating a structure and diverse models of the world. Until now, all such hypotheses turned out to be only approximations; but we learn evolutionarily about their validity by following the *falsification principle*. Since we perceive reality as more and more complex, and thus devise concepts on higher and higher levels of complexity according to the *emergence principle,* we shall probably always work with approximate hypotheses.

(5) *The origins of culture are both linguistic,* such as stories, myths, and symbols, *and technical*, such as tools and devices used for improving human life. Both these aspects helped in the slow development of *science* – by testing, abstracting, and accumulating human experiences with nature and other people, and testing and refining the corresponding models and theories. This development is evolutionary and, as in any punctuated evolution, includes revolutionary periods.

(6) The accumulation of human experiences and culture results in and is preserved as the *intellectual heritage of humanity* (or the *third world* according to Popper) with its *emotive, intuitive, and rational* parts, existing independently from the human mind in libraries and other depositories of knowledge.

(7) Human thought is imaginative, has emotive, intuitive, and rational components, and develops out of perception, sensory experiences, social interaction, and interaction with the intellectual heritage of humanity, including interpretive hermeneutic processes.

(8) Objectivity is a higher value that helps us interpret the intellectual heritage of humanity and select those components that more closely and truthfully correspond to reality, or that are more useful either when constructing new tools or analysing social behaviour.

(9) A prescriptive interpretation of objectivity is the *falsification principle;* when faced cognitively with increasing complexity, we apply the *emergence principle.* The sources of our cognitive power are related to the *multimedia principle.*

(10) While the above general principles are equally applicable to the hard and natural sciences, social sciences/humanities, and technology, they might be differently interpreted by each of them: the hard and natural sciences search for theories that are universal, calling them *laws of nature,* and are thus influenced by *paradigms, exemplars* of such theories*;* the social sciences and humanities concentrate on the local and multiple aspects of reality, thus follow multiple paradigms; technology is the most pragmatic, motivated by the joy of creating technical artefacts, and following the principle of falsification more than paradigms in its everyday practice.

We are aware that the contemporary differences between the episteme of the three cultural spheres - social sciences and humanities, hard and

natural sciences, and technology - are very great, thus the acceptance of the principles listed above might take a long time. We are also aware that the principles we listed above might be modified during the adoption process. But we listed them precisely for that purpose, to present them as an object for discussion and possible falsification.

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