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Methodology Transfers Between Social Sciences and Humanities in Relation to Natural Sciences, Technology and Government Policy

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1. Introduction

Social sciences may be regarded as derived from humanities such as philosophy and history, but have been developed in different ways (sometimes parallel but often opposite ways) from humanities. In this chapter, social sciences denote the set of social scientific branches (economics, sociology, *etc.*) while social science denotes the general concept abstracted from each of social sciences. Analogously, natural sciences denote the set of natural scientific branches (physics, chemistry, *etc.*), while natural science denotes the general concept abstracted from each of natural sciences. An analogy is the difference between behavioral sciences (the set of behavioral psychology, behavioral sociology, *etc.*) and behavioral science as a general concept. The general concept abstracted from natural and social sciences and humanities (including arts) are referred to as knowledge (the modern version of medieval *scientia*). This chapter mainly or almost exclusively discusses western knowledge and ignore eastern or southern one because western knowledge is worldwide dominant in the latest centuries. The global transfer of methodologies of knowledge is a challenging theme but too comprehensive for one chapter. Therefore it will be left for future research.

Since the Renaissance, particularly the Galileo's revolution of physics from Aristotelian *phusika* or scholastic *physica*, many philosophers have discussed the characteristics and methods of natural sciences. They have also discussed social sciences but very differently in discussing natural sciences. This chapter discusses their differences to clarify the fundamental characteristics of social sciences in relation to humanities, instead of presenting a particular theory of or the particular application of a theory of social sciences or humanities. In this discussion, the separation of social sciences from humanities are considered as a 'crisis' of knowledge, where crisis (*krisis*) means the decisive turning point in clinics or the radical change by conflict in drama as originally meant in Greek. Later, crisis began to mean the crossing to sharply or crucially change the direction. Hereafter, pre-modern knowledge will be referred to as *scientia*.

2. Paradigms of social sciences and their shifts

Humanities was central in *scientia* and concentrated itself on the study of the classics. Humanities was relatively free from the paradigm shift because it founded itself on the succeeded classics having the eternal values, although the introduction of Aristotelian metaphysics to West affected the paradigm of Bible-based knowledge and the comprehensive recognition of the entire Greek classics affected the belief in Christianity. Despite these influences, humanities retained the exegetic methodology of the classics. This affected the methodology of social sciences, and many social scientists were scholastically engaged in closely reading and faithfully interpreting or commenting on the classical books by Smith or Marx. The rise of social sciences little affected the paradigm of humanities at first. The concept of paradigm has been associated with science revolution [Kuhn, 1962] and used as a general (sometimes too general and ambiguous) term. This chapter uses this word as a general term and replaces this with methodology in more specific discussions.

Before the medieval era like in Greece, without particularly established 'bibles', humanities (particularly, philosophy in Greek) was rather natural historic (if not natural scientific) in embracing what may be called zoology, cosmology, *etc.* Greek knowledge was transferred to and developed in East, but not transferred to Europe except for Islamic Iberia. The Greek classics were rediscovered and became central in humanities in Europe in the Renaissance almost for the first time although Aristotelian metaphysic was already influential there.

Legal systems and their enforcements have often been called justice. This shows that they have been originally founded on ethics or religions. Pre-modern legal *scientia* was founded by jurisprudence that was a branch of theology or humanities. This helped political leaders persuade people. Policy-making and the implementations were founded by *philosophia* including social ethics, religions, and the view of history and historical lessons, all in humanities. This stabilized the paradigm of social *scientia* and prevented it from the paradigm shift against the social development. In the modern legal system, the constitutions mean the fundamental principles supposedly stable for decades, found other laws, and constrain "the evolution of law". This idea is extended to technology as the standardization, often stipulated by law.

When the close studies of ethical or religious texts were developed, the exegetic method dominated the study of classics. This method sought for the eternal truth uninfluenced by the shift of 'vulgar' life in time, and was developed by scholiasts as a positivism to strictly respect what was really written and to ignore the prevalent practices in contemporary life. This positivism prevented *scientia* from paradigm shift. While humanities specialized itself in the study of classics, the exegetic method influenced jurisprudence in the interpretation of laws, which was supposed to be eternal.

Ironically, classic-based humanities for the eternal truth drove a radical revolution in entire *scientia*, called the Renaissance. This revolution was to revolve from the Christian classics (the Bible) to non-Christian Greek classics or to rediscover the latter, and to transform the positivism but not to deny the positivism. The Renaissance physicists succeeded the exegetic positivism and successfully transformed it from reading the given texts like scholastic *physica* (translated from Aristotelian *phusika*) into experimenting the earthly movement, as ancient and medieval astronomers observed and predicted the heavenly movement. Motivated by the theological system, Newton unified the earthly and heavenly movements

into a universal theory by mathematically formulating the observed data. Centuries later, this founded the physics-mimicked economic theories, although the Galilean experimentalism is succeeded in social sciences only by psychology except for the recent experimental or behavioral economic methods. .

The denial of the Aristotelian *phusika* led to the denial of Aristotelian multi-disciplinary unification of knowledge encompassing *oikonomia*, *politika, ethikos*, *zoologia*, *kosmologia*, *meteorologia*, and many others. Modern science proudly distinguishes itself from *scientia* or metaphysics by the specialization of knowledge into narrow branches. The unification of theories of physics is only within physics, as the unified axiomatic system of geometry is only within geometry. This scientific systemization by narrowing the zone contributed to the success in scientific development.

Many philosophers and historians of natural sciences have almost unanimously regarded the Galilean and Newtonian methodologies as the first great steps of modern scientific paradigm. But they have no consensus about the paradigm of social sciences. Some of them seem to regard social sciences as occupied by para-dogmas or pseudo-dogmas, although paradigm is believed etymologically unrelated to dogma.

Dogmas or not, social sciences have had their paradigms and shifted them several times in the last few centuries. Each shift has been investigated by historians of social sciences, but little has been discussed about the shift in general. Philosophers usually prefer general discussions rather than case studies, but few succeeded in the general discussion of paradigm shifts in social sciences. To avoid the confusion of paradigm with dogma, the discussions below will avoid this term and use the word of methodology.

3. Views of humans and history in social sciences

In the ancient era, the studies on law and politics were founded on the ground of theological idea of justice. After theology was replaced with humanities, social *scientia* borrowed the methodology from humanities, which often explained social phenomena by historical background with the view of human behaviors and acts in the course of historical development or as path-dependent. Upon the view of history of ideas, Hegel founded his *Encyklopädie* of total knowledge and unified various branches of knowledge via dialectical logic demonstrated in the historical development of various ideas. Introducing the economic or materialistic view into the dialectic logic in historical development, Marx presented the view of history as the unifying core of social sciences. In opposition to founding social sciences upon history, however, the ideas of social engineering and social technology blamed the Marxian view of social sciences as the 'historicism' or the mixture of social sciences with social philosophy. In the meantime, the view of humans as *homo economics* rather than *homo sapiens* has been the core of the prevalent neoclassic economics, where *sapience* means wisdom or intellect and is often synonymous to the humanness or benevolence possibly to selflessly consider others (altruism). Before the *homo economics* view, the view of humans as *homo sapiens* was (and is outside economics) almost exclusively prevalent and has been used as the terminology of anthropology in distinction from more primitive humans (*e.g.*, *home erectus*).

The view of humans as *homo economics* or the economic rationalism validated the physics-mimicked economic theories. Physics took the economy-mimicked view of nature and

successfully constructed a set of calculations of variations to explain natural 'behaviors' as minimizing the 'power' or 'energy'. This method led physics to successfully explain the ball shape of the earth as resulting from the 'purposed effort' to minimize the surface area for the given volume. Economics imported this economy-mimicked methodology of physics and successfully modeled the human behavior to minimize the cost and similarly to maximize the profit by multiplying by -1.

The success of modern science largely owes to that of physics, particularly that of mechanics. The Cartesian view of human body (*phusike*) as a machine was successfully extended to societies. As machine is mechanical and calculable, the mechanistic view of everything as mechanicals promoted the application of mathematics to everything including society. In legal prudence and political science, the monarchical system and the congressional system were unified as 'the Emperor as Machine' theory that viewed the Emperor as no dictator but as controllable by congress.

Yet another view of humans is to view humans as mankind or humankind, where 'man-kind' or 'human-kind' means humans collectively or the genus (kind). With deep knowledge of the Greek classics, Marx followed the traditional ethics to view humans in society like Aristotle, Kant, Hegel and Feuerbach. The Feuerbach's view of humans as man-kind affected the Marxian view of humans as beings fostered in history. As history is the product of the collaboration of humans, the view of humans in history is nearly synonymous to the view of humans as collaborative or societal beings. In the first half of the 1800s, before Marx, many intellectuals from the established families accused the capitalism that promoted the competition motivated by individual desires, and they proposed the 'renaissance' of cooperative society or community called the socialism or communism. Workers from fallen but formerly established families in agricultural areas led workers to the socialism movement. This radically changed the intellectuals' movement into the class struggle, or the individuals' movement into unionized movement of similar kind of workers or 'workers-kind'. The mankind view of humans helped workers unions oppose the individual competition principle. The history of borderless collaboration of Jewish businesses also helped the international unionization of Jewish-led communism movement against the pursuit of the wealth of each nation.

The resources within Europe limited its growth. The alternatives were to decrease the population; to revolutionize the social system for the equal distribution of resources to all; or to bring the resources outside to Europe. The progress of transportation technology and its adroit management allowed Europe to choose the last one. This meant the inequality of humans between Europe and elsewhere and resulted in the denial of the Marxian economic and anthropological equalities (*i.e.*, same kind) including his view of humans as mankind. The competition was intensified at the global and domestic levels and led the world to the war. The worldwide prediction of global war may partly be one factor of the Kant renaissance, who discussed the eternal peace in Napoleonic Wars in the entire Europe. World War I replaced the neo-Kantian philosophy with the neo-Hegelian philosophy, the state philosophy of which justified the worldwide domination of the best system for the global and eternal peace. This idea was supported by Heidegger, Jaspers, Tanabe, and other intellectuals besides economists. Traditional ethics and lesson-based view of history failed to prevent the repetition of global war. Traditional humanities proved to be materially powerless. The only lesson of the wars is to replace the armed race with the economic one by extending the *homo economics* view to the view of the world.

After the prevalence of the philosophical methodology of history on the basis of the views of history, history in academia resumed the scholasticism to limit itself to the exegetic positivism of historical documents. The progress of information technology helps historians in academia efficiently process the documents in ivory towers. Mass media contributed to the renaissance of the view of history that great leaders or single events determine the course of history. This helped management science stress the decisive power of decisions made by leadership. Outside academia, Marx saw the driving force of history in the economic or materialistic desire as in Smith, and focused on the conflicts between the production system and technological development and that between the ruling and the ruled classes. Although Marx himself failed to discuss technology in detail, philosophers including Heidegger discussed the effects of technology on societies and humans in the 1900s. As its effect on humans, the alienation of humans from technological societies motivated philosophers to develop the existentialism to rediscover the value of spiritually independent individuality. This stimulated the anti-industrialization feeling, affected economic policies, and later, promoted technology assessment.

The Hitler's view of the global conflict as resulting from the division of the world between the have and the have-not nations helped some social scientists and historians to interpret the struggles in Asia and Africa against West. Further, the Toynbee's method to explain history via the responses against the outer stimuli as in the ecological living world helped social scientists interpret the struggles in Asia and Africa against West. After the competition between the views of history was replaced with the quantitative analyses of social sciences, social sciences almost exclusively explained the *status quo* in precise ways. The range of quantitative social sciences is limited by the data availability as the range of astronomy is limited by the performance of telescopes. Meanwhile, history remains useful as the source of fictions in novels, comics, and other media.

Around 1900, theoretical philosophers (epistemologists and logicians) like Russell viewed humans as rational and logical (maybe termed *homo logos*). They were optimistic about the human capability to construct symbolic logic, mathematics, and linguistics of artificially constructed symbolic language. This program was to unify all sciences including social sciences and psychology in rigorously unifying ways with the persuasive power over all rational beings beyond national borders and classes. This was called the unity of science or unified science movement. This optimism was broken by Gödel in the early 1930s in the era of the fall of traditional social sciences and the rise of different types of social sciences between Great Panic and World War II. This failure encouraged the idea to base intellect on emotion. The national emotion was proved powerful in decision-making via the development of mass-media as sociologists predicted.

After the failure of formal logic as the power to unify all sciences, logicians and mathematical philosophers with the help of linguists conceptually generalized the strict symbolism to more flexible semiotics to embrace all kinds of language- or symbol-expressible knowledge by following Kant, the epistemology of whom was to consider only the perception itself instead of the thing itself. Semiotics is the first methodology jointly originated in mathematics, physics, linguistics, poetics, aesthetics, *etc.* and influencing social sciences, particularly sociology. The semiotic methodology is to "poeticize" all knowledge and thereby justifies the deviation of knowledge from the reality. This is acceptable and applicable not only to aesthetics but also to the theories of mass-media, election campaigns,

social panics, marketing, and the likes. Economics remains uninvolved in semiotics itself because it has already involved itself in money by valuing physical or material commodities symbolically in monetary terms. In this respect, economics is nothing but semiotics. Another origin of semiotics is from medicine, physics and astronomy. The symptom is the most important information to "symbolize" the internal state of body. Astronomers observe images via lens, and modern physicists read the numerals on measurement instruments. Instead of experiencing the reality, economists read the statistical data provided by government, "operate" economic theories in terms of differential or integral calculus, and use computers, as poets create the imaginations of worlds and minds, and painters create worlds and emotions on paper. In this respect, the idea of *homo economics* is consistent with that of *homo logos*. As *homo logos* of logical intelligence is deeply related with *homo sapience*, *homo economics* may be considered as related with *homo sapience* in this respect.

The view of humans is now experimentally examined to provide the evidences of the pros and the cons of viewing humans as *homo economics.* This view is also called the economic rationalism and is often attributed to Smith, an ethicist in a Catholic city. As the economic rationalism is opposite to the classic rationalism that respects the religious and ethical reasonableness, it fails to persuade non-economists. Using natural or behavioral scientific methods, brain scientists and psychologists test the *homo economics* view of humans [Gazzaniga, 2005; Camerer and Fehr, 2006; Warmeken and Tomasollo, 2006; Haidt, 2007].

4. Mathematical, quantitative and physicalistic methodologies in social sciences and humanities

Many philosophers and historians of natural sciences regard physics (particularly, mechanics) as the core of natural sciences and the mathematics as its core method, which all sciences are supposed to make efforts to use.

Astrology and the calendar based on real observation and calculation provided the foundation of decision-making (divination). Policy making of government and families' (or clans') household (*oikonomia*) also depended on the calendar and the financial calculation like the calculation of inventory or provision. Under the strong control of myths, religions and historical lessons (all in humanities), social techniques collecting data for taxation and the calculation were undervalued. Despite the economic usefulness, calculation was not respected as knowledge (*sophia*). Greek philosophers were interested in geographic figures and the properties of natural numbers including their ratio. As the calculation was important in distribution, algebra as the fundamental theory of calculation was developed in the Islam countries, where the studies of complicated figures or patterns were also developed. Owing to the development of transportation, such knowledge was transferred to West, where mathematics was combined with physics (particularly dynamics) during and after the Renaissance. Much later, this provided economics with powerful methods.

Transportation techniques including calculation techniques for road or bridge construction, shipbuilding and navigation accomplished the expansion of territories to obtain more resources and knowledge. This stimulated social technocrats in judiciary and administration into geography including anthropology, and contributed to the development of natural sciences, science-based technologies and humanities. Informed of the customs in various civilizations, for example, Montesquieu presented the comparative philosophy of law.

Conversely, the method of social sciences owes to humanities, natural sciences and technology. Extending the Arabic and Cartesian view of blood circulation in human body to the circulation of commodities and money, Quesnay, a surgeon and a physiocrat, presented *tableau économique* to represent economic flows and made the first step towards econometrics and economic planning. But this physiological view of economics failed to win the worldwide support of economists, the majority of whom have almost exclusively regarded physics aided by mathematics as central in science. This may partly be explained as the bias of the mainstream manufacturing- and trade-oriented Anglo-American economists against the land-based French physiocratic economists. Naturally, manufacturing-based economy was rather related to mechanics, while agriculture-based economy was relatively related to biology.

Biology (historically, botany, zoology, entomology, and ichthyology were not unified) seldom affected the methodology of social sciences after the modern civilization succeeded in conquering the nature by using mechanical technology based on physics. Contrarily, the severe competition of *home economics* after Industrial Revolution induced Darwin to think of the natural selection as the driving force for biological evolution.

Ethics (*praktische Philosophie*) was influenced by biology like the collaborative behaviors of bees and ants, but theoretical philosophy (epistemology and logic) considered physics and mathematics as central in natural science. Before February Revolution, Comte at *École Polytechnique* presented positive philosophy to found all knowledge including social study (*sociologie*) upon natural sciences, particularly physics. Later, Marx claimed his social science (*Sozialwissenschaft*) to be as rigorous as physics. Around 1900, Frege, Russell and Hilbert attempted to construct the logico-mathematical system upon which all knowledge is supposed to stand. This yielded the logico-mathematical movement toward the unified science (unity of science) in the 1930s in Vienna and then Chicago, where many Jewish scholars fled from Vienna. At the same time, the biological idea of general systems was developed in Vienna.

Today, many social scientists, particularly economists, take the physico-mathematical view of natural sciences, although they have almost no knowledge of the recent states of natural sciences and mathematics. Actually, central in physics is solid-state physics or alternatively called material science, which is located between physics and chemistry (solid-state chemistry). Many papers in this field appear in the journals of the fields called chemical physics, physical chemistry or chemistry itself even if all the authors have the background of physics [Eto, 2003; Whiteside, 2007]. Biology is shifting towards biochemistry and is often renamed life science. Biochemical views date back to the origin of pharmacology, which has paid deep attention to material or chemical processes in living bodies. Deeply connected with pharmacology, medical *scientia* from China, India, Arabia to Roma had long considered human bodies (and sometimes also the minds) as controlled by the subtle rate between various fluids or moisture (humidity) like *humor*. Rather than mechanically, Descartes biochemically considered mental and emotional states as determined by the internal liquid secreted from pineal body. In many aspects, chemistry is rather central in natural sciences. As chemistry and biology or life science are rather central in natural sciences today, mathematics is no longer the central method of natural sciences [Eto, 2008a; Kemsley, 2009].

Behavioral sciences like psychology have developed and prefer factors analysis, structural equation modeling. LISREL and other information processing type methods or data analysis to mathematically well-founded methods [Kruskal, 1964; Tukey, 1977; Bentler, 1986; Bollen, 1989; Jöreskog, 1997; Hayashi, 2002]. Mathematics including mathematical statistics retains the central position of methods only in economics. Even economics, although slightly, revised mathematical statistics for economic analysis purposes. Many papers in physics are to report the experiment results without using mathematics, although mathematics is still an important subject in high-school and undergraduate education of physics. Today, the most mathematics-prone science is economics rather than physics. Indeed, most papers in economic journals are full of mathematics, and mathematical tools are the most important subjects in undergraduate and graduate training of economics. As the ancient empires stressed calculation for taxation and budgeting, Petty presented the concept of political arithmetic from his experience with finance and is often respected as a forerunner of economics. Mathematics is now the tool for finance rather than physics as will be discussed below.

Social scientists learn some established knowledge of natural sciences from textbook but almost never collected the data through observations and experiments by themselves. Except for sociologists, social scientists (particularly, economists) are usually provided data by governments or sponsors and have almost never trained for data collection. In this respect, economics are in common with mathematics. Therefore it is easy for economists to use undergraduate mathematics without tedious work of data collection. The similarity or dissimilarity in data acquirement may decisively affect the similarity or dissimilarity in the methodologies of sciences.

In regard to data acquirement, mathematics has been distantly divided into abstract mathematics developed in the 1900s and physics-motivated mathematics developed in the 1700s ans 1800s. Economic theories almost exclusively use differential/integral mathematics and elementary linear algebra, which are no longer central in modern mathematics. In this regard, economics is actually in no relation with modern mathematics. Statistics is no longer mathematics-centric but rather toward informatics to fully exploit the information carried in data [Benzécri, 1973; Hand, 1998; Hayashi, 2002]. In regard to methodology, economics is isolated in the knowledge world. After the failure of logico-mathematical program of the unified science movement, philosophy seemed fallen into the isolation but succeeded in allying other knowledge by constructing semiotics. Today, only economics is isolated in the knowledge world, although it is in a close relation to economy-centric government.

In the meantime, various fields demand economic knowledge in the economy-dominant society. The healthcare sector is the most severely suffering from the economic pressure [Zweifel and Breyer, 1997; Olsen, 2009] and is required to get more profit possibly at the sacrifice of healthcare quality in the aging society even in the country of socialism tradition [Yan *et al*., 2011]. Here, economics is requested to come to the real world instead of the comfortable world of government and banks and acquire real data by using own hands in collaboration with medical personnel [Nielsen and Mather, 2011] by designing surveys themselves [Hayashi, 1984]. Also, many other welfare problems including environment and education wait for "true welfare" economics. Besides the history of science, evidence-based humanities such as archaeology, anthropology and history have already collaborated with natural science and technology in essential ways [Balter, 2006].

5. Policy sciences in relation to mathematical/quantitative methods

As real worlds demand medical and agricultural sciences and engineering to serve human lives, social sciences have been requested to be usefully applicable to real problems. The idea of policy science is as old as that of social sciences themselves but has little been implemented as a new interdisciplinary field except for economic planning, research and development (R&D) management, and science and technology (S&T) policy and management. This section discusses why it has been so.

Almost all social scientists have been interested in real societies as persons. But the involvement in real societies often obstructed the free activities because of the gap between contemporary secular worlds and the pursuit of the eternal truth. For the freedom, many social scientists fled from real societies to ivory towers usually protected by the church power. Under the church protection, humanities to study the classics were dominant in universities. Under this influence, social sciences developed the method not to involve themselves deeply in urgent problems. Like the division of labor between natural sciences and engineering and that between Classics scholars and religious practitioners such as priests, labors have also been divided in social sciences between social scientists in academia and practitioners in real society. The former has so distantly separated themselves from the latter that the former has not admitted the latter in the professional societies. Their information exchange channels have been cut off.

As mathematics including mathematical statistics and quantitative data analyses are usually regarded as independent of interest and neutral between the conflict of interest, the development of mathematical theories and statistical analyses were expected to generate a new type of social sciences. This was called policy science. Indeed, the first professional journal in policy sciences was issued by a publisher in mathematical sciences. .

Mathematical approach still dominates policy sciences in academia, but those who deal with policy studies outside academia have increased in number and have had more varieties in their approaches. While academics tend to insist on beautiful models and sophisticated methodologies, administrators and practitioners in government and business prefer more practical approach by observing actual cases or data even when they discuss the same problems with academics. Today, the tension between these two groups becomes stronger; or between academic circles of policy scientists using advanced mathematical models and practitioners in government and business not using mathematics so often except simple calculations and data analysis. Anyway, academics in policy sciences cannot neglect the demands from practitioners in various fields.

In the meantime, several new scientific associations in policy sciences have emerged and developed their activities in Japan. One of their specific characters is that they consist of practitioners in the government and business besides professionals in universities and research institutions. They also accept interdisciplinary approaches of research because their main purpose is to solve real problems of their concern. *Nihon Keikaku Gyosei Gakkai* (Japan Association for Planning Administration), for example, was established in 1977 by the researchers and practitioners in the fields of public administration/finance, national land development, economic planning, and so on, insisting the need of closer collaboration of academia, government and industry. *Kenkyu Gijutu Keikaku Gakkai* (The Japan Society for Science Policy and Research Management: JSSPRM) was established in 1985 for the

promotion of practical interdisciplinary studies on science/technology policy and innovation. They said "So far JSSPRM has been providing researchers and practitioners in this field with unique opportunity of networking or information exchange." More recently, *Seisaku Kagaku Gakkai* (Association for Policy Sciences) was established in 2009.

In addition to these associations, policy science-oriented research activities are observed in other fields of research. In the educational research field, policy studies are one of the most prevalent approaches rather than traditional pedagogical ways of research. The Japan Society of Educational Sociology, having played the leading role of performing empirical research on educational phenomena, deals with many kinds of policy-oriented research recently. Japanese Association of Higher Education Research also put on the emphasis on practical problem solving at the ages of university reform. Same trends are observed in other academic associations in educational research.

As for the universities in Japan, the number of schools and departments with title "policy" has increased especially in private universities. They need more efforts to recruit more students into their institutes, because the population of 18-year-olds has been decreasing since early 1990s and the decrease may not stop within several decades. Thus, universities need to attract the youth to attend. One of the ways for being attractive is to reform and rename their schools and departments. The new names include "modern," "international," "environment," "information," and "policy," even though the teaching staff remain as same as before the renaming. But social science departments are challenged by the reform of the humanities departments, where English and foreign study professors are trained in USA and learn the American way of humanities to stress the contemporary problems for practical purposes against the traditional stress on the study of classics. Social science departments need the own philosophy to compete with the humanities departments.

Back to the 1970s in Japan, there was a group who intended to establish the graduate school of policy science in Saitama University, one of the national universities. They started planning and succeeded in establishment of Graduate School of Policy Science in 1977, just one year behind the start of Graduate School of Management and Policy Science, the University of Tsukuba, which will be mentioned in the next section.

The policy science group of Saitama University strongly oriented themselves to the policy analysis in real fields. Thus, they invited not only scholars in social sciences, such as in economics and political science, but also bureaucrats who were actively working for the ministries of finance, construction, international trade and commerce, agriculture, science/technology and education. The dean of the school, who later became the first president of *Seisaku Kenkyu Daigakuin Daigaku* (The National Graduate Institute for Policy Studies: GRIPS), had the strong belief that academics and policy makers should cooperate intensively and thus policy makers and bureaucrats at central and local governments should be educated well; preferably they should have PhDs.

In contrast to the philosophical discussions on natural sciences and technology [*e.g.*, Eto, 2008b], non-Marxian social scientists had avoided the philosophical discussions on social sciences policies. The postwar reform of education and bureaucracies required social science students to study some natural sciences and humanities. Without publishing the design philosophy of social sciences in systematic manners, however, Uehara extended a commercial college to include the departments of sociology and law (now Hitotsubashi

University), and Yanaihara established a comprehensive research institute for social sciences including history. Gradually, however, universities and government began to "forget" such a cultural training and to stress the specialization. Three decades later, a systematic view of policy sciences with some regard to other fields appeared [Yoshimura, *et.al*., 1982]. This book was critical of the situation in government office that most of the bureaucrats had only the background of positive law without any scientific manner in their undergraduate programs and that they often lacked the knowledge and the way of thinking in economics, statistics, mathematics and humanities. Further, this book criticized that the bureaucrats in Japan leaned exclusively on legal aspects and didn't or even couldn't care about identifying the real problem and its solving. Moreover, it pointed out that the bureaucrats consumed most of their time for the discussion of legal consistency with the existing legal system. In the meantime, the retired diplomats of Japan serve as the presidents of the International Court of Justice and the International Tribunal for the Law of the Sea, respectively, after the Japanese judges with academic backgrounds of law retired from the court and the tribunal, respectively.

In international organizations such as OECD have many professional staff. In the Department of Science, Technology and Innovation (DSTI), the professional staff produces regulatory reports and policy papers on these fields, while serving for committees consisting of delegates and scientists from member countries. The Center for Educational Research and Innovation (CERI) has led educational thoughts and practices for member countries by their practical research and survey. A couple of decades ago, the idea of "Recurrent Education" was presented and began to affect the life-long learning policy in Japan.

6. Social sciences and its relations with humanities in the design of universities

Natural sciences including engineering, medicine and agriculture are relatively borderless. Humanities are either national (the studies of own culture like language, literature, philosophy and history) or foreign (the studies of foreign culture). Social sciences are in between. The globalization limits the national characters of social sciences. When Japan ceased to isolate itself from the world, Japan had to adapt itself to the world, where the western systems dominated. The task of social sciences of Japan was to adopt the western ones possibly with some adaptation to the reality of Japan.

In 1867, the Emperor of Japan restored the power and began the radical modernization by the westernization called Meiji Restoration. The first modern university called The University of Tokyo (now University of Tokyo) was established in 1877. The word "university" was translated into Japanese "*daigaku*," so named after *daigaku*, the school for training bureaucrats in ancient Japan. The task of The University of Tokyo was to train bureaucrats with western knowledge in adaptation to the West-dominant world. Professors were all invited from West with high salaries. They gave lectures on the western culture and systems all in their languages. Students merely dictated the lectures without mutual discussion. This university had no department of Japanese or Asian studies, which were left to traditional schools with the original research activities in the fields [Eto, 1993]. This teaching style of lecturing on foreign knowledge and dictating the lectures without mutual discussion was (and is) long succeeded in the discipline system, where young assistant or associate professors follow the senior professors and succeed the positions.

It had been the only university in Japan until 1897, after The University of Tokyo was renamed The Imperial University and then The Imperial University of Tokyo and set up the departments of Japanese and Asian studies. In 1897, the second imperial university was established in Kyoto, which was mainly for law, science and engineering at first. The third and fourth imperial universities set up in Sendai and Fukuoka, respectively, were mainly for medicine, science and engineering at first.

The Imperial University of Tokyo had two main missions; the first one was to introduce advanced knowledge from overseas especially from West; the second was to train talented personnel for bureaucrats, engineers and various kinds of specialists that were essential for the rapid modernization of Japan. To realize these missions, this university consisted of five colleges, *i.e.*, Colleges of Law, Medicine, Engineering, Literature, and Natural Sciences in this order. The former three colleges dealt with applied studies while the latter two colleges were for basic and academic matters. In this sense, the main concern of the government over higher education was applied matters rather than the promotion of basic sciences that was an important function of universities in West. This application-purposed character of Japanese higher education became clearer when the government added imperial universities and different kinds of higher education institutions later, *i.e.* technical colleges, commercial colleges, teachers colleges (higher normal schools) and so on, all of which had practical missions of training professionals in their fields.

Whether applied or basic, however, Japan had to quickly introduce western knowledge and technology because she needed the rapid modernization for going along with West, with the aim of being recognized as advanced countries and joining their circle instead of being colonized like neighboring countries in Asia. Thus, the universities heavily depended on "imported knowledge" at the first stage of their development.

The import of established knowledge had characterized every field of sciences in Japan until the early 1900s. However, in the field of natural sciences, things were gradually improved and some distinguished achievements of original research made Japanese scientists being worldwide famous, such as Kitazato and Honda, although such excellent scientists were limited in number. However, in social sciences, the situations had not or even have not improved. Some critics say that Japanese scholars in social sciences have only introduced knowledge and theories from overseas and talk about them among domestic colleagues and to students; they know much about what and how foreign scholars say or do but never think of the contextual difference between the country that foreign scholars work and Japan; they only learn but publish no original article not only in international journals but in domestic ones; they keep their status of scholar by only translating foreign works into Japanese [Kuroki, 2009].

Without disciplinary system, elementary and secondary school teachers attempted the self-inquiry education around 1930. But government oppressed it because it was associated with the democratic movement [Johnston, 2006]. As Army demanded the promotion of science education, the self-inquiry education method was promoted for science education by Hashida, a physiologist, moral philosopher and the Minister of Education. Accused as a war criminal, however, he committed suicide in 1945. In the 1930s and the early 1940s, social scientists made efforts to build social sciences appropriate to Japan. For example, Ono tried to replace the Napoleon Code-based legal system with the Japanese practice-based ones. But Allied Forces arrested them as nationalists or prohibited their publications as nationalistic.

Regarding the import of social sciences from West, things worsened after World War II. For the purpose of oppressing the nationalism, Allied Forces utilized the energy of west-minded social scientists. They were given the task to lead people toward western ideas and their social activities were encouraged. Social scientists who criticized government in the prewar period were highly praised, while those who kept silence were blamed.

The increase of universities and students worsened the professors' environment for creative research. Far more universities and colleges were established. There were only 47 universities in 1940 but the number increased to 228 in 1955 and 382 in 1970; out of the 382, 75 were national, 33 were local public, and 274 were private universities [Monbu-Kagaku-sho, 2010]. Along with the increase of institutions, enrollment in universities also rapidly increased. It was about 500 thousands in 1955 but, by 1970, it reached to 1,400 thousands, and the enrollment ratio of 18-year-old student into higher education jumped to over 30 percent. The massification of higher education became one of the problems in keeping quality of faculties as well as students and university education. The massification more seriously affected the departments of social sciences, because it was relatively inexpensive for private institutions to establish new schools and departments, and students tended to prefer studying social sciences and humanities to studying science and engineering. Around the 1970s, more than 40 percent of students enrolled in social sciences departments. In addition, most of the newly established private universities and departments in social science had no graduate program.

As is easily imagined, professors were involved in too heavy duties of teaching to conduct creative research. Teaching subjects of social sciences for undergraduate programs needed little research because teaching was often only to read textbooks or even without use of textbook. Many professors read their notebooks in the classrooms slowly so that students could dictate professors' reading. At national universities, things were a little bit better, but graduate programs in social sciences were only allowed in pre-war universities, such as imperial universities and a few other institutions. In this environment, there were little creative research activities. In most graduate programs in social sciences, faculties tended only to follow research results by foreign scholars and graduate students tended to read books and articles written in English or other foreign languages without critical thinking regarding the contents. There was almost no room for the development of original research in social sciences.

Moreover, the term "university autonomy by faculties" occupied the way of university management after World War II. As a lesson from the governmental control of social sciences, the post-war Constitution of Japan guaranteed academic freedom and the School Education Law put an article saying "universities should have faculty meetings to discuss about important matters for the universities," while declaring in another article that university president should have the power on and the responsibility for institutional management. Faculty positions in national and local public universities were strongly protected by law, thus employment and dismissal could not be done without consent of faculty meeting. By this protection of their positions and little pressure for creative research, some professors in social sciences, especially in economics where Marxian school took the majority, became very politically sensitive and their main activities were to criticize government policies for outwards and, for inwards, they strongly insisted on departmental autonomy against their presidents. This annoyed Ministry of Education and Science responsible for management of national and other universities.

The economic growth of Japan around the 1960s allowed government to invest in various projects. The campus unrest motivated government to design and to set up a new national university often called the university of new idea (officially, the University of Tsukuba), in which the social science department was designed to be the most radically innovative. For the first (and the last) time among seventy-five national universities (at that time), the University of Tsukuba was set up by the virtually new laws (generally named the law of the establishment of the University of Tsukuba; precisely, the drastic revision of the Law of Establishment of National School and Institutions and other related laws, government orders and the orders of the Minister of Education). After the nationwide hot debates, this law passed the Diet Houses in the early October of 1973 shortly before Oil Embargo in the late October. The sudden depression of economy in the end of 1973 did not obstruct this project.

With no precedent, this "law" stipulates the names of the departments. Among the legally stipulated departments, two are related to social sciences: One is sociology and the second is *shakai-kogaku* (social engineering or social technology). The governmental order based on the law stipulates the graduate schools and their names of programs including Graduate School of Management and Policy Sciences (simply, policy sciences hereafter).

After World War II, the imprisoned Marxian economists were released and occupied many faculty positions in the economics departments of major universities after the nationalistic professors were all purged by the Allied Forces (virtually the US Forces). A couple of decades after World War II, government regained the power over universities through the budget control, but the paper-and-pen sciences including economics remained nearly out of the control. Government allocated the faculty of *shakai-kogaku* and the graduate school of policy sciences more budgets than other social science-related ones for the reason that these two use computers.

Against the Marxian theory, Popper presented the idea of social engineering. Shortly after World War I, Russian Revolution, socialism or communism movements in Europe and China, nationalistic self-determination movements in East and Ireland, social engineering denoted the manipulation of the society, close to the socialism or communism. In the late 1930s and the early 1940s, Popper presented the idea of social engineering, the same name but another meaning. With the background of the methodological discussions of quantum physics, he learned the systematic idea (systems engineering in the today's term) from mechanical engineering and presented the idea of piecemeal reform of society by cutting off the long-range view of history from social sciences. But almost all of the faculties of *shakai-kogaku* had never heard of the term of social engineering or the name of Popper. Almost all of the faculties had never heard of the Pound's social engineering view of evolutionary legal system.

In the innovative decades around the 1960s, some staff of RAND Corporation, a most representative think-tank, considered technology as the engine of historical development and as carrying the social meaning. They called this view of technology as social technology. But almost all of the faculties of *shakai-kogaku* had never heard of the term of social technology or their editing journal "Technological Forecasting and Social Changes" published by a mathematical science publisher. The same publisher was publishing another journal "Policy Sciences" but only a few faculties of policy sciences knew this journal although never opened even a single page.

Almost all of the faculties of *shakai-kogaku* and policy sciences were aware only of the disciplinary system in ivory tower and therefore naively believed the disciplinary system as the only possible system or the interdisciplinary system as absurd. Without natural scientific idea, almost none of them knew the success of biochemistry as an interdisciplinary field. When the student organization of the university planned a seminar of Egami, the most representative pioneer of biochemistry in Japan, the university administration ordered the students to cancel it for the reason that he was a leftist. Almost all of the faculties of *shakai-kogaku* and policy sciences naively believed the new social sciences promoted by government merely as the non- or anti-Marxian social sciences or as the US-originated social sciences. Indeed, President and Vice-Presidents of the university repeatedly and proudly pronounced the novelty of the university as the US-oriented university with the US-imported system. The first chairman of Graduate School of Policy Sciences and many other faculties repeatedly and proudly pronounced this graduate school as having been established for US-originated economics. Its official publications have never used the term of policy sciences. "The New Idea" of the new university was a novel form of West-imported knowledge. It was really novel as the model of anti-leftist university.

The faculties of *shakai-kogaku* and policy sciences knew the term of cybernetics and the name of Wiener but only the term and the name. Some regarded cybernetics as a pro-Marxism social science. Almost all of the faculties regarded computers merely as statistical data calculators rather than information processing systems. Allocated an enormous amount of budget by government, some of the faculties put a huge amount of numeric data into computers and simulated every combination of possible cases of economic situations and took pride of this as a new social science.

Originally, the University of Tsukuba was not designed for the innovation of natural and social sciences and humanities. At first, this project was called the relocation of university rather than the design of university with new idea. Actually, it was motivated to promote economy at the cost of universities and R&D institutes. More specifically, it was mainly motivated for more profitable use of land within Tokyo by relocating "useless" institutes to rural areas. The leading members of the planning board of the university (mainly physicists) ignored the balanced development of natural and social sciences and humanities, and once seriously planned to exclude social sciences and humanities as useless. Their view of physics as the model of all knowledge affected the design of the new university, and viewed social sciences and humanities merely as ideologies, either left or right without scientific base.

Government promised universities and R&D institutes to increase the budget if they "sell" the expensive land in Tokyo" to more "profitable" sectors. This promise was partly broken. Government including the Ministry of Education and the Science and Technology Agency (now Ministry of Education and Science) failed to recognize the importance of information exchange of universities and R&D institutes with governmental organizations including budgeting offices. This forced professors and scientists to consume many hours to visit the government offices in Tokyo for budgeting negotiation [Eto, 2005]. Far away from government and business centers, social scientists were engaged in mathematical tools of social sciences with little relevance to real societies.

It has passed nearly forty years since the establishment of the University of Tsukuba. Although Tsukuba is still called the University of New Idea, the environment surrounding higher education has been completely changed. One of the biggest turning points of change

was around 1990, when the Cold War ended by disintegration of former Soviet Union, and the bubble economy in Japan was collapsed, which later seriously affected Japanese politics and economy. Left-wing opposition parties decreased their seats greatly in the Diet and people who used to oppose the higher education policies by the government lost strong support by such parties. At the same time, the ruling Liberal Democratic Party also decreased their seats in accordance with the growth of centrist parties, which caused the political instability. In this situation, the main concern of universities and faculties shifted from the protection of university autonomy to the acquisition of more financial support from government. Science and engineering faculties were particularly so, and some national universities such as ex-imperial universities succeeded in getting more resources by the "prioritizing of graduate education" policy, which was initiated by the Ministry of Education and Science for the purpose of improvement of research infrastructure of selected universities [Yamamoto, 2007].

The second big turning point was in 2001-2004. In 2001, Prime Minister Koizumi took office and immediately started to implement reform policies in various fields, particularly in the postal services, based on his radical market-oriented mind and neo-liberalism thought. In higher education, "Toyama Plan" was opened in public without pre-negotiation with national universities. This was very unusual in decision-making style in Japan, where the negotiation beforehand is crucially important for consensus formation [Eto, 1984]. The plan aimed at the radical reform of national university system, *i.e.*, merging and reorganizing of existing national universities, the introduction of managerial method developed in private enterprise, and the introduction of competitive environment based on third-party evaluation of universities. The plan said only 30 institutions were allowed to grow as research-intensive universities by the selective resource allocation of the government. By this plan and for related reasons, the university reform in Japan progressed swiftly and reached to the incorporation of national universities in 2004. In the same year, the accreditation system of universities and colleges was also introduced. Every university and college must be evaluated by one of the authorized accreditation agencies every seven years and the failure of being accredited might cause serious problems on the further existence of universities and colleges.

The third and the biggest problem particularly for private institutions continued to grow. It is the decline of 18-year-old population. It was 2 millions in early 1990s but it has continued to decline to 1.2 million in 2010 and will be 0.7 million in the middle of the 21st century. Because of the heavy reliance on young students, it is very serious for universities in Japan. Data provided by the Ministry of Education and Science says that nearly 95 percent of university freshmen are at the age of 18 or 19. The number of adult freshmen over 25 years old is only 2 percent, while the average of this figure at the OECD member countries is 20 percent. By the decline of the population, about one half of private universities did not enroll the enough numbers of students in 2010 and this will cause the decrease of their tuition revenue. This is directly related to the managerial problems. In this situation, student recruitment activities have become serious, and the raise of the attractiveness by university reform is the top priority of their institutional running.

Teaching of social sciences has become more application-oriented, practical and vocational oriented in many institutions in response to the needs of students, while research in social sciences is needed to reform fundamentally. After the Report of Higher Education System in

the 21st Century issued by the National Council on Education in 2005, the public concern and governmental policy on higher education have shifted to the quality assurance of university teaching, which means the existing way of and contents of teaching must be examined and improved so that Japanese higher education may be more recognized globally. The Science Council of Japan issued a report on quality assurance for university education in each field in 2010 by the request of the Ministry of Education and Science. Although the Council says only the basic idea and does not give details on the contents and levels of each field including social sciences, more concern will be focused on the contents and levels of teaching in details. It is seriously feared for the standardization of university teaching in the field of social sciences in the near future. It may either kill the fundamental character of university education, which should be different from that of secondary education at high schools, or it may improve the quality of teaching and research on social sciences to some extent.

In the 2010s, the relationship between universities and government is expected to be different from that in the 1960s and 70s. Social sciences in Japan are expected to be more than the tools for opposing the governmental policies and rather important measures to educate students for good citizens with rich culture. Social sciences should be more contemporary with society, and students should learn the analytical and critical way of thinking through lectures. As for research in social sciences, the relevance to the actual society in Japan should be stressed for their further development, while the originality and quality should be improved for global recognition. However, the fact shows that the Japanese way of management and the theoretical and empirical studies on it were often ignored in international journals or remained only as a "Galapagos species" [Eto, 2008c]. In this situation, it is feared that the stress to increase original research activities might drive social science professors just to "apply" foreign-made theories to Japan without regard to the reality of Japan.

7. Conclusion, limitations, remaining problems and future research

This chapter discussed the mutual relationships between social and natural sciences, humanities, and technology in regard to their methodological influences. The discussion was mainly or nearly exclusively focused on the western knowledge including higher education systems. The non-western ones were mentioned only as a case of West-influence on East. But one can not ignore the historical fact that many of the western ones originally came from East and that East developed its own ones. The eastern ideas and systems have developed in different ways (sometimes analogous but often opposite ways) from the western ones, but are often ignored even within East. The same comment holds for South. This chapter is no exception.

Highly but locally developed knowledge or intellectual systems in East are often regarded as Galapagos species or isolated minorities and are ignored or despised or even hated as enemies in the West-dominant world like non-European languages and non-Christian religions. Many crops were bred and domesticated from wild grasses in central or western Asia in dry climate unfavorable to agriculture and transferred to West, where very few crops were originated [Doebly, 2006; Balter, 2007]. That is, West just imported knowledge from East as well as Africa (*e.g.*, cattle keeping), American Continent (*e.g.*, potato), Pacific Islands (*e.g.*, banana) and, besides food, Siberia (*e.g.*, the domestication of dog). Long after

that, West began to build the leading civilization. In analogy, Eastern civilization may take time to be recognized worldwide as Greek culture was recognized in Europe nearly two thousands years after. The Buddhists and Hebrews predicted the declines of their knowledge and the revivals again. The same comment may hold for the knowledge of Africans, American natives and Pacific Islanders.

Under the globally dominant western systems in societies and knowledge, non-western countries accept and follow the western knowledge system to avoid the isolation [Eto, 1993]. But the non-western ones survive in the invisible undercurrents. For example, western idea-based laws are radically modified in enforcement by police, prosecutors and judges in non-western countries, where law is one thing and the enforcement is another. In such situations, many universities of Japan avoid to offer the lectures of jurisprudence and Constitution. Another example is the so-called the Law of the Establishment of the University of Tsukuba (officially claimed as the university of new idea). This law stipulates to establish the department of *shakai-kogaku* (social engineering), but actually in its implementation only a few years after the pass of the law in the Diet, the department of *shakai-kogaku* (social engineering) was semi-officially replaced with the department of economics in accordance with the traditional idea of university.

Related to the view of humans as *homo economics* and an economic sin, a Buddhist Honen in the suburbs of Kyoto in the 1100s discussed so great power of the Buddha's palm to remedy any evils and cleanse any sins. Here, evils and sins mainly denoted the economic activities for profits that were prohibited in the classic Buddhism. His theory was developed further by his disciple Shinran, and their school called the *Jodo* School is today the most popular among the Buddhism schools in Japan. Here *Jodo* literally means the pure or sinless land as the quasi-paradise for general citizens or paradise above the purgatory and below but near Heaven. Honen and Shinran admitted all common people to paradise if not Heaven and thereby approved economic activities as remediable on the great palm of Buddha. Later, however, the economic power overwhelmed the power of the great Buddha's palm and destructed the agriculture-based society.

The classic ideas valued the agriculture and undervalued commerce. But agricultural activities kill noxious insects. Therefore, the Indian Jainists were engaged in commerce to avoid killing, while living in extremely simple manners. The commercial activities were free from sin if not for profit but for just distribution. The Muslims were engaged in the commerce between the East and the West but avoided the capital gain to lend money at interest. These traditional wisdoms are not known among modern economists. This blind spot must be clarified and the gap between modern western ideas and the classic non-western ones must be filled someday.

This chapter did not discuss the ethics of social scientists. The mega-quake and tsunami in 2011 affected the ethics of natural scientists, engineers and medical doctors. After the disaster, they participate in social activities. The public also expects the social scientists' activities, but finds that they remain relatively inactive possibly because of the university reform, which seems to affect the ethics of social scientists in the opposite direction from that of natural scientists.

This chapter merely followed the prevalent idea to regard the Greek culture as the origin of the scientific ideas. But some physicists date back the origin of the relativity and the

quantum theories to the Indian Vedas, 3000 or more years old. The ideas of evolution and genetics could date back to the origin of breeding grains or cattle from grasses or wild animals in East Africa, and West or Central Asia in the Neolithic Age. Scientific evidences demonstrate that the species of dog (*Canis familiaris*; family *Canidae*) was bred from species of wolf (*Canis lupus*; family *Canidae*) about or over 10,000 years ago in East Siberia [Savolanien, *et al*., 2002]. The currently prevalent idea to date back the origin of the modern idea to the Greek classic era might be needed to reconsider on the basis of evidences.

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