DYNAMICS OF KNOWLEDGE PRODUCTION AND THE SOCIAL FORMATION OF THE UNIVERSITY

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Approval of the Graduate School of Social Sciences

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

DYNAMICS OF KNOWLEDGE PRODUCTION
AND
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Ceyhan, Murat
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The purpose of this thesis is to establish a preliminary foundation of a research method aimed at understanding the social identity, role and function of the university. In this respect, it aims at identifying and articulating a set of issues, concepts, questions, social dynamics and so on, which have to be addressed and investigated carefully, before starting to build such a research method. To this end, the thesis focuses on and analyzes a recent debate on the changing nature of the contemporary social system of knowledge production; a debate constituted by several theses of change, namely, Mode 2, Finalization in Science, Post-normal Science, Academic Capitalism and Triple Helix, and the critiques directed towards these theses. In consequence, the thesis argues that to understand the social nature and function of the university, first and foremost, a versatile conceptual framework is required to capture the phenomenon of the social construction of the paradigm of knowledge/science; a phenomenon which is certainly nonlinear by nature and involves complex interrelations between scientific, political, economic and cultural realms.

Keywords: University, Knowledge Production, Mode 2

ÖZ

BİLGİ ÜRETİM DİNAMİKLERİ
VE
ÜNİVERSİTE'NİN TOPLUMSAL OLUŞUMU

Ceyhan, Murat
Yüksek Lisans, Bilim ve Teknoloji Politikası Çalışmaları
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Eylül 2010, 104 sayfa

Bu tez, üniversite'nin toplumsal karakter, rol ve işlevini anlamaya yönelik bir araştırma yöntemi kurma yolunda başlangıç seviyesinde bir altyapı oluşturmayı hedeflemektedir. Bu bağlamda, tezin amacı, böyle bir araştırma yöntemi kurma çalışmalarına başlamadan önce farkedilmesi ve dikkatli bir incelemeye tabi tutulması gereken konuları, kavramları, soruları, toplumsal dinamikleri belirlemek ve dile getirmektir. Bu hedef doğrultusunda, tezin odağı ve araştırma nesnesi olarak günümüz bilgi üretim sisteminin doğasındaki değişimler üzerine süregiden, bir tarafında Mode 2, Finalization in Science, Post-normal Science, Academic Capitalism ve Triple Helix isimleri anılan değişim tezlerinin, diğer tarafında da bu tezlerin eleştirilerinin yer aldığı, güncel bir tartışma seçilmiştir. Çalışmanın sonucu olarak; üniversite'nin toplumsal karakterini anlayabilmek için, öncelikle, doğası gereği kesinlikle doğrusal ilişkilerle açıklayanamayan ve karmaşık bilimsel, siyasal, ekonomik ve kültürel süreçlerin sonucunda toplumsal olarak şekillenen bilgi/bilim paradigması kavramını tam anlamıyla kavrayabilecek bir kavramsal çerçeveye ihtiyaç duyulduğu öne sürülmektedir.

Anahtar Kelimeler: Üniversite, Bilgi Üretimi, Mode 2

To My Big Family

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CHAPTER I

INTRODUCTION

1.1 The Purpose, Focus and the Scope

1.1.1. The Purpose

What is the social character and identity of the university? In other words, what is its social role and function?

Since the emergence of the modern university at the outset of the 19th century, this question – and various derivatives of it – has been investigated by many authors, and a lively and long lasting academic discussion is formed around it.[1] However, as examined thoroughly by Delanty and Rothblatt, and as further noted by Fuller, the majority of this discussion has been revolving around the question of what *should* be the social function of the university; instead of addressing the original question of 'what *is*'.[2] Accordingly, most of the treatises which contribute to this discussion lack

[1] In the historical studies of universities, the emergence of the modern university is unequivocally associated with the foundation of the University of Berlin in 1810. Moreover, historians and sociologists alike, point to the fact that starting with the debate on the foundational principles of Berlin University, the issue of the societal role and function of universities started to be the subject of many scholarly discussions. For a full historical account of the rise and growth of modern university, and also of the discussions on social identity of universities see; W. Rüegg, ed., *Universities in the Nineteenth and Early Twentieth Centuries, 1800 - 1945* (Cambridge: Cambridge University Press, 2004).; S. Rothblatt and B. Wittrock, eds., *The European and American University since 1800: Historical and Sociological Essays* (Cambridge: Cambridge University Press, 1993).; R. Lowe, ed., *The History of Higher Education*, 5 vols (New York: Routledge, 2009).; G. Delanty, *Challenging Knowledge: The University in the Knowledge Society* (Buckingham: SRHE and Open University Press, 2001).

[2] Beside his book, *Challenging Knowledge: The University in the Knowledge Society*, Delanty investigates this issue in two other studies: G. Delanty, "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge", *Social Epistemology*, 12 (1998): 3-25. & G. Delanty, "The Sociology of the University and Higher Education: The Consequences of Globalization ," in *Handbook of International Sociology*, ed. C. Calhoun, C. Rojek and B. Turner (London: SAGE, 2005), 530-45. Rothblatt and Fuller investigate the same issues in; S. Rothblatt, "The Idea of the Idea of a University and its Antithesis," in *The History of Higher Education*, ed. R. Lowe (New York: Routledge, 2009), II:178-221. S. Fuller, "Rethinking the University from a Social Constructivist Standpoint", *Science Studies*, 7 (1994): 4-16.

a rigorous empirical and theoretical base to tackle with the question of 'what is', and for this reason, the discussion itself is ill-equipped to provide the *actual* picture.[3]

In this respect, this thesis raises the following questions and aims at answering them: *How* should one address this issue of social identity, role and function of the university in the first place? What kind of a conceptual framework and research method is required to effectively deal with this issue of understanding the university as a social institution? On which theoretical and methodological foundation should one base such a research method? Which issues, concepts, questions, social dynamics, factors and so on should be taken into account while constructing such a method and, thus, require a careful examination? How can these related issues be identified in the first place? And how can they be incorporated into this research agenda and method formation?

By answering these questions, this study intends to establish the foundation of a research method aimed at understanding the social identity, role and function of the university. Thus, the main purpose here is to identify a set of issues and questions which have to be addressed and investigated carefully, before starting to build such a research method; so that, the theoretical and methodological building blocks of it will rest on cautiously examined grounds. As such, this thesis can be considered as a preliminary study; in the sense that, its goal is not to construct this research framework itself directly, but rather to prepare its basis.

[3] As noted by Fuller as well, this statement should not be extended to all enquries on universities. It applies only for the studies that focus on the specific issue of social function of universities. Other than that, there is a vast amount literature that deals with micro-level analysis of universities' organization, structure and so forth; especially in the field of education sciences.

1.1.2 The Scope and the Focus

Building such a fully-defined research agenda to investigate the social identity of the university, however, would mean a major enquiry with strong theoretical and empirical dimensions. The formation of the basis of such a method alone is equally difficult, simply because of the open-ended nature of the problem. For these reasons, first, it is necessary to determine a context and a method in and through which the answers to the questions of this study can be searched for. And this method and context have to be chosen in such a way that, the study will have a manageable, yet comprehensive, scope and extent and so that it yields tangible results.

Accordingly, to establish the boundaries of the study, a particular topic and a body of literature is selected from the whole spectrum of academic discussions that have a bearing on the social character of the university. In addition to it – mostly due to the nature of the questions at hand – an analytical exploratory approach is selected as the primary method of investigation. The specific topic that is selected to this end is a recent debate on *the nature of the contemporary social system of knowledge production*.[4] Considering the fact that universities are institutions of knowledge production, this debate has a direct relevance for the subject of this study, and as will be seen in the course of this study, its boundaries are rather well-defined and its scope and extent is adequate enough. Thus, in this sense, the basic purpose of this study is to analytically investigate this specific debate thoroughly in search for the answers to its research questions. Nevertheless, this particular debate represents only one single topic among all the studies that deals with social nature of the university,

[4] The emphasis is mine.

and naturally it does not touch upon every possible issue related with universities. Hence, in this sense, the findings of this study will be partial at best.

In this regard, the rest of this introductory chapter is organized as follows. First, a brief summary of this debate – the primary topic and the participants – is presented. Then, the history of the modern university and the academic discussions around it is summarized in brief; so that, this particular discussion which is studied in this thesis, could roughly be positioned in a broader map of issues. And in the final section, the details of the method, organization and structure of this thesis are presented.

1.2 Changing Nature of the Knowledge Production?

Especially after the 1980's, several authors started to suggest that we witness important changes in various aspects of the social system of knowledge production and introduced different notions to explain these changes; such as finalized science, strategic research/strategic science, post-normal science, academic capitalism, post-academic science, Mode 2 and Triple Helix.[5] They all have different perspectives, their claims have different extent and scope and are sometimes even contradictory; but, their basic arguments converge to a common point: The practices and processes of contemporary knowledge production differ significantly from the past in one way or another.

None of these tracts is uncontested, however. A diverse range of theoretical and methodological concerns are raised, and several empirical studies are conducted to

[5] This body of literature is constituted by numerous journal articles, books and book sections. For this reason, they will be cited fully later when they are analyzed separately in detail. For the studies that provide a collective analyzes of them, on the other hand, see; L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.; J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.

test the validity of the claims. As a result, a lively and ongoing 'transformation debate' on the contemporary social system of knowledge production, is formed. And, in this study, the particularities of this debate will be under investigation.

More specifically, however, not all the individual thesis that constitutes this debate gets an equal amount of reception in the literature, and they do not have equal amount of weight in the discussion either. On the contrary, one of them stands out remarkably, and occupies the centre of this discussion, unrivalled: Mode-2 thesis of Gibbons et al.[6] It is not the first one chronologically, nevertheless, it is the well-known spokesman of "new mode of knowledge production" and influences not only academic studies but also policy-making agendas[7]. As presented by Hessels and Van Lente, a Scopus search on 14th June of 2010 shows the total number citation it receives as 1879, which is way more than the total citations of all the other theses.[8]

In brief, this Mode 2 thesis is based on the author's observations of several radical changes which, in their strongly interdependent and multifaceted composition, point to the emergence of an entirely new social system of knowledge production. They call this new system as 'Mode 2 knowledge production' to differentiate it from the old one which they call 'Mode 1'.

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[6] The concept of Mode 2 is introduced in two books: M. Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (London: SAGE Publications, 1994). & H. Nowotny, P. Scott and M. Gibbons, *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty* (Cambridge: Polity Press, 2001).

[7] For detailed bibliometric studies of Mode 2 analysis and its impact see; L.K. Hessels and H. Van Lente, "The Mixed Blessing of Mode 2 Knowledge Production", *Science, Technology and Innovation Studies*, 6 (2010): 65-9.; L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60. & T. Shinn, "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology", *Social Studies of Science*, 32 (2002): 599-614.

[8] Hessels and Van Lente, "The Mixed Blessing of Mode 2 Knowledge Production," 65.

In its very well known format, Gibbons et al. present their thesis with several dichotomies which represent the characteristics of each mode. (1) The paradigm of knowledge/science is shifting from a 'knowledge production for its own sake', to a 'knowledge production for use'. That is, the orientation of knowledge production is changing from basic research towards an application and use-oriented research. Solving practical problems and creating useful knowledge is replacing the scientific pursuit of fundamental laws and first principles. (2) Again paradigmatically, the clear-cut boundaries between the 'autonomous' Mode 1 science and the other spheres of society are becoming transparent in Mode 2. Society starts to be included into the processes of knowledge production and thus a more socially accountable and reflexive research is emerging. (3) Moreover, this paradigm shift also changes the way knowledge production is scientifically and socially realized. First of all, transdisciplinary and collective way of work is replacing disciplinary and individualistic practices. (4) Along the same lines, the universities are losing their privileged status as the primary and stable institution of knowledge production; instead, many new sites and settings of knowledge production proliferate in more heterogeneous and transient institutional and organizational patterns. (5) Furthermore, knowledge being produced is no longer distributed and accumulated solely inside the academic community; rather, it is disseminated to a wider range of realms and into a broader society. (6) And finally, even the quality control mechanisms start to include new considerations, elements and actors which were absent in the traditional peer review process.

As seen above, regarding the university, Mode-2 thesis represents a certain model of decline: In contrast to being the sole institution of knowledge production and

enjoying a monopoly in Mode 1, in Mode 2 "the universities, in particular, will comprise only a part, perhaps only a small part, of the knowledge producing sector."[9] According to the authors, however, paradoxically, universities themselves are behind this downfall. They have enlarged extraordinarily due to the rise of mass higher education in the second half of the 20th century, and as a result of it, they started to train numerous competent researchers beyond their own capacities of employment. In turn, this growing cohort of competent researchers, who are familiar with the methods of science, started to conduct research elsewhere, and so they helped the proliferation of different sites of knowledge production. And this way, claim the authors, the monopoly and the significance of the university in knowledge production is undermined remarkably. According to Delanty and Fuller, however, this picture depicted by Gibbons et al. means even more than a decline; in fact, it means the end of the university or even the end of knowledge.[10] In any case, Gibbons et al. see a strong connection between the mode of knowledge production and the role and function of universities in it. This supposed connection certainly requires attention from the perspective of this study.

As noted by Shinn and Hessels & Van Lente alike, there are two reasons for the extraordinary popularity of Mode 2 diagnosis.[11] First one is related with the scope and extent of its claims. In contrast to the other thesis which suggest some 'changes'

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[9] M. Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (London: SAGE Publications, 1994).

[10] G. Delanty, "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge", *Social Epistemology*, 12 (1998): 3-25. & S. Fuller, "Rethinking the University from a Social Constructivist Standpoint", *Science Studies*, 7 (1994): 4-16.

[11] Shinn, "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology". & Hessels and Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda".

in the way knowledge is being produced, Mode 2 thesis proposes the emergence of a totally new social system of knowledge production. In fine, it proposes a total transformation. Accordingly, the reactions to it are also quite varied. They come from different perspectives and fields of study, such as sociology, science studies, policy studies, history, and educational sciences and so on. Second reason, on the other hand, is associated with the radical discontinuity it proposes: According to the authors, this new system is in sharp contrast with the old one in nearly every respect: From the initial social/scientific mechanisms of research agenda shaping to the institutionalization of knowledge production and even to the quality control mechanisms. Such generic and far reaching claims are not shared by the other diagnoses of change. They remain moderate in this sense. In turn, such comprehensive arguments naturally evoke an equally comprehensive critical response.

For the same reasons, and also because of the strong connection it proposes between knowledge production and the nature of the universities as mentioned above, the Mode 2 thesis of Gibbons et al. will occupy the core of this study as well. It will be the main diagnosis of transformation that is analyzed in length and depth. The other treatises will nonetheless be examined, but to a lesser extent, and only when they provide additional insights for the task of this study.

Hence is the focus of this study; the social character of the university at one hand, and on the other, the transformation debate centered on the “new production of knowledge” thesis by Gibbons et al.

1.3 Historical Background

The transformation debate explained above is not the only discussion that is related with the university, however. It has its own position in the history of the modern university and the studies on it. Below, this history is presented briefly, in order to locate the transformation in a broader framework.

During the three decades following the French Revolution, the number of universities in Europe has declined remarkably: In 1789 there were 143 universities, but by 1815, almost half of them were either dissolved or replaced by specialized professional schools.[12] However, this downhill trend did not continue any further. On the contrary, both the quantity and the size of the universities have grown significantly in the following two centuries.[13] Yet, this was not just a shutdown and reopening process. What has happened was the disappearance of the traditional university model, the birth of a new one in its place, and then further evolution and expansion of the latter.

The first example of this new model was the University of Berlin which was founded in 1810 through the efforts of the scholar and politician Wilhelm von Humboldt. His intention was to establish a new university based on liberal enlightenment ideals; especially those of Kant, Fichte and Schleiermacher. For him, unlike the traditional ones, the primary function of the university was not only to disseminate already established knowledge but also to promote research for basic principles and

[12] C. Charle, "Patterns," in *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, ed. W. Rüegg (New York: Cambridge University Press, 2004), 33-80.

[13] D.J. Frank and J.W. Meyer, "Worldwide Expansion and Change in the University," in *Towards a Multiversity? Universities between Global Trends and National Traditions*, ed. G. Krücken, A. Kosmützky and M. Torka (Bielefeld: Transcript, 2007), 19-44.

fundamentals.[14] Through this unity of teaching and research, he believed, the students would also acquire the whole outlook of scientific discovery. Humboldt's principles were also a reaction to the system of separate institutions oriented towards practical knowledge and specialised training, then prevailing in France. However, full implementation and realization of this model was not a straightforward process. Some of the original plans are dropped out in time, and some of them only took place slowly.[15] Nevertheless, the reform succeeded, and at the end of the 19th century, the Humboldtian model was the dominant form of university throughout the whole Europe, and even beyond that.[16]

The defining characteristics of this model, however, which differentiate it from its predecessors, were not only academic or intellectual. It was different than the traditional university regarding two more aspects. First as a result of the increasing secularization of the times, the basic alliance of the university was not anymore with the church but with the state. Wilhelm von Humboldt himself was a minister of the Prussian state, and he founded the University of Berlin under its authority. Yet, for Humboldt the conditions of this new alliance were very important: The main responsibility of the state was to provide the university with scientific 'freedom' and 'autonomy', and in return, the university would supply the state with necessary

[14] W. Rüegg, "Themes," in *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, ed. W. Rüegg (New York: Cambridge University Press, 2004), 3-31.

[15] Ibid.

[16] E. Shils and J. Roberts, "The Diffusion of European Models Outside Europe," in *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, ed. W. Rüegg (New York: Cambridge University Press, 2004), 163-230.

professional, scientific and cultural capital. 'Financial autonomy' was also a part of the Humboldt's original plans, but he could not succeed.[17]

Second the impact of an intense bureaucratization process could be seen in all parts of the modern nation state and education was no exception. Hence the universities increasingly became subjected to the national education policies. Ministries of Education started to be established all over the Europe. They shaped the higher education scenery of the country, "governed access to the universities...controlled their curricula and exams and provided the universities with modern buildings and laboratories."[18] As a result, in an integrated fashion research and teaching were institutionalized in these state universities, and accordingly, scholars have turned into functionaries of the state.

In short, in these two centuries of evolution, the university experienced a profound transformation in two major ways. First, research and basic scientific activities which were absent in traditional universities became the second mission of the university besides teaching. Second, the university started to occupy a central position in the society due to its association with the state. The traditional university was essentially an ecclesiastical institution and it was secluded from the rest of the society. For the nation state, the new financier and protector, on the other hand, the university was a crucial institution of scientific, professional and cultural knowledge.

As a result of its growing importance in the society, sociological studies on the university have also intensified in this same two centuries. It became the subject to a

[17] Rüegg, "Themes".

[18] Rüegg, "Themes".

quite diverse range of discussions, both from micro and macro level perspectives. The educational aspects of it are addressed in the focused views of sociology of education. But, more importantly, numerous scholars started to present their views on the nature and function of university in the society, and thus emerged the lively debate on 'the idea of the university'.[19] In fact, Kant's famous plea to the King of Prussia about the need of establishing a university based on liberal ideals is considered to be the start of this debate. Then there followed the works of Von Humboldt, Newman and Jaspers, to name a few. Furthermore, in addition to these micro level studies and the idea of the university debate, the university also started to be a part of broader agendas of sociology of knowledge and social theories: "most of the major sociologists and social theorists from those in the classical tradition such as Weber, Durkheim and Veblen and mid-century sociologists such as Parsons, Bell, Riesman and Shils, to the radical generation – Tourain, Gouldner, Habermas and Bourdieu – wrote extensively on it."[20] All these authors had their own different perspectives, yet, they shared a common belief. The university is not merely an important institution of knowledge production; it has a mutual relationship with the modernity. It follows its ups and downs. But, more than being shaped by society, the university also shapes it in turn.

Regarding the wide range of discussions on the university, the situation today is not different. In fact, it is even more complicated. For example, according to Burton Clark, the following topics have matured enough in the second half of the twentieth

[19] For a comprehensive account of the participants of this debate see; G. Delanty, *Challenging Knowledge: The University in the Knowledge Society* (Buckingham: SRHE and Open University Press, 2001). & S. Rothblatt, "The Idea of the Idea of a University and its Antithesis," in *The History of Higher Education*, ed. R. Lowe (New York: Routledge, 2009), II:178-221.

[20] Delanty, *Challenging Knowledge: The University in the Knowledge Society*.

century, so that one can speak of the emergence of sociology of higher education: The inequalities in higher education, the effects of higher education on individuals, academia as a profession, the organization and governance of the universities, and the university as an institution.[21] Likewise, several present day sociological theories of knowledge and society that attempt to analyze the "postmodern", "post-industrial", "knowledge" or "global" social order include the university as a part of their larger agendas.[22]

Thus, the university occupies a central position in a diverse range of contemporary discussions, and the 'transformation debate' is one of the many.

1.4 Method, Organization and Structure

To fulfil its task, this study employs the following strategy and way of conduct: In the first chapter, the main claims of the Mode-2 thesis are analyzed in detail. The definitions and the characteristics of Mode 1 and Mode 2 knowledge production are investigated and compared with each other. This way, the nature of the university in each mode will be visible. Furthermore, comparing *what* is new in the contemporary mode of knowledge production and *what* has changed in the organization, structure and social standing of the university in this respect, with the conditions of the old one; the nature of the correlation between the mode of knowledge production and the character of the university, proposed by Gibbons et al., will be made visible. And this

[21] Burton R. Clark, "Development of the Sociology of Higher Education," in *Sociology of Higher Education: Contributions and Their Contexts* , ed. P.J. Gumport (Baltimore: The Johns Hopkins University Press, 2007), 3-16.

[22] For details see; Delanty, "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge".

way, a preliminary insight, based on the arguments of the authors, will be gained about the relationship between ‘knowledge production’ and ‘the university’.

In the second chapter, *how* these arguments are constructed by Gibbons et al. is examined by answering the following questions: What are the actual phenomena behind the suggested changes and the emergence of the Mode 2? What conditions, events or social changes paved the way to the rise of Mode 2 knowledge production? Consequently, what kind of reasoning or method is employed to connect these phenomena to the authors’ final arguments? Is it just a linear cause and effect relationship or are there any theoretical and methodological premises that validate these connections? If so, what are those? More importantly, is there any justification or analysis about why and how these background phenomena should lead to final conclusions? The purpose of this part of analysis is to identify how the authors connect the formation of social system of knowledge production to the broader societal contexts and processes. This way, the formation of the university will be put into a wider social setting.

Following this analysis, however, in the third chapter, the attention is turned to the other participants of the debate, to actually check the validity of the findings so far. To this end, the other diagnoses of transformation and the direct critiques to Mode 2 thesis in the literature are examined. In this way, which points in the analysis of Gibbons et al. seem to be confirmed and which points are considered to require a further investigation are identified. For example, is the factuality of the background social phenomena which are responsible for the emergence of Mode 2 considered to be valid? More importantly, do the other authors and critics confirm the theoretical

and methodological premises of Gibbons et al. through which they connect these phenomena to the rise of Mode 2? If not, which specific element in the Mode 2 analysis is questioned? Do the critics demand a further reinterpretation or improvement in some of the theoretical and methodological considerations of the Mode 2 analysis? Or do they simply represent a total rejection? Is the system of knowledge production really shaped in the way described by Gibbons et al.? Or does it require more careful considerations? This way, this study aims at refining its findings.

Further in this part of the study, two more types of response to the Mode 2 thesis are addressed: (1) both the critical and non-critical treatises that are concerned with the Mode 2 thesis as a whole and place it in a larger context, and (2) the empirical studies primarily designed to test the claims of Gibbons et al.

Through the first set of treatises, the broader issues of sociology of knowledge that would otherwise be concealed by the particularities of this transformation debate will be visible. For instance, one of the most prominent critiques of the Mode 2 thesis is its implicitly normative stance. Yet, as will be elaborated later, it strongly influences policy making agendas, and in turn, these policies try to shape both the knowledge production regime and the place of the university in it. Thus, the very phenomenon described by the Mode 2 thesis is also being shaped by it.

The second set of studies, that is, the empirical ones which test the validity of some aspect of Mode 2 diagnosis, on the other hand, will provide with valuable micro level insights about the institutional and organizational characteristics of the university. So that, they will direct this study to issues which are outside of the transformation

debate but valuable for the task at hand. However, to remain within certain limits, the broader issues of sociology of knowledge or micro level analysis of the university will be kept out of scope. They will be referred to only when they appear in the studies which are explicitly concerned with the Mode 2 thesis.

This is the main strategy to be employed in this study. At this point, it should be noted that, however, the purpose here is not to make a direct contribution to this transformation debate. Regarding the contemporary mode of knowledge production, this thesis neither proposes a new hypothesis, nor does it conduct a critical analysis of the arguments of Gibbons et al. Similarly, concerning the nature and function of the university in this knowledge regime, it neither attempts to test the conclusions of the Mode-2 thesis empirically, nor does it construct its own theory of the contemporary university. Thus this study does not seek to resolve these two issues: The social characteristics and dynamics of the present-day knowledge production system and the sociological understanding of the contemporary university. On the contrary, as strongly emphasized earlier, it seeks to lay down a foundational framework to address the latter.

CHAPTER II

MODE 1 VS. MODE 2 AND THE UNIVERSITY

One of the most important – and most debated – aspect of Gibbons et al.'s thesis, which differentiates it from the other similar diagnoses, is the fundamental dichotomy it depicts between the supposed old (Mode 1) and new (Mode 2) systems of knowledge production.[1] This aspect, identified as a "radical discontinuity" by Shinn, is visible throughout the whole "New Production of Knowledge" treatise.[2] As summarized in the introduction, the authors draw a very sharp line between the characteristics of Mode 1 and Mode 2. They formulate their thesis with several dichotomies representing the characteristics of each mode. Such as, basic vs. application-oriented research, academic vs. socially distributed, disciplinary vs. transdisciplinary and so on. In fine, it can be posited that, Gibbons et al. do not only talk about the emergence of an entire social system of knowledge production, but also claim that this new one is the complete opposite of the old one.

The authors' description of the changing role and function of the university in each mode is equally 'radical' as well. Their study suggests a contradictory type of university in each mode. In fact, they identify a sharp contrast between the universities of Mode 1 and Mode 2. In Mode-1, the authors identify the university as the primary, privileged and paradigmatic institution of knowledge production and describe it as an isolated, ivory tower like institution. In Mode 2, on the other hand,

[1] For a fuller account of this aspect see especially; D. Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading", *Minerva*, 41 (2003): 245-61. & J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.

[2] T. Shinn, "Change or Mutation? Reflections on the Foundations of Contemporary Science", *Social Science Information*, 38 (1999): 149-76.

they no longer talk about the monopoly of the university, rather they consider it as just another player among the various types of knowledge production sites and settings, and claim that its importance is in serious decline.[3]

Seeing two different types of universities in two different social systems of knowledge production, however, evokes some important questions: Can one assume a connection between the 'mode of knowledge production' and the 'social standing and function of the university'?[4] In other words, is the university an institution shaped by the prevalent knowledge production system? If this is the case, how does it happen in the first place? Which aspects, subsystems or mechanisms of the mode of knowledge production play a role in the formation of the university's identity, and how?

In this respect, answering these questions is the primary purpose of this chapter. By doing so, the intention is to reveal the characteristics of this likely linkage between the social system of knowledge production and its elements on the one hand and the formation of the university on the other. This way, in line with the main task of this study, it is expected to detect one of the probable background phenomena which play a role in the shaping of the social character of the university. It should be noted that,

[3] Even though they themselves propose a transformation in the system of change, the diagnoses of 'academic capitalism' and 'triple helix' seriously question this argument of Mode 2 thesis. They argue a change in the nature of universities, but do not accept the model of decline proposed by Gibbons et al. See; S. Slaughter and L.L. Leslie, *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Baltimore: The John Hopkins University Press, 1997). & H. Etzkowitz and L. Leydesdorff, "The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations", *Research Policy*, 29 (2000): 109-23.

[4] It is quite obvious that knowledge, knowledge production and the university are naturally connected phenomena, since the university is a knowledge production and higher education institution. The emphasis here is, however, on the concept of 'social system'. It involves a diverse range of actors, agents or processes, and it is the connection of these elements to the institution of the university is what matters. This point will be clarified in the course of this study.

however, since the focus will be solely on the study of Gibbons et al. the findings will be partial and preliminary.

Accordingly, keeping the above questions in mind, in the rest of this chapter, the characteristics of Mode 1 and Mode 2 knowledge production are thoroughly examined and compared with each other. To properly do that, however, that is, to fully understand each mode and their relationship with the university, first, the core concept of Gibbons et al.'s analysis, the 'mode of knowledge production,' has to be clarified.

2.1 The Concept of the 'Mode'

In the sense used by the authors, the term 'Mode' refers to 'a coherent system of knowledge production,' and they define a coherent system as an internally consistent unity; formed by several mutually related and interdependent elements.

In this respect, the first and the most important element of a Mode, according to the authors, is its paradigm. As they see it; the paradigm is a collection of fundamental values, norms, conceptions, ideas and ideals about the nature, role and function of knowledge and knowledge production. As such, it constitutes and shapes the essence of a Mode. Thus, it implicitly determines, for example, the criteria which demarcates science from non-science; the criteria which determines what shall count as 'good' science; the direction of research; the social standing and the character of science; its relation with the other spheres of the society; the people who are eligible to conduct

research; and finally, even, the attitude and character of scientists. Hence, in this sense, according to the authors, the paradigm is the core of a Mode.[5]

Still, having a core, according to the authors, is not enough to have an entire Mode. Several other elements are required to support, supplement and complete it. More specifically, it has to be realized both scientifically and socially, through some actual processes, practices, systems and mechanisms. In this regard, they identify the following elements. **(1)** A mechanism through which the paradigm of a Mode is translated into actual research agendas. More specifically, an operational and functional social system or base in which the direction of research is established, the research priorities are set and the research agendas are conceived and shaped. **(2)** A mechanism through which the methods, norms, guidelines or frameworks that steer the actual research practices emanate. That is, a system through which all the conceptual tools of research are provided. **(3)** A pattern in which knowledge production is organized and institutionalized. **(4)** A consensual way of conduct which is followed in the actual knowledge production activities and practices. **(5)** A mechanism which provides the distribution, diffusion and accumulation of knowledge. **(6)** And finally, a mechanism through which the quality and control are maintained. As one can easily see, these six elements clearly represent the phenomenology of a Mode. Consequently, since they are visible and observable, the authors consider them as the 'characteristics' of a Mode.

[5] For example, in accordance with this understanding they define Mode 1 as follows: "In this essay, the term Mode 1 refers to a form of knowledge production – a complex of ideas, methods, values, norms – that has grown up to control the diffusion of the Newtonian model to more and fields of enquiry and ensure its compliance with what ic considered sound scientific practice. Mode 1 is meant to summarize in a single phrase the cognitive and social norms which must be followed in the production, legitimation and diffusion of knowledge of this kind." Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 2.

Not surprisingly, the writers claim that all of these apparent characteristics are also shaped by the paradigm of the mode, and consequently, there is a strong coherence among them. In other words, they claim that they perfectly fit together. For example, the authors argue that, the 'extended' quality control mechanism of Mode 2 is a natural outcome of the inclusion of various social actors into the Mode 2 knowledge production process. In the same manner, they assert that, the peer review process – the quality control system of Mode 1 which includes only scientists – is strongly connected with the isolated and autonomous nature of Mode 1. But, for now, two examples would suffice to show the authors' point. The entire interrelation pattern of both modes is presented in detail in the coming sections.

Hence is the fundamental concept of Gibbons et al.'s thesis: a coherent system of knowledge production constituted around a paradigmatic core; and scientifically/socially realized through several mutually related elements In the rest of the chapter, Mode 1 and Mode 2 are examined and compared with each other in detail, based on this definition of mode of knowledge production and its seven constituting elements.

2.2 Mode 1

2.2.1 The Paradigm

According to Gibbons et al., the nature (or the paradigm) of Mode 1 knowledge production can be described by the following three characteristics: First and foremost, it is conducted in the absence of any practical goal or application-oriented concerns. Thus, it is oriented towards discovering the fundamental laws or first principles. Second, it is organized autonomously, meaning that, it is conducted in a

self-governing community of scientists. And third, this scientific community is clearly isolated and demarcated from the rest of the society. In other words, there is a clear-cut boundary between these two realms and so that external influences rarely penetrate into this world of science; in fact, they are deliberately kept outside.

In fine, the writers claim that, in Mode 1, scientists themselves choose the problems they want to pursue, free from any kind of external inputs or influences, and they have no practical goals or applied concerns whatsoever. Put this way, the authors seem to imply the very well known ivory tower metaphor, though they do not use it explicitly.

Defined as such, however, Mode-1 simply seems to represent 'fundamental science' in the commonly used sense, and the authors are aware of this: "For many, Mode 1 is identical with what is meant by science."[6] Still, there is an important question to be answered: What about the applied sciences such as various disciplines of engineering? They are certainly application oriented, but the authors nonetheless consider them to operate in accordance with the imperatives of Mode 1. This, however, creates confusion. To remove it, what exactly the authors mean by 'the absence of any practical goals and application-oriented concerns,' has to be clarified.

The authors' explanation to resolve this issue is associated with the way they characterize the relationship between society, knowledge and science in the case of Mode 1.[7] First of all, they claim that, there is always a demand for knowledge of any

[6] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 3.

[7] In fact, as will be seen later in detail, this science – society relationship occupies quite an important place in the analysis of Gibbons et al. It is elaborated more in the second book, however; H. Nowotny,

sorts in the society: it is needed to be 'used' and 'applied' in a variety of social contexts; Such as, governmental issues, development of the society, technological progress, industrial and commercial product development, policy making, management, politics, environmental and health issues, all sort of social issues, and even everyday life, and so on. In short, according to the authors, the society is mainly concerned with practical problems, and accordingly, they require 'applicable' and 'useful' knowledge to solve them.

Still, say Gibbons et al., the detached and isolated character of Mode 1 described in the first paragraph above, does not allow these 'applied' concerns of the society to enter into the knowledge production process. The rest of the society is kept at the doors of the ivory tower so to say. Thus, when the authors state that Mode 1 research lacks any application-oriented concerns and practical goals, they actually refer to the absence of such concerns of the society in it. In other words, they claim that Mode 1 simply does not care about the usefulness of its outputs for the society. Along the same line, the practitioners of Mode1 are not concerned with who would use the knowledge they produce, how and when. That is the true meaning of the phrase 'lack of practical goals and applied concerns' from the perspective of the authors.

With this explanation, the case of the applied sciences in Mode 1 becomes clearer. It is now evident that the first characteristic of Mode 1 described above does not merely address the classical dichotomy between basic vs. applied sciences.[8] In other words, having an application-oriented subject of study, according to the authors, is

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P. Scott and M. Gibbons, *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty* (Cambridge: Polity Press, 2001).

[8] L. Oliveira, "Commodification of Science and Paradoxes in Universities", *Science Studies*, 13 (2000): 23-36.

not enough for the applied sciences to be excluded from Mode 1. On the contrary, by having an isolated and detached posture towards the society's concerns described above, they certainly comply with the essence of Mode 1.

More importantly, however, with this explanation, a connection is also established between the three characteristics described in the first paragraph, so that, now they represent a coherent whole. To summarize; the essence of the Mode 1, according to Gibbons et al., is shaped through its relation with the other spheres of the society. It rest on an idea of disinterested knowledge, and because of this, it is simply detached from the concerns of the rest of the world. This way, it continues with its pursuit of fundamentals. But, to achieve these conditions, that is, to work in this way, it certainly has to be a self-governing enterprise, that is, autonomous.

Hence, borrowing a phrase from Delanty, the basic paradigm of Mode 1 can simply be identified as follows: 'autonomous knowledge production for its own sake.'[9]

2.2.2 The Operational and Functional Base

As shown above, Gibbons et al. maintain that Mode 1 is socially organized as an autonomous and isolated scientific community. Still, they admit that that it would be wrong to assume a centrally managed, monolithic and homogeneous scientific enterprise. Thus, they accept that there is no such an entity, like a high council of scientific community, which directly organize all knowledge production activities,

[9] Delanty does not use this phrase directly to explain Gibbons et al.'s concept of Mode 1. His context is different. But the idea of knowledge that he describes with this phrase exactly matches with the paradigm of Mode 1. For details see; G. Delanty, *Challenging Knowledge: The University in the Knowledge Society* (Buckingham: SRHE and Open University Press, 2001).; G. Delanty, "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge", *Social Epistemology*, 12 (1998): 3-25. & G. Delanty, "The Sociology of the University and Higher Education: The Consequences of Globalization ," in *Handbook of International Sociology*, ed. C. Calhoun, C. Rojek and B. Turner (London: SAGE, 2005), 530-45.

choose all research topics and tell the scientists what to do. But, in this case, there has to be another mechanism through which the actual research agendas can be conceived and shaped.

In regards, the authors assert that, the internal organization of Mode 1 scientific community in which this mechanism is established, is a natural outcome of its mission and paradigm explained above. They emphasize that, even though Mode 1 is a pursuit of fundamental laws; the universe is so vast to be understood in its entirety. Therefore, they maintain that in order to achieve its goal and thus to operate properly, Mode 1 has to divide its primary mission into manageable pieces. In other words, it has to divide its subject of study into manageable fields of enquiry. Consequently, say Gibbons et al., the scientific community itself has to be divided into specialized sections which concentrate on these several fields of enquiry separately.

Hence emerges the basic organizational unit of the academic community of Mode 1, say Gibbons et al.: the disciplines. With their own distinctive and differentiated position in the scientific realm, and with their distinct fields of enquiry, they form the functional core of Mode 1 knowledge production system. The direction of research is determined through them. They simply constitute the sole context in which the research agendas or the problems to be solved are determined and executed.

2.2.3 The Source of Methods, Guidelines and Framework

The authors do not qualify the disciplines as only the organizational units of Mode 1, however. They consider them as functional and operational units of it as well. They believe that having a subject of enquiry is not enough to conduct a research. Every

research or every knowledge production activity has to follow certain theoretical and methodological guidelines or frameworks as well. And in the case of Mode 1, they claim, alongside the subject of study, the disciplines provide this framework as well. This way, that is, being inside a discipline, they argue, the scientists already know how they should work and which methods they should follow. They do not have to discover new methods every time they get involved with a new research question. In fact, for Gibbons et al., working inside a discipline implicitly means to obey and follow the way of work already defined by the discipline. Hence is the recurring statement of Gibbons et al.: 'Mode 1 is disciplinary.'

2.2.4 Organizational and Institutional Patterns

Even in this case, however, the realization of Mode 1 in the society is still not completely visible. Disciplines are less abstract than the academic community, for sure, but where to find these disciplines inside the society? The answer of the authors is quite clear: inside the primary and paradigmatic institution of Mode 1 knowledge production; The University. Thus, according to the authors, in Mode 1, the university is the home of this structured, pre-formulated and strictly isolated disciplinary way of work. As a result, it is an elite and detached research institution, and accordingly, its research activities are not affected by the concerns of usefulness for the society. Hence, regarding the Mode 1 knowledge production, it is the realization of the ivory tower.

This is, however, only one side of the coin. Besides research, the university certainly has another equally important function: education. As for that, Gibbons et al. think that this function actually has two components. At one side, they identify the

education of researchers, that is, fellow scientists. In this case, they claim, the university still remains as an elite institution and provide its education for a selected few, and in the mean time, this side of education is the way that the paradigm of Mode 1 is transmitted to the new generations. On the other side, according to the authors, there is the general education of the public, that is, the professional training. Regarding this function, they claim that, the university remained as an elite institution for a very long time. But now, they say, this is changing, and in fact it is one of reasons for the emergence of Mode 2. This is discussed in the following chapter.

So far, one by one, the defining characteristics of Mode 1 academic community; the importance of the disciplines as the primary functional unit of Mode 1 and as the provider of the conceptual tools of research; and the significance of the university as the place of the actual Mode 1 research, have been thoroughly investigated. Yet, as identified earlier when the concept of the mode was explained, to completely understand Mode 1 as a system, there are still three more attributes that has to be addressed. According to Gibbons et al. these are as follows:

2.2.5 The Actual Way of Conduct

Even though some collective and collaborative examples exist, disciplinary research, according to Gibbons et al., is primarily performed by individual scientists who are mostly disconnected both from their peers in their own disciplines and from the fellow scientists in the other disciplines. In this respect, the paradigm of disconnected science can said to be showing itself also in the real practices of knowledge production. The lack of communication between science and society in general

terms, applies to the case of individual scientists as well. As will be seen in the following section, these communication patterns change profoundly in Mode 2.

2.2.6 Mechanisms of Distribution and Accumulation of Knowledge

In Mode 1, claim Gibbons et al., knowledge is primarily distributed and accumulated internally inside the scientific community, through well established institutional channels, such as journal articles, books, conferences and seminars.[10] And this is consistent with the basic paradigm of Mode 1. This way, there is simply no interaction with the outside world. Even in this case, say the authors, however, that is, even though Mode 1 science is conducted in such a way inside an isolated scientific community, knowledge, nonetheless, is diffused through the society. But, since Mode 1 science is not concerned with the distribution or use of their outputs outside of its own realm, the job is left to others. Hence, in Mode 1, it is customary to speak of a linear knowledge transfer model: First, the fundamental knowledge is produced and then it is transferred to where it could be applied. This is, in fact, one of the first aspects of Mode 1 which changes profoundly in the Mode 2 paradigm.

2.2.7 Mechanisms of Quality Control

The primary mechanism of quality control, in Mode 1, is the traditional peer review process, and it is again an internal one. The value and the quality of a research are solely determined by the senior and qualified members of academia. Moreover, in a sense, it also implicitly determines which research ideas are worthy to pursue and even what shall count as ‘good’ science. Thus, peer review process, in this sense,

[10] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 5.

performs like a guardian of the Mode 1 paradigm, by ensuring the compliance of all processes and practices with it.

2.3 Mode 2

As shown in the previous section, Gibbons et al. define the paradigmatic characteristics of Mode 1 as 'being detached from the society' and 'not having any applied concerns'. Not surprisingly, they describe an entirely opposite condition for Mode 2. They define the essence of this new Mode as a 'socially distributed knowledge production for use,' conducted in a "context of application".[11] In this section, this essence is examined in detail; first, the underlying paradigm, and then, the way it is socially realized.

2.3.1 The Paradigm

To begin with, the authors argue that, various social groups and actors that are kept outside of the ivory tower of Mode 1, such as government, industry, policy makers, NGO's, so-called concerned groups and so on, are now actively participating to knowledge production in Mode 2 and directly contributing to its outputs. They are present in all phases of knowledge production; from shaping of the research agendas to the evaluation of the results. In other words, they no longer wait for the knowledge to be transferred to them, because they are already involved with its production. From the authors' perspective, this means that the realms of science and the society are not anymore differentiated in Mode 2.[12] There is no demarcation line between

[11] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 4.

[12] Shinn considers this as the primary argument of Gibbons et al. Therefore he calls the Mode 2 thesis as the one of 'anti-differentiationist' T. Shinn, "Change or Mutation? Reflections on the Foundations of Contemporary Science", *Social Science Information*, 38 (1999): 149-76.

them. In consequence, they consider Mode 2 as a knowledge production system which is diffused throughout the whole society; and in this respect, they call it 'socially distributed.'

As for being a knowledge production for use; the authors think that this is the natural outcome of the socially inclusive and socially distributed nature described above. As is mentioned in the last section, according to the authors, these social actors, newly joined to knowledge production process, are not interested with knowledge for its own sake. On the contrary, they have application and use oriented concerns. They are after useful knowledge production, want to solve practical problems, achieve practical goals. In short, their idea of knowledge is different. In consequence, claim Gibbons et al., as they join the knowledge production process, the mission of Mode 2 cannot be described as fundamental discovery anymore. On the contrary, it is now to solve practical problems and to create useful knowledge. Hence, they say, Mode 2 knowledge production is constituted in a 'context of application.' In other words, it is formed around the use-oriented concerns of a broader society.

Like the scientific community of Mode 1 mentioned in the previous section, however, this socially distributed Mode 2 environment described above is rather vague. How Mode 2 is realized in the society is yet to be explained by Gibbons et al. To repeat the elements of a Mode described in the first section, there has to be some tangible social mechanisms and processes in which (1) the actual research agendas originate and take shape, (2) the theoretical and methodological frameworks of research are established, (3) research is organized and institutionalized, (4) research

is conducted in reality, (5) the knowledge being produced is distributed and accumulated, and finally (6) the quality and control are maintained.

To explain how these mechanisms or processes are shaped in Mode 2, the authors use a market analogy. They propose that all of them are established through the processes of a complex and dynamic knowledge market in which "supply and demand factors can be said to operate."[13] The details are below.

2.3.2 The Operational and Functional Base

They begin with defining the basic process of this market, which correspond to the first item of the above list, that is, shaping of the research agendas. They mainly claim that Mode 2 knowledge market is an imaginary market where all the participants of knowledge production meet, and through a complex negotiation process, create, shape, and initiate the actual research agendas together. In other words, this market is where the real 'contexts of application' come to reality through the direct and equal participation of all involved actors. This way, say Gibbons et al., Mode 2 knowledge "is always produced under an aspect of continuous negotiation and it will not be produced unless and until the interests of the various actors are included."[14] From the perspective of the authors, this is exactly why Mode 2 knowledge production is "useful to someone whether in industry or government, or society more generally,"[15] because through such participation of and the negotiation among all concerned parties, "this imperative is present from the beginning."[16]

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[13] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 4.

[14] Ibid., 4.

[15] Ibid., 4.

To avoid any confusion, and to provide further clarification, however, the authors distinguish this market from a commercial one in one important respect. They assert that the linear transaction practice of the latter does not apply in this case: in Mode 2 knowledge market, knowledge is not an already produced commodity to be traded. In other words, the producers do not come there to sell their products. Similarly, the users are not mere clients who want to buy these commodities off the shelf. In this respect, as described by the authors, this knowledge market certainly does not represent the linear knowledge transfer mechanism of Mode 1, in which the knowledge is produced first and then transmitted to the users. On the contrary, it is the core of Mode 2 knowledge production where fundamental discovery and application creation take place at the same time.

In consequence, the authors declare that, in Mode 2, the disciplines cannot function as the basic operational and functional unit of knowledge production anymore. Since Mode 2 is conducted in a context of application as described above and deals with complex practical problems, research agendas clearly cannot emanate from the basic research oriented contexts of the disciplines. Thus, in Mode 2, the knowledge market and its basic process explained above becomes the context through which the direction of knowledge production is determined.

2.3.3 The Source of Methods, Guidelines and Framework

More importantly, however, the authors believe that, again due to their orientation, the disciplines cannot provide Mode 2 research with required conceptual tools, methods and frameworks of work, either. In this sense, since the disciplines loses

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[16] Ibid., 4.

their importance both as the basic functional unit of operation and as the provider of conceptual tools, the authors affirm that Mode 2 research goes beyond the well established realms of the disciplines, that is, it becomes trans-disciplinary. Accordingly, they see the disciplines only as one of the participants of Mode 2 knowledge production process.

At this point, the authors rightfully assert that, however, "to qualify as a specific form of knowledge production it is essential that enquiry be guided by specifiable consensus as to appropriate cognitive and social practice."[17] But how can this consensus are established, if the disciplines are no longer the focus of knowledge production? As an answer to this question, the authors assert that, unlike the case of Mode 1 in which this consensus is created and provided by the disciplines beforehand, in Mode 2, it is established right on the spot while a specific research agenda is being formed through the participative and negotiation based process described above. Moreover, they claim that, since every particular Mode 2 enquiry is different; the theoretical and methodological frameworks that guide each are also different. Hence, according to the authors, both the conceptual tools and the methods of conduct of a particular Mode 2 research are dynamically created according to the requirements of the particular problem at hand. And in this sense, they cannot be reduced to the ones of any single contributing discipline.

According to the authors, as the core of knowledge production shifts paradigmatically from 'knowledge as an end itself' towards 'knowledge for use', and consequently, from disciplines to the knowledge market, every other remaining characteristics of Mode 2 are also shaped accordingly.

[17] Ibid., 4.

2.3.4 Organizational and Institutional Patterns

As expected, the authors claim that Mode 2 is not institutionalized in a structured way like Mode 1. Rather, contexts of application or the knowledge market in other words, appear in different sites and settings. This, in turn, means "an increase in the number of potential sites where knowledge can be created; no longer only universities and colleges, but non-university institutes, research centres, government agencies, industrial laboratories, think-tanks, consultancies, in their interaction."[18] On the other hand, what are stable in Mode 2 are the network and the communication patterns. As for the concerns of this study; this means that the university is no longer the primary and monopolistic institution of knowledge production. The ivory tower collapses, because the paradigm that it is based on is transformed. The disciplines or the disinterested scientists that it houses are no longer there. It is drawn into a wider knowledge production regime in which it plays only a small role. In this respect, the authors even question the adequacy of the university in Mode 2 environment.

2.3.5 The Actual Way of Conduct

Accordingly, say Gibbons et al., in Mode 2, research is no longer individualistic. Rather it is conducted by teams in a transdisciplinary fashion. However, the composition of these teams is quite diverse. In accordance with the nature of the problem at hand, social scientists for example join the engineers and natural scientists. More than that, non-scientist stakeholders are also present in the whole process, from the very beginning to the end. In this respect, they emphasize the difference of such transdisciplinary practices from inter- or multidisciplinary ones.

[18] Ibid., 6.

According to the authors this implies another characteristic of Mode 2 science: There is no longer a gap between fundamental discovery and application. In fact, in a project conducted in a context of application, inside a transdisciplinary team, they occur at the same time. New problems, or new instrumentations, techniques and methods that are developed to solve these problems, trigger further fundamental research. In the mean time, fundamental questions that arise at some phases of Mode 2 research create further contexts of application.

2.3.6 Mechanisms of Distribution and Accumulation of Knowledge

Regarding the mechanisms of distribution and accumulation of knowledge, the authors basically claim that, since the disciplines are irrelevant to Mode 2 research now, the disciplinary institutional channels of distribution and accumulation become also irrelevant. Instead, they say, in Mode 2, knowledge is mainly distributed and diffused as tacit knowledge. When one problem is solved and the practitioners move to another Mode 2 project, they carry their experience, skill and knowledge with them. The authors call this a 'heterogeneous growth', which means that, in Mode 2, knowledge does not accumulate and grow vertically like it happens in Mode 1. Rather, it grows horizontally as the contexts of application and the movement of practitioners increase. In other words, what persists and actually grows is the network of rearrangements, that is, the market of knowledge itself.

In this sense, the knowledge transfer mechanisms also become obsolete in Mode 2, because the results of a Mode 2 enquiry are immediately transferred to the participants. Thus, in Mode 2, instead of a knowledge transfer, one can speak of a knowledge interchange.

2.3.7 Mechanisms of Quality Control

According to the authors, the criteria of quality and the mechanisms of control in Mode 2 are also determined by the same processes of knowledge market explained above. Since all the concerned parties are present right from the start as a particular Mode 2 research is shaped, their criteria of a 'good' work or a 'better' solution also becomes integrated with the research agenda. In this sense, depending on the concerned groups or people involved, "in Mode 2 additional criteria are added through the context of application which now incorporates a diverse range of intellectual interests as well as other social, economic or political ones. To the criterion of intellectual interest and its interaction, further questions are posed, such as 'Will the solution, if found, be competitive in the market?' 'Will it be cost effective?' 'Will it be socially acceptable?'"[19]

2.4 Summary

Based on the seven elements of a mode of knowledge production repeatedly referred to in this chapter, one can make the following brief summary which compares Mode 1 with Mode 2.

To begin with, behind the fundamental dichotomy between Mode 1 and Mode 2 lies the sharp paradigmatic contrast between the respective ideas of knowledge/science of each mode. Mode 1 is a form of science which is after the knowledge itself, whereas Mode 2 is concerned with the uses of it. In this respect, Mode 1 is mainly confined to the clear-cut boundaries of a scientific community detached from the rest of society;

[19] Ibid., 8.

however, in Mode 2 a broader society which demands useful knowledge is involved with all the processes of knowledge production.

Consequently, in Mode 1, all the methods, guidelines, frameworks and the direction of research is determined through confines of well-structured and well-differentiated disciplines, but, in Mode 2, all these important elements of knowledge production are established through the transient and dynamic processes of a knowledge market where all the involved parties meet, negotiate and shape the research agendas together.

Furthermore, based on its paradigm, Mode 1 is institutionalized primarily in the universities, which provide home for the disciplines and scientists, whereas, the number and type of Mode 2 knowledge production locations are profoundly diverse, and accordingly the universities loses their privileged status in Mode 2.

The quality control mechanisms are also in sharp contrast in each mode. Traditional peer review process which function perfectly for a secluded community of scientists, is no longer adequate for Mode 2 type of research in the number and type of stakeholders are quite diverse. Thus Mode 2 quality control is ‘extended’ with the incorporation of additional criteria which are absent in the peer review.

Not surprisingly, how the knowledge being produced is distributed and accumulated also differs in each mode. In Mode 1, again the disciplinary mechanisms are at play, which does not apply to the case of Mode 2. In Mode 2, tacit knowledge prevails, and it travels from context to context. Thus instead of a vertical accumulation of knowledge that is witnessed in Mode 1, in Mode 2 the knowledge market itself, that is, the contexts of application which grows.

Regarding the main question of this chapter which asks about the connection of the social system of knowledge with the social formation of the university, the answer of Gibbons et al. is an implicit yes. As shown above, the ivory tower like and monopolistic posture of the Mode 1 university is in accordance with the essence of Mode 1 as depicted by the authors: autonomous, self-regulating and secluded from society. Likewise, for the university in Mode 2, being only one of the many knowledge production sites is an expected outcome of being inside a socially distributed and organizationally diverse mode of knowledge production.

Moreover, this analysis also shows that at the core of the social shaping of the university there stands the paradigm of knowledge and science. That is, the thesis of Gibbons et al. clearly suggests that the university is a 'paradigmatic' institution, in the sense that it rests on a basic idea of knowledge. This is a point concurred by Delanty as well.[20] In this sense, it is evident that the existence and the nature of a linkage between the paradigm of knowledge and the social formation of the university ought to be an important issue to be addressed in every research on the social standing and role of the university as an institution. Yet, it is also evident that, so far, the analysis of Gibbons et al. did not provide any more tangible insights, about how this linkage actually works. This is the subject of the next chapter.

[20] G. Delanty, "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge", *Social Epistemology*, 12 (1998): 3-25.

CHAPTER III

THE EMERGENCE OF MODE 2

In the previous chapter, Gibbons et al.'s central concept, the mode of knowledge production, and its constituting elements – the paradigm and mechanisms of scientific/social realization – are examined and explained in detail. Following that, based on this explanation, the essential characteristics of Mode 1 and Mode 2, as defined by the authors, are presented and compared with each other. This comparison clearly exposed that the underlying reason for both the fundamental dichotomy between Mode 1 and Mode 2, and also for the sharp contrast in the social form of the university in each mode, is the contradictory nature of the respective paradigms of the two modes.

The intention of this analysis was to investigate the likely impact of the prevalent social system of knowledge production on the social formation of the university. In the end it clearly showed that such an impact exists and it actually occurs at the very basic level of ideas and paradigms. At least from the perspective of Gibbons et al. it is so. In brief, the analysis so far provided a certain – albeit preliminary – answer to the main question of this study, 'which issues ought to be addressed and examined carefully in the creation of a research method to understand the social role and function of the university?' In this respect, the conclusion was that the dynamics of the impact of the paradigm of knowledge/science on the social formation of the university definitely ought to be addressed in such a research agenda.

Exactly at this point however, further questions arise: How, then, is a certain 'mode of knowledge production' in general, and its paradigm in particular, takes root, grow

and eventually become dominant in a society? What sort of actual social processes, actors, forces or mechanisms are involved in this process? Which social agents participate in the process of paradigm formation, and more importantly, how?

The main purpose of this chapter is to search for the answers to these questions. This way it is aimed at further developing the findings of this study so far in the direction of a better elaborated view on the dynamics of paradigm formation; so that, a clearer, and probably more tangible, perspective on the dynamics of the social shaping of the university can be reached.

To this end, the focus of analysis in this chapter is the explanations and descriptions of Gibbons et al. regarding the reasons for the birth and growth of Mode 2. This way, the intention is to understand how the paradigm of it is formed in the first place. In this respect, more specifically, this chapter searches for the authors' answers to the following questions: What are the reasons behind this shift from Mode 1 to Mode 2? How did this transformation take roots and then continued to grow? More specifically, which social conditions, processes, developments, changes, forces or agents actually paved the way to the emergence of the socially distributed Mode 2 knowledge market in the sense described in the previous chapter?

Since these questions are concerned with broader social issues, Mode 2 is first put into a larger societal context, below. The details of the reasons for the emergence of Mode 2 knowledge production, as explained by Gibbons et al. are investigated after that. As will be clarified in the course of the chapter, this way it would be easier to sort out the social processes behind the rise of Mode 2.

3.1 A New Type of Society

Put into a larger societal context; Mode 1, according to the authors, is the natural mode of a clearly differentiated society. By differentiated, they refer to a form of society which is divided into distinct and separate realms with definite positions and functions; such as science, industry, government, public, further sub-systems and sub-sections, and so on.[1] Thus, Mode 1 society, according to the authors, is characterized with clear-cut functional boundaries, and accordingly, the mission of knowledge production is solely assigned to one of the distinct social realms: the scientific community. And, they argue, this is why Mode 1 knowledge production is autonomous and isolated from the rest of society. Moreover, the authors claim that the position of the university in such a society should also be interpreted from this perspective. It has a definite function: being the home of science.

Not surprisingly, contrary to the Mode 1 society described above, the authors depict the new one in which Mode 2 is prevalent as a clearly de-differentiated one.[2] In this new society, they claim, all the boundaries described above are blurred, became transparent, or vanished all together.[3] That is, it is no longer divided into functional and operational realms. The keyword to describe this society, in this sense, is permeability. In this regard, Krücken gives the following summary of Mode 2 society: “The role of the state has eroded. Territorial boundaries, bureaucratic norms,

[1] Nowotny, Scott and Gibbons, *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty*, 21.

[2] According to Shinn, this is the most distinguishing characteristic of Mode 2 thesis. Yet the validity of it is in serious question. T. Shinn, "Change or Mutation? Reflections on the Foundations of Contemporary Science", *Social Science Information*, 38 (1999): 149-76.

[3] The work of the authors that puts the Mode 2 knowledge production in broader societal context is their second book; Nowotny, Scott and Gibbons, *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty*.

and the distinction between public and private spheres no longer serve to clearly demarcate the state from the rest of the society […] The market has undergone similar transformations…Similarly, culture has become transgressive, and traditional boundaries have blurred. Panta Rei – everything flows."[4]

Accordingly, knowledge production in such a society cannot be the function of a dedicated scientific community anymore. Rather, since the boundaries collapsed, it is now everywhere. It is distributed throughout society. And this is exactly why the authors employ the knowledge market analogy to describe the Mode 2 science. In a sense, as depicted by the authors, this knowledge market is the counterpart of the universities of Mode 1 society. But, the difference is by nature: knowledge market involves lots of different sites and settings besides the universities, where knowledge production can happen. Furthermore, it is not a differentiated realm of society; on the contrary it is embedded in it.

In this respect, according to the authors, the best way to describe Mode 2 knowledge production is to think of it as a complex and large-scale web of nodes with a busy traffic.[5] Nodes, here, refer to the sites and settings where the 'contexts of application', that is, the problems of Mode 2, are created, shaped and eventually solved. In brief, they are both physical and conceptual locations of Mode 2 knowledge production. In this sense, they are also the meeting points of all the actors involved with knowledge production; such as knowledge producers, users of knowledge, or all kinds of concerned parties. The lines connecting these nodes with

[4] G. Krücken, "Panta Rei - Re-thinking Science, Re-thinking Society", *Science as Culture*, 11 (2002): 125-30.

[5] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 156.

each other, on the other hand, are the ways through which all these actors of knowledge production can actually reach to these nodes. They represent all kinds of interaction, communication or mobility patterns.

Seen from this perspective, the underlying reasons for the emergence of Mode 2, according to the authors, are several social developments which cause or facilitate either the creation of more nodes, or the establishment of more linkages between the nodes.[6] Creation of nodes, in this respect, refers to the formation of new sites of knowledge production, or rearrangement of the existing ones to act like a Mode 2 node. Establishment of more linkages between the nodes, on the other hand, refers to any kind of development that helps the blurring of the boundaries between different realms of the society; either by facilitating interaction and communication among them, or by enhancing the mobility in overall terms.

3.2 The Reasons for the Emergence of Mode 2

Following the guideline described just above, in a nutshell, the social processes or changes the authors associate with the eventual rise of Mode 2 stretch into the second half of the twentieth century.[7] More specifically, they divide this half century roughly into two parts and identify two distinct set of processes in each period: In the first phase, that is, in the three decades following the end of the Second World War up until the end of 1970's, they specify **(1)** the rise and continuous growth of mass higher education and **(2)** the remarkable enlargement of scientific enterprise as a

[6] The authors describe this condition by showing the increase of 'communication patterns' between science and society. Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 38.

[7] As will especially be visible in the next chapter, the validity or the actuality of these historical developments that the authors describe is not questioned at all.

result of the supportive governmental policies for the so-called Big Science. In the second phase, that is, in 1980's and later, they identify **(3)** intensified competition in international markets and the reactions of governments and industry to this development; namely, the shift in the orientation of policies from 'Big Science' to 'technological innovation,' and industry's move towards being more directly involved with firsthand knowledge production. In addition to this, in this phase they also identify **(4)** advances in information and communication technologies, for obvious reasons: they physically and directly enhance communication and interaction throughout the world.

Now, the details are given below.

3.2.1 Phase 1: Enlargement of Higher Education and Science

According to the authors, in this first phase which roughly extends into the third quarter of the twentieth century, one can identify two developments which relate with the later emergence of Mode 2: First is the phenomenon of large scale growth and transformation in higher education, which first started in modern industrial countries after the Second World War, and then reached to this day with an even bigger and more global extent.[8] It is marked by gradually increasing enrolments from different social strata to higher education, and the extension of both number and size of universities. Second is the remarkable enlargement of scientific enterprise itself as a result of large scale governmental investments in science.[9] And this is marked by

[8] For a complete historical account of these development regarding the enlargement of higher education see; G. Krücken, A. Kosmützky and M. Torka, eds., *Towards a Multiversity? Universities Between a Global Trend and National Traditions* (Bielefeld: Transcript, 2007).

[9] Another diagnosis of change, the 'academic capitalism' provides a better account of these developments. S. Slaughter and L.L. Leslie, *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Baltimore: The John Hopkins University Press, 1997). & S. Slaughter and

further extension of the universities and the creation of various non-university research centers, both in public and private sectors.

In brief, the authors argue that, in combination, these two processes have had the following implications for the rise of Mode 2. **(1)** Since the enlargement of both higher education and science required so, the sheer number of physical places where knowledge production can be carried out is proliferated. **(2)** As a result of mass enrolments to higher education, the number of graduates who are familiar with the methods of science and have necessary knowledge and skills to conduct research increased largely. And since the places where they can work multiplied as explained just above, they spread widely to these sites of knowledge production, and increased the sites of knowledge production. **(3)** Because of the changing profile of students due to the mass access, the cultural, social or political concerns of a broader society start to penetrate into the universities. In this respect, the walls of the ivory tower became more permeable. **(4)** As a result of this boost of higher education, the general education level of society reached to an extent that once ignorant lay public gradually started to debate on the implications of scientific and technological developments. Thus, a demand for social accountability took roots in society.

Continuing with the 'web of nodes' metaphor to describe Mode 2, one can think of the first two implications as the establishment of more nodes, and the last two as creation of more linkages. To fully understand the details, however, these four implications are further elaborated below.

G. Rhoades, "The Emergence of a Competitiveness Research and Development Policy Coalition and the Commercialization of Academic Science and Technology", *Science, Technology & Human Values*, 21 (1996): 303-39.

(1) Physical Enlargement. The authors associate the enlargement of both higher education and science with several social changes. First of all, they argue that, in this period, many social actors started to believe that higher education should not be limited only to train a small quantity of privileged elite for cultural and political leadership.[10] On the contrary, it ought to be oriented towards educating the society as a whole, because it is an imperative of democracy to do so. The authors consider this change in emphasis as a part of broader "democratization of politics and society."[11] As the second force, they identify the increasing demand for better educated (so-called white collar) manpower both in industry and public sectors, as a result of the conviction that education is the key to both economic and political development. Thirdly, they point to another belief which was gaining prominence in various circles of society; a belief which stresses the significance of fundamental science for the progress and well-being of society. According to the writers, this belief was particularly visible in the realm of policy making and so there arose a form of policy thinking which the authors call 'policies for Big Science.' The primary orientation of these policies, as they describe it, was to enlarge the "scientific enterprise per se,"[12] that is, to create a bigger science, in other words to expand Mode 1 type of knowledge production.

As a consequence of these forces, claim Gibbons et al., a profound transformation has started: More and more numbers of young people – and not only from upper class but from middle and lower class origins as well – are encouraged and facilitated

[10] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 73.

[11] Ibid., 73.

[12] Ibid., 158.

to enroll to higher education.[13] And to make it possible, a large amount of investments are made. A secondary school reformation took place in many countries to accommodate this massively increasing population of students. Then, to enable them to continue with higher education, the number and size of the higher education institutions have also increased to great proportions.

Consequently, as the authors describe, first, the traditional, so-called elite universities began to grow and expand.[14] Several new subjects and fields which were not represented in them before started to be included. Various new faculties and departments are added to existing universities. Their capacities are increased to accommodate increasing student population. But, say Gibbons et al., this was not enough. So, in addition, a visible amount of new universities are established as well. Furthermore, the number of non-university institutions which provide some form of post-secondary education also grew. In brief, both the quantity and extent of the universities reached to their peaks, and accordingly, higher education is marked by a gradually increasing mass access.

At the same time, state Gibbons et al., governments have begun to initiate large scale investments to promote science/research for its own sake.[15] As a consequence, already accelerating enlargement of higher education institutions is boosted further. Several initiatives are launched to support and strengthen the research side of the

[13] Ibid., 73.

[14] For statistical data for the developments described in this paragraph see; J.W. Meyer et al., "Higher Education as an Institution," in *Sociology of Higher Education: Contributions and Their Contexts*, ed. P.J. Gumport (Baltimore: The Johns Hopkins University Press, 2007).

[15] For details of these developments see; H. Etzkowitz and L. Leydesdorff, eds., *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations* (London: Cassell, 1997).

universities as well. Moreover, various extra-university institutions like government research centers and national laboratories are set up. Besides, the industry is also encouraged to perform basic research and development activities. In this respect, R&D departments of some large companies gradually reached to a point that as such they can even compete with the universities in basic research.

Thus, according to the authors, in approximately three decades following the end of the Second World War, the number of actual sites of knowledge production has increased dramatically. And for them, this means that a significant number of Mode 2 nodes are created in this period, even though this enlargement was basically the expansion of Mode 1.[16]

(2) Increase of potential knowledge producers. The authors assert that the physical increase of the sites of knowledge production as described above would be useless in the absence of the researchers who would work there. Nevertheless, they say, the necessary human resources are also provided by this enlarged higher education: Because of the massification, the number of graduates who are familiar with the methods of science, competent in research, and have specialized knowledge and skills also increased remarkably. Yet, even though the universities were expanding, the number of graduates was nonetheless too many to be absorbed into the disciplinary structure of universities. That is, not all of these potential knowledge producers could be employed by the universities. They had to use their skills elsewhere. So, they spread into a variety of sites and settings where competent research can be carried out. As a result, the conduct of "scientific and technological knowledge production" became possible "not only in universities but also in industry

[16] This seems like a contradiction. However, the point is clarified in the course of this chapter.

and government laboratories, in think-tanks, research institutions and consultancies, etc."[17]

Thus, according to the authors, the combined enlargement of higher education and science not only increased the sites of knowledge production physically, but at the same time, it also provided the necessary manpower to do the research in all these settings. But, ironically, say the authors, this is also how the universities gradually undermined their monopoly, by training lots of competent potential researchers, who can "pass judgment on university research and belong to organizations which might do the job just as well"[18]

(3) Democratization of the University. The authors assert that, however, the development of higher education described above, did not merely mean an increase in the number and size of the universities. Such a mass inclusion of society naturally brought along a certain transformation in the structure of higher education as well. First of all, as foreseen and in fact supported, the composition of the student population became radically diverse. Both secondary schools and also the universities were no longer dominated by upper class males. Rather, a majority of the students were now from lower social strata and both sexes became to be represented in a more balanced manner. This way, claim the authors, that is, through "the democratization of graduate origins and destinations…the core skills and liberal values of higher education are being reinterpreted in different ways by groups which bring into the university the cultural and political currents and conflicts of the larger

[17] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 11.

[18] Ibid., 11.

society."[19] Thus, "as knowledge production moves out of the university into the larger society, so the society's diverse values move in. The boundaries of the university are increasingly blurred by both tendencies."[20]

The authors emphasize that however, the phrase 'bringing along the conflicts of society' does not simply refer to an increase in the theoretical debates and discussions inside the universities. It involves more than that. It involves changes in the structure, organization and values of the universities as well as certain transformations "in the curriculum, in modes of governance, in relations between students and teachers, in forms of finance and in the relations of the universities with other institutions in society."[21] This is the sense the authors have in mind, when they refer to the increasing permeability of the boundaries of the universities: Starting with the rise of massification, the grounds of the ivory tower started to shake. And as will be seen later, this process will gain a larger momentum after the 1980's.

(4) The rise of the social accountability. From the perspective of the authors, this large cohort of university graduates does not merely symbolize potential knowledge producers or professionally trained workforce for public or private sectors. On top of it, it also represents a highly educated citizenry widely distributed throughout the society. And in this sense, it represents society's dramatically increased level of education after the Second World War.

[19] Ibid., 77.

[20] Ibid., 77.

[21] Ibid., 76.

According to the authors this has an important implication for the rise of Mode 2. They believe that with this increasing level of society's education the adequacy of the traditional one way communication between science and society started to be questioned. The dominant way of understanding that gives science a full authority over knowledge and treats the rest of society as layman to be educated has been thus shaken. Instead, a firm "awareness about the variety of ways in which advances in science and technology can affect the public interest"[22] started to take roots in society. And this awareness became evident in various public debates on the "issues to do with the environment, health, communications, privacy and procreation, and so forth."[23] Thus, according to the authors, this way, that is, as the citizenry becomes better educated, society started to speak back to science, and they increasingly demanded for social accountability.

As will be seen below, however, over the years, besides social accountability and reflexivity, several other demands on science were gradually maturing in society.

3.2.1 Phase 2: Economic Decline and Intensified Competition

Thus, state Gibbons et al., from the Second World War up until the late 1970's, science and higher education got bigger and bigger. Yet, they say, for some time now, not everything was going well for both the governments and the industry. Despite the enormous amount of investments in science and research as depicted above, economic performances of advanced countries did not improve as expected.[24]

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[22] Ibid., 7.

[23] Ibid., 7.

[24] M. Hayrinen-Alestalo, "The University Under the Pressure of Innovation Policy - Reflecting on European and Finnish Experiences", *Science Studies*, 12 (1999): 44-69.

On the contrary, especially in the 1980's, the challenge they have to face intensified remarkably. Their once irreducible market share began to be threatened by several newcomers. The international competition reached to its peaks, and despite the efforts of industrialized countries, newly arrived ones gradually have become major players in international markets.

According to the authors, to counter this threat, the first reaction of once dominant world leaders was to turn their attention to occupy some niche markets. However, this strategy did not prove to be effective, because new players of world markets immediately reached there. Accordingly, claim the authors, both the industry and the governments are forced to find a more permanent solution: Thus, in many circles, the concept of continuous innovation started to be seen as the remedy for this intensified competition.[25] However, it is soon realized that this remedy could not be employed effectively without a paradigm shift. Hence, both public and private actors started to question and reevaluate their presuppositions regarding the role of science in economic and social growth. The traditional linear model of innovation, which clearly separates fundamental knowledge production from commercial/industrial realization, is abandoned. In this respect, to enlarge the scientific enterprise itself as the primary source of this linear model considered as being unrealistic. Instead, another understanding gained prominence: science ought to be an integral part of innovation process; it cannot stand outside of it.

According to the authors, related with this paradigm shift, both policy makers and the industry started to take serious measures and launched several initiatives. And these

[25] For a summary of the literature on the rise of innovation policies see; L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.

measures in turn increasingly paved the way to the emergence of Mode 2. In this respect, below, the actions taken by the governments and the industry, and the effects of these actions on knowledge production, are examined in detail.

(1) The Rise of the Innovation Policies. As described by Gibbons et al above., for a long time, the primary concern of the governmental policies for science was the growth of science itself: "The key questions, then, were concerned with criteria for choice within science; setting up guidelines for choosing between expensive projects, often in different disciplines."[26] Accordingly the decision makers were mainly the scientists themselves, and thus they were primarily interested with the autonomous internal workings of the scientific community.

The authors argue that, however, over the years, especially because of the declining economic performances, the effectiveness of this vision started to be questioned in policy circles as well. Voices from government and business, mainly external to the scientific community, started to express their concerns, and demanded representation in decision making processes. And as time prove their points, and one could not see any visible improvement in economic performance, scientific committees and groups which decide on the direction of science gradually began to include these non-scientist agents.

Then, at around the turn of the 1980's, state Gibbons et al., due to the ever increasing global economic competition, these voices became stronger than ever, and even forced a radical shift in the policies. Like the industrial decision makers, policy makers also started to believe that the only cure for declining economic performance

[26] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 158.

is an ever continuing technological innovation. Only this way, they thought, it would be possible to be one step ahead of this intensifying competition.

Accordingly, they decided to abandon their position as the supporters of Big Science altogether. That is, the idea that science in itself is the key to social and economic development is completely left behind. They started "to narrow their perspective on the role of science in achieving national goals to the single question of how to hitch the scientific enterprise to industrial innovation and competitiveness."[27] Accordingly, their focus is shifted to make science – more accurately, the university – a part of a broader innovation system.

According to the authors, the rise of such innovation policies showed itself in two important ways, and both of these actions immensely impacted knowledge production and accelerated the emergence of Mode 2:

(A) First there came the increasing demands for a financial accountability of science. That is, the governments started to ask for the returns of their investments. Accordingly, with an eye towards increasing the innovative capabilities, they started to monitor the effectiveness and value of research in a stricter manner. But it was not just monitoring. Based on the results, heavy cutbacks in state funding of science followed. The state retreated from being the sole financier of science so to speak.[28] The case of increasing pressures on the US National Science Foundation, for example, clearly summarizes the situation:

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[27] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 158.

[28] J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.

> The committees that hold NSF's purse strings…have told the NSF to pay more attention to research that will enhance US economic competitiveness. Even some of its staunchest supporters have been warning that it must find a new rationale if it is to maintain support from Congress. For example, Congressmen such as George Brown argue that the need is for a fundamental reformulation of the principles of science policy. His committee – the Science Committee – stressed that the aim should be to exploit research as a tool rather than a black box into which federal funds are deposited. The committee talks about the need for 'performance assessment' to be carried out by persons and organizations independent of research performers. It may be necessary to establish a clear statutory mandate to redirect programmes that are not making sufficient progress towards stated goals.[29]

According to the writers this development deeply affected the internal workings of the already enlarged scientific enterprise and even the character of the scientists. Decreasing funds created a definite resource allocation problem. And the case was even worse for the disciplines which do not have a direct association with innovation due to the nature of their fields. Ability to raise funds became a desired attribute of character. But, more importantly, the possibility to receive support for a curiosity driven disciplinary research agenda was gradually decreasing. Thus, claim the authors, a majority of the scientists adopted a strategic approach: "The more astute researchers in trying to balance their need for equipment and staff with the need to work within a given paradigmatic structure built their careers around a broad base of research funding."[30] But, this 'broad base of research funding' was actually forcing them to engage in projects or programmes usually located outside of their disciplinary boundaries and outside of the universities. As a result, they started to acquire an entrepreneurial attitude. And from the perspective of the authors the

[29] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 144.

[30] Ibid., 23.

meaning of this is quite clear: scientists started to become to be a part of Mode 2 network.

(B) Yet, it was not only the individual scientists who were being affected by these developments, assert the authors. The universities, as institutions, also had to adopt. Their structure, organization and management are all affected. First of all, as a result of governmental initiatives to draw them into the innovation process, technology exchange and transfer offices started to be added to the universities to facilitate their interface with the industry, science parks are built in the vicinity or inside the universities. Moreover, "University patent offices were created or reorganized; new approaches to obtain value from intellectual property such as equity ownership were tried; liaison programmes developed markedly; industrial sponsorship of research groups and universities rapidly became increasingly involved in regional development plans."[31] Accordingly, a professional managerial attitude started to infiltrate into the university administration. As described by Grit the mentality of economization started to penetrate the universities.[32] Furthermore to solve the resource allocation problem, several ways of research evaluation and performance assessment criteria are added to the criteria of scientific excellence. In other words, quality control gradually became quality monitoring.

From the perspective of the authors, these developments are very critical for the emergence of Mode 2: They greatly facilitated the blurring of the boundaries between science and the society, or in other words, between universities and the

[31] Ibid., 87.

[32] Kor Grit, "The Rise of the Entrepreneurial University: A Heritage of the Enlightenment?" *Science Studies 10*, no. 2 (1997) 3-22

industry. Furthermore, they changed the behavior of scientists, corroded their disciplinary attachments and made them more mobile. In this sense, after the creation of more and more nodes in the first phase, in this phase of developments actually the connections between the nodes are activated. However, according to the authors, it is only one side of coin, for the following reasons, the industry also started to move closer towards the universities.

(2) Times of Collaboration. According to the authors, the demand for knowledge in the industry is known for a long time. They state that traditionally it has been fulfilled by two mechanisms: First, knowledge transfer through hiring university students and professors, through consultancy and through professional journals where the outcomes of the disciplinary science are published. And second, obviously, through in-house research and development activities.

The authors note that, however, over the years, as the international competition intensified, both methods gradually became inadequate for the industry. First of all, the traditional way of knowledge transfer was putting the industry at an idle position. Basically, it had to wait for the scientists to do their job. More than that, it could not even influence the agendas of the scientific community either. In this sense, especially with the pressure of continuous innovation, this mechanism proved to be quite cumbersome for the industry.

In-house research, on the other hand, claim the authors, began to be ineffective in terms of both cost and factors of strategic goals: “Research in industry, even if conditions are better than in many university laboratories, is always problematic because it has to keep its objectives in harmony with the company’s overall strategy.

A commitment to basic research is particularly difficult to sustain. It is constrained by time limits and subject to frequent, rigorous evaluation in the light of shifting company fortunes. As research becomes more expensive, and is subjected to strategic and financial considerations its base tends to narrow."[33]

According to the authors, under these conditions, the industry realized that, what it has to do is to reach to knowledge regardless of where it is produced. More than that, it has to be a part of the knowledge production process itself, so that, it could immediately receive the required knowledge even as it is produced. Accordingly, the industry started to make big steps towards collaboration. Different firms started to launch big joint projects, and more importantly industry in general moved towards the universities. In times of decreasing state funds, they tried to seize the opportunity and started to support university research by all means. This way, in contrast to in-house research, where all the investments and overhead costs were the sole concerns of the firms, the variety, speed and the cost of knowledge production decreased a lot.

In fine, as Gibbons et al. understand it, the intention of both innovation policies and the industry's effort to become a participant in knowledge production, was to replace the traditional linear knowledge transfer mechanisms with a knowledge interchange paradigm, so that the universities become a more direct 'player' in innovation than a remote actor. As explained in the previous chapter, knowledge transfer mechanisms rest on the idea of discovery of the fundamentals comes before the application o knowledge, and thus these two processes are separate from each other. The notion of Triple Helix by Etzkowitz and others shows the development of these efforts via a

[33] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, 86.

large set of empirical studies, and according to them it succeeded.[34] From the perspective of Gibbons et al., on the other hand, this is only one of the underlying reasons for the emergence of Mode 2.

3.3 Summary

As shown by the analysis above, one can evidently posit that according to Gibbons et al.' treatise almost every political, social, cultural and economic actors and processes play a role in the shaping of the social system of knowledge production.

For example, as the case of two different stages of policy orientation – the one for the Big Science and the one for technological innovation – clearly show, the governments have agency and power to change the knowledge production scene dramatically. Nevertheless, it is also noteworthy to emphasize the contradiction between these two policy periods. According to the Gibbons et al., in the epoch after the Second World War up until the start of 1980's, the governments were mainly concentrated on enlarging the Mode 1 science. In fact, one can argue that, then, the paradigm of 'knowledge as an end itself' mainly reserved to the scientific community, was articulated in the policy circles as well.

As explained by Gibbons et al., however, the governments, or the 'political agencies' in society to use a broader term, are also nonetheless affected by broader 'economic' factors and conditions as well. In fact, these factors seem to be so strong that, they force the governments to change their paradigms of knowledge/science, as the shift towards innovation policies clearly shows.

[34] For a complete list of the Triple Helix corpus see the next chapter.

In this respect, however, these economic factors should not merely be constrained to the dynamics and demands of 'the industry.' In fact, according to the analysis of Gibbons et al., in the second half of the twentieth century, the industry itself seems to be transformed by larger economic forces. As the large scale investments into the in-house basic research infrastructure show, in the period up to early 1970s, the industry also seems to follow the paradigm of Mode 1. But the decline in the economic performances seems to force it to reconsider its stance.

The social and cultural realms, on the other hand, also occupy an important role in the diagnosis of Gibbons et al. For example, they claim that, especially after the Second World War, the increasing level of awareness and education gradually created a demand for social accountability for science. In addition, the inclusion of more and more people from different cultural backgrounds changed the composition and identity of the universities remarkably.

So, what does the thesis of Gibbons et al. say about the main issue of this study, that is, the social formation of the university?

In brief, one can argue that it advocates a strong connection with broader social processes. It mainly proposes that the political, economic and social conditions, in a complex albeit unpredictable way, shape the mode of knowledge production; and the latter in turn, creates its adequate form of university. And in simplest terms, from the perspective of the authors, this happens through shift in the paradigm of knowledge/science. As more tangible elements of this social shaping of the paradigm, however, they only mention governmental policies, economic factors and industry's initiatives in very broad terms. In this respect, it fails to provide anything

more than the broad categories of state and the industry as the forces behind the social formation of the university. Most striking, however, is the rather passive stance of academia in this process. As will be seen in the following chapter, however, this is rather questionable.

CHAPTER IV

OTHER DIAGNOSES OF CHANGE & CRITIQUES OF MODE 2

Regarding the primary concern of this study, the analysis of Gibbons et al. described so far clearly suggests that in the attempts to understand the social standing and function of universities, one has to take into account the complex social dynamics of knowledge production system. In this respect, they emphasize the importance of the paradigm of knowledge and science, which shapes all the other characteristics of this system, including the identity of the university. That is, the authors basically claim that the prevalent mode of knowledge production creates its own form of university and it does this through its paradigmatic core.

Going one level deeper, Mode 2 diagnosis also provides an account of the social agents, factors and processes which shape the dominant mode and its core paradigm. In this regard, the authors identify four broad categorical social spheres which play a role in this process of social shaping: industry, state, public and science itself. Following this understanding, Mode 1 is a mode which is dominated and shaped by the scientific realm itself by keeping the other three actors outside. And that is why, in Mode 1, the university is the 'ivory tower'. In contrast, Mode 2 is a mode created by the mutual interactions and interdependencies of all four actors, and thus, the social function of the university is no longer being the home of 'autonomous knowledge production for its own sake'. Instead, it is being one of the many locations of a socially distributed knowledge production.

As such, however, the analysis of Gibbons et al. remains rather at a very generic level. It evidently emphasizes the importance and complexity of social shaping of the

university. However, it does not provide, any concrete mechanisms of this social construction; with the notable exception of policy driven government initiatives and economic decisions. But, even in this case, it does not offer an explanation of the actual dynamics of this process.

In fact, this generality seems to be main reason for the lack of any tangible claims and empirical substantiation on the part of Mode 2 analysis:[1]

> It would have taken a major research program – far beyond the resources at our disposal – to collect the appropriate data and establish precisely the limits of our hypothesis across the whole gamut of knowledge production. Rather than attempt this at this stage, we have tried to specify the new mode and its principle characteristics and to show how they are affecting knowledge production in science and industry and to some extent the social sciences and the humanities… To this end, we have adopted an essay style of exposition.[2]

In this respect, to descend from this generic level to a more tangible detailed one, and thus to better understand how this social shaping actually happens, several questions have to be evoked: First of all, is it really tenable to regard these four social spheres, that is, science, government, industry and public such uniform and homogeneous entities as depicted by Gibbons et al.? Don't they show any inherent diversity at all? For example, do different disciplines or universities always operate in the same way? What about the national contexts? Second, isn't it possible to have processes and practices of Mode 1 and Mode 2 knowledge production at the same time, side by side? That is, isn't it possible to have diversified and maybe contradictory knowledge production practices in different settings and contexts at the same time? Does it have

[1] As will be seen throughout the rest of this chapter, this characteristic is seen as the major weakness of Gibbons et al.'s study.

[2] Gibbons et al., *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, viii.

to be a coherent 'social system of knowledge production'? What if there is no such a system? Can one concentrate on different characteristics of knowledge production depicted by Gibbons et al. separately and independently from each other? In this respect, is the historical perspective of Mode 2 thesis which articulates only two fundamentally dichotomous mode of knowledge production in the history of science plausible?

The purpose of this chapter is to find answers to these questions. To this end, this time, the focus is set on the other participants of the transformation debate; first on the similar diagnoses which also study changes in knowledge production,[3] and second, on the direct critiques of Mode 2 thesis. In brief, the intention is to get a better articulated, detailed and more substantial account of the dynamics of the social formation of the university, which can be turned into a manageable research agenda. In this respect, different perspectives, analyses, scopes and emphases of the other theses of change, might provide valuable insights, especially by identifying some 'limiting conditions' and 'details' to the large scale generality of Mode 2 diagnosis. The focused attention of the critiques on the 'specific' parts of Gibbons et al.'s claims, on the other hand, would certainly be useful in testing and reevaluating the validity of the arguments of the authors. Thus, the main goal in this chapter is to combine the different perspectives of Mode 2 thesis, the other similar ones, and the critics in such a way that in the end a better articulated dynamics of the social formation of the university can be achieved. To this end, below, first the alternative

[3] The selection of these four studies is based on the literature survey of Hessels and Van Lente which identified these particular treatises "based on their prominence (number of citations) and the degree of apparent similarity with 'New Production of Knowledge'" L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.

diagnoses of change are examined. Then the critiques of Mode 2 thesis are scrutinized. And finally the conclusions are presented.

4.1 Other studies on the 'changes in knowledge production'

4.1.1 Finalization in Science

The notion of 'finalization in science' is proposed by a German research group called 'Starnbergers' as the outcome of several empirical studies on the dynamics of scientific disciplines.[4] Basically, the concept depicts and explains the changes in the character and social orientation of scientific disciplines in the course of their theoretical development.

In brief, based on their case studies, the Starnbergers identify three distinct phases in the evolution of a particular scientific discipline.[5] The first two phases they depict are clearly inspired by Kuhnian terminology:[6] The first one is the phase of exploration, during which the discipline do not yet have a consensual internal theory and method. Rather, several different paradigms coexist and fight for the dominance. However, according to the Starnbergers, this phase does not last forever. Eventually, one of the possible paradigms becomes the dominant one, and so the discipline shifts to the second phase of its evolution: the paradigmatic phase, during which the

[4] The original studies are mostly in German and published separately. The most accessible source in English is the following volume: G. Böhme et al., *Finalization in Science: The Social Orientation of Scientific Progress* (Dordrecht: D. Reidel Publishing, 1983).

[5] For a more detailed explanation of these phases see; J. Schopman, "Finalization and Functionalization", *Journal for General Philosophy of Science*, 11 (1980): 347-53.

[6] As noted by Pfetsch, the Starnbergers "follow but do not copy the growth model of" Kuhn. For a fuller account see; Frank R. Pfetsch, "The 'Finalization' Debate in Germany: Some Comments and Explanations", *Social Studies of Science*, 9 (1979): 115-24. & Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962).

theoretical development is achieved through normal science practices, the primary goal of which is to further elaborate and refine the established paradigm.

Still, according to the finalization thesis, this is not the end of the development of a disciplinary science. On the contrary, gradually accumulating theoretical maturity leads to a final phase: the post-paradigmatic phase. And it is at this point the Starnbergers start to diverge from Kuhn. At this stage, they claim, the disciplines reach to such a level of theoretical maturity that the direction of further progress starts to be determined by other extra-scientific socio-political objectives and concerns. That is, at this 'finalization' phase, further theoretical development is no longer determined by scientific terms alone. The orientation of the disciplines begins to be shaped by the practical concerns of a broader society, through planning, policy making and participation. And, "According to the 'finalists', more and more disciplines reach this phase. This implies that the relation between science and society is changing. In this relationship, society is becoming an active rather than a passive partner, and it increasingly takes a guiding role".[7]

As explained above, the finalization thesis clearly resembles with Mode 2, in the sense that in both treatises "the ultimate stage in the evolution of the relation between science and society" is characterized by the disappearance of the boundary which separates these two realms.[8] Yet, these two theses differ from each other significantly in several respects as well, and those differences have important

[7] L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.

[8] P. Weingart, "From 'Finalization' to 'Mode 2': Old Wine in New Bottles?", *Social Science Information*, 36 (1997): 591-613.

implications for the task of this study.[9] First of all, contrary to Mode 2, the concept of 'finalization in science' is the conclusion of empirical studies. That is, it has a better substantiated base. Second, and more importantly, the research program of Starnbergers treats different disciplines separately. That is, unlike the authors of Mode 2, the authors of 'finalization in science' acknowledge the possibility that different disciplines might have different trajectories of evolution. Accordingly, the latter explicitly state that their conclusion of applicability of finalization concept to all disciplines is their rather normative conclusion.

According to Weingart, however, there is yet another very important difference between the theses of finalization and Mode 2: The overall reaction to the former was rather unwelcoming back then, but in contrast, the concept of Mode 2 is mostly accepted both in academic and policy making circles. Many commentators accused the finalists of being advocates of "Stalinization of science", by undermining the spirit of autonomous free research.[10] The resulting academic and public debates even lead to the dissolution of the Max Planck Institute in Starnberg where the research program of Böhme et al. is first conceived and initiated.[11] On the other hand, say Weingart, the concept of Mode 2 could easily penetrate into both academic and policy making circles. In this respect, he raises the following question: Despite the obvious similarity between the concepts of Mode 2 and finalization in science, why are the responses to the former mostly positive, whereas the latter was almost completely rejected back then? The answer of Weingart is as follows:

[9] For a fuller account of the similarities and differences see Hessels and Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda".

[10] T. Schroyer, "On Finalizatin in Science", *Theory and Society*, 13 (1984): 715-23.

[11] P.K. Koch, "Review", *The British Journal for the History of Science*, 19 (1986): 116.

> During the 20-odd years which separate the earlier debate on "finalization" from that of "Mode 2", the context has changed considerably both in terms of the ruling ideology and of the relevant institutional arrangements. The ideological connection between basic research, freedom of science and freedom of the West in the context of the Cold War motivated the nervous and sometimes even fearful reactions against "finalization", which was identified by the opponents with the "planning" of research and, therefore, with a threat to the freedom of science. Now the tide has turned. Against the backdrop of tightening research budgets and four decades of uninhibited growth, the orientation of science to societal values is seen as a new virtue, a promising source of legitimation.[12]

Regarding this thesis, this explanation has important implications. Above, Weingart actually speaks of the same social development which Gibbons et al. identify as one of the underlying reasons for the rise of Mode 2; namely the shift in the dominant paradigm of science. In this sense, one can argue that, he acknowledges the claim of Gibbons et al. that the social context in which science operates has undergone changes; yet he places a rather different accent. Actually, he brings forth another layer and articulates a word which is clearly missing in Gibbons et al.'s analysis: the ideology. As such the word paradigm receives a more 'political' accent.

In short, one can argue that the diagnosis of 'finalization in science' points to the probability of different way of operation in different disciplinary structures. And through the comparison of it with Mode 2, Weingart points to the more inherently 'political' aspects of knowledge production. Both issues are investigated throughout the analysis below.

[12] P. Weingart, "From 'Finalization' to 'Mode 2': Old Wine in New Bottles?", *Social Science Information*, 36 (1997): 591-613.

4.1.2 Post-normal Science

'Post-normal science' is a scientific problem-solving strategy, suggested by Silvio Funtowicz and Jerome Ravetz, to deal with complex, large-scale, policy-related real-world issues of today's global industrial world, such as health, safety and environment.[13] The authors believe that, such issues the humanity faces today involve a considerable amount of risk for the whole humanity as well as for the nature.[14] But, more importantly, in these issues the "facts are uncertain, values in dispute, stakes high and decisions urgent".[15] Yet, they claim, the very first remedy that comes to mind to solve these issues – science – is clearly inadequate for this task at hand in its current form. The familiar rational decision making process of Kuhnian normal science is ill-equipped to deal with uncertainties and value plurality. First, it does not abandon its established theories or frameworks, that is, it disregards any 'uncertainties' which cannot be addressed in the framework of its paradigm. Second, it turns the nature into a laboratory by dividing it into analytically manageable small-scale pieces, but this way, it loses the perspective towards the big picture. Third, it disregards any extra-scientific concerns and values of a broader society, and thus, it

[13] The concept first appeared in S.O. Funtowicz and J.R. Ravetz, "Science for the Post-Normal Age", *Futures*, 25 (1993): 735-55. Then, the same year, it also became a part of an edited volume of risk studies: S.O. Funtowicz and J.R. Ravetz, "The Emergence of Post-Normal Science," in *Science, Politics and Morality. Scientific Uncertainty and Decision Making*, ed. R. von Schomberg (Dordrecht: Kluwer, 1993). Over time, it also influenced some other authors and turned into a research programme of its own. Examples that follow this programme include; J.P. Van der Sluijs et al., "Combining Quantitative and Qualitative Measures of Uncertainty in Model-based Environmental Assessment: the NUSAP System", *Risk Analysis*, 25 (2005): 481-92.; M. Craye and S.O. Funtowicz, "A Reflexive Approach to Dealing with Uncertainties in Environmental Health Risk Science and Policy", *International Journal of Risk Assessment and Management*, 5 (2005): 216-36. And P. Kloprogge and J.P. Van der Sluijs, "The Inclusion of Stakeholder Knowledge and Perspectives in Integrated Assessment of Climate Change", *Climate Change*, 75 (2006): 359-89.

[14] As noted by Gowda, the study of Funtowicz and Ravetz appeared against the background of increasing concerns about the large scale risks related with health, safety and for this reason the authors' study is part of a larger body of literature on risk and environment. M.V. Rajeev Gowda, review of *Science, Politics and Morality. Scientific Uncertainty and Decision Making*, by R. Von Schomberg, (ed.) *Journal of Policy Analysis and Management* 15, no.3 (1996) 461-466

[15] S.O. Funtowicz and J.R. Ravetz, "Science for the Post-Normal Age", *Futures*, 25 (1993): 735-55.

cannot manage multiplicity of opinions, values and stakeholders. Fourth, it does not have any time constraints either, and because of this it cannot effectively deal with urgent issues.

Consequently, claim the authors, another form of science is needed to solve such issues, and to this end, they propose what they call 'post-normal science'. The most important characteristic of this new form of science, according to the authors, is the participation of a broader society in the decision making processes. They propose to have an 'extended peer community', so that all stakeholders will be involved with every phase of problem-solving practices. They assert that, however, such involvement ought not to be understood merely as a quality control of products of research. "It must also include process and persons, and in the last resort purposes as well. This 'p-fourth' approach to quality assurance of science necessarily involves the participation of people other than the technically qualified researchers".[16] This way, the authors believe, the nature and society, formerly turned into a laboratory by science, can start to talk back to science.

Put this way, this participative nature of 'post-normal science' as proposed by Funtowicz and Ravetz, is quite similar to the 'socially inclusive' character of Mode 2 science. More than that, Funtowicz and Ravetz's metaphor of 'nature invading back the laboratory' clearly resonates with Gibbons et al.'s rhetoric of 'society speaks back to science'. Nonetheless, post-normal science and Mode 2 have important differences in emphasis and scope as well. First of all, it should be noted that, 'post-normal science' has a clear prescriptive message. In contrast to the Mode 2 thesis which claims to *describe* changes in the form of science, post-normal science is a

[16] S.O. Funtowicz and J.R. Ravetz, "Science for the Post-Normal Age", *Futures*, 25 (1993): 735-55.

direct answer to the question of how science *should* operate in certain conditions. However, even though it claims to be descriptive, the Mode 2 thesis is not substantiated empirically. And thus, it is rather prone to the accusations of being prescriptive.[17] This brings the very first paragraph of this study in mind, where the long lasting normative character of the treatises on the university has been addressed. Can the transformation debate be a continuation of this?

Second, unlike Gibbons et al.'s claims which cover the whole spectrum of knowledge production, Funtowicz and Ravetz propose the notion of 'post-normal science' as a particular problem-solving strategy applicable to a specific set of issues; namely, the policy-related issues of risk and environment. In this sense, Funtowicz and Ravetz emphasize that "the new challenges do not render traditional science irrelevant; the task is to choose the appropriate kinds of problem-solving strategies for each particular case."[18] Accordingly, they suggest adding 'systems uncertainties' and 'decision stakes' as additional parameters to find the appropriate strategy for a particular problem. And in this respect, they maintain that, the curiosity-driven fundamental or basic research, the mission-oriented applied science and client-serving professional consultancy, all have their own areas of application.

Such a perspective of 'diversity' in science is clearly missing in the analysis of Gibbons et al. In fact, as seen in chapters two and three in detail, they insist on their claims of a total transformation. As Funtowicz and Ravetz join with the Starnbergers

[17] In fact, as will be seen below, it is one of the most important critiques directed towards the Mode 2 thesis.

[18] S.O. Funtowicz and J.R. Ravetz, "Science for the Post-Normal Age", *Futures*, 25 (1993): 735-55.

regarding this issue, however, this question of diversity in science starts to gain more grounds.

4.1.3 Academic Capitalism

Both of the concepts described above result from an analysis which focuses on internal dynamics of science. Starnbergers identify the 'finalized science' as the final stage of, mainly internal, scientific and theoretical evolution of disciplines. Likewise, Funtowicz and Ravetz propose the 'post-normal science' as a new form of science because of their belief that the traditional scientific practices are inadequate to provide solution to a certain set of issues. In brief, in both of these accounts, the effects of extra-scientific developments, processes or forces which possibly shape knowledge production activities are not mentioned.

The diagnosis of 'academic capitalism' presented by Slaughter, Leslie and Rhoades in a set of empirical case studies, investigates such external effects on scientists and scientific institutions.[19] In broad terms, the concept represents the increasing market-like and for-profit activities in the academia as a result of external political and economical pressures. By market-like activities the authors refer to "the increasing competition for external funding: grants and contracts, endowment funds, university-industry partnerships, institutional investment in spin-off companies, or student tuition and fees".[20] And for-profit activities involve earning money from patenting

[19] S. Slaughter and G. Rhoades, "The Emergence of a Competitiveness Research and Development Policy Coalition and the Commercialization of Academic Science and Technology", *Science, Technology & Human Values*, 21 (1996): 303-39. & S. Slaughter and L.L. Leslie, *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Baltimore: The John Hopkins University Press, 1997).

[20] L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60. For more details see; J. Tuunainen,

and licensing activities, the establishment of spin-off or hybrid companies, and direct commercial agreements with industry.

As for the external reasons for these changes in the way academia and academics operate, the authors identify the following: (1) Due to the increasing international economic competition, the industry's requirement for innovation and knowledge has increased substantially, and to fulfill that, the industry turned to the universities for help. (2) At the same, as a result of the emergence of a policy orientation towards competitiveness and innovation, the state funding for university research has decreased considerably. In combination, these two external developments have forced the universities to conduct the capitalist activities described above to survive.

As depicted above, the reasons for the rise of academic capitalism explained by Slaughter and Leslie, exactly match with the social developments Gibbons et al. associate with the emergence of Mode 2 knowledge production. Yet, there is an important difference in the way they explain the phenomena. As noted by Pestre, Gibbons et al., describe these external social developments implicitly as a natural phenomena, "which have simply to be identified and acknowledged".[21] Slaughter and Leslie, however, strongly emphasize that, in such social processes, all of the involved actors, such as policy-makers, business and academia, are quite active and make deliberate choices. More than that, these actors do not behave like homogeneous entities either.

"Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.

[21] D. Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading", *Minerva*, 41 (2003): 245-61.

For example, according to them the twentieth century has seen two opposite policy perspectives which has existed side by side, even though the dominance has shifted from one to the other. Similarly, while some part of the academia is quite resistant to the external pressures and try to do everything they can to avoid being a part of academic capitalism, some other part indeed has played an important role in the promotion of 'competitiveness' policy thinking. In this respect, one can argue that unlike Gibbons et al., Slaughter and Leslie acknowledge the possibility of different active stances inside the academia itself. Moreover, their empirical studies yields different amount of 'academic capitalism' in different universities, and accordingly they do not directly assume a causal link between the existence of social pressures and the real changes.

To summarize, like the Finalist and the writers of post-normal science, the analysis of academic capitalism also emphasizes different and diverse conditions in different parts of the enterprise of science. But, Slaughter and Leslie add another layer to the issue: the active stance by the academia and the academics against the forces which aims at shaping the university. As specified earlier, Gibbons et al. do not articulate such an understanding.

4.1.4 Triple Helix

The concept of 'Triple Helix', put forth by Etzkowitz and Leydesdorff in a diverse set of theoretical and empirical studies, is a model and a heuristic tool to investigate the dynamics of innovation and knowledge production in contemporary societies.[22]

[22] Unlike Mode 2 thesis which is presented in a single volume, the notion of Triple Helix is heterogeneosuly articulated in different publications, and the body of literature it constitutes is still growing: L. Leydesdorff and H. Etzkowitz, "Emergence of a Triple Helix of University-Industry-Government Relations", *Science and Public Policy*, 23 (1996): 279-86.; H. Etzkowitz and L.

Its main premise is the increasing interdependency and interaction between the realms of university, government and the industry. Accordingly, as a model, it suggests employing a co-evolutionary perspective in the studies of institutional characteristics of knowledge production.

More specifically, being completely in line with the observations of both Gibbons et al. and Slaughter and Leslie, the authors argue that the "increased international competition, the end of the Cold War, and the emergence of new models knowledge-based economic development have called the traditional 'ivory tower' role of the university into question."[23] As a result, they claim, the formerly separate institutional spheres of the university and the industry started to approach to each other. At the same time, the governments also started to encourage this growing interaction further, by assuming a kind of a facilitator role. Now, the "governments are offering incentives and encouraging academic institutions to go beyond performing the traditional functions of cultural memory, education and research, and to make a more

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Leydesdorff, "The Future Location of Rsearch: A Triple Helix of University-Industry-Government Relations, II", *EASST Review*, 15 (1996): 20-5.; H. Etzkowitz and L. Leydesdorff, eds., *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations* (London: Cassell, 1997).; L. Leydesdorff and H. Etzkowitz, eds., *A Triple Helix of University-Industry-Government Relations: The Future Location of Research?* (New York: Science Policy Institute, State University of New York, 1998).; L. Leydesdorff and H. Etzkowitz, "Technology Innovation in a Triple Helix of University-Industry-Government Rlations, Asia Pacific Tech", *Monitor*, 15 (1998): 32-8.; L. Leydesdorff and H. Etzkowitz, "The Triple Helix as a Model for Innovation Studies", *Science and Public Policy*, 25 (1998): 195-203.; H. Etzkowitz and L. Leydesdorff, "The Endless Transition: A Triple Helix of University-Industry-Government Relations", *Minerva*, 36 (1998): 203-18.; L. Leydesdorff and H. Etzkowitz, "Triple Helix of Innovation: Introduction", *Science and Public Policy*, 20 (1998): 358-64.; H. Etzkowitz and L. Leydesdorff, "The Future Location of Research and Technology Transfer", *Journal of Technology Transfer*, 14 (1999): 111-23.; H. Etzkowitz, "The Norms of Entrepreneurial Science: Cognitive Effects of the New University-Industry Linkages", *Research Policy*, 27 (1998): 823-33.; H. Etzkowitz et al., "The Future of the University and the University of the Future: Evolution of Ivory Tower to Entrepreneurial Paradigm", *Research Policy*, 29 (2000): 313-30.; H. Etzkowitz and L. Leydesdorff, "The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations", *Research Policy*, 29 (2000): 109-23.

[23] Etzkowitz and Leydesdorff, *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*, 2.

direct contribution to 'wealth creation'."[24] According to Etzkowitz and Leydesdorff, behind these initiatives lies the belief that stresses the inadequacy of the traditional linear model of knowledge and technology transfer. Instead, both governments and the industry emphasize the requirement for a dynamic network of reflexive communications in which the realms of academia, business and state overlap. The result, state the authors, is the emergence of an entrepreneurial university.

As such, the Triple Helix model confirms with the argument of Gibbons et al. that states that the clear-cut boundaries between science, industry and government are dissolving recently.[25] In addition, Etzkowitz and Leydesdorff also confirms with the social developments which are identified by Gibbons et al. as the reasons for the rise of Mode 2.

As explained by Shinn, as well as by Hessel and Van Lente in detail, however, the authors of Triple Helix explicitly reject some of the claims of Mode 2. First of all, they seriously question the historical discontinuity presented in the Mode 2 thesis: "The so-called Mode 2 is not new; it is the original format of science before its academic institutionalization in the 19th century."[26] Second, they also reject the idea that up until recently the realm of science was detached from any sort of application

[24] Etzkowitz and Leydesdorff, *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*, 2.

[25] For a better comparison of Mode 2 and Triple Helix see; J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.; J. Tuunainen, "Reconsidering the Mode 2 and Triple Helix: A Critical Comment Based on a Case Study", *Science Studies*, 15 (2002): 36-58.; T. Shinn, "Change or Mutation? Reflections on the Foundations of Contemporary Science", *Social Science Information*, 38 (1999): 149-76.; T. Shinn, "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology", *Social Studies of Science*, 32 (2002): 599-614.

[26] H. Etzkowitz and L. Leydesdorff, "The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations", *Research Policy*, 29 (2000): 109-23.

oriented concerns. On the contrary, they claim, practical as well as theoretical concerns were always present side by side in the history of science. Third, as noted by Shinn, Etzkowitz and Leydesdorff have a neo-differentiationist stance in contrast to the anti – differentiationist position of Gibbons et al.[27] Thus, Etzkowitz and Leydesdorff claim the rise of a new institutional arrangement of academia, government and the industry, instead of an altogether disappearance of these three realms. And finally, according to the Triple Helix authors, the importance of the universities as knowledge production institutions is far from being in decline, on the contrary, it is increasing substantially.

As such, the Triple Helix model brings forth another very important dimension to the discussion of this study; namely the historical inaccuracy witnessed in Mode 2 analysis. They simply reject the idea of two dichotomous modes of knowledge production. Rather they emphasize the coexistence of them throughout the history.

4.2 Critiques, Contestations and Disagreements

In this section, mainly the contested points of Mode 2 thesis are presented. However, there also are points which receive little or no protest at all, and first they are examined below, before delving into the detail of the critiques.

To begin with, the recent political and economical developments which Gibbons et al. identify as the underlying reasons for the rise of Mode 2 knowledge production are unanimously acknowledged by all the authors referenced in this study; including the direct critiques of Mode 2 thesis. In this respect, the body of literature addressed

[27] T. Shinn, "Change or Mutation? Reflections on the Foundations of Contemporary Science", *Social Science Information*, 38 (1999): 149-76.

in this study sees the following as the broad level realities of today's political and economic panorama: (1) The global scale decline in economic performances, and the intensification of the global competition; (2) the resulting pressure on the industry to innovate and to reach for knowledge as fast as possible; (3) the related shift in the states' policy orientations towards facilitating a dynamic and robust knowledge-based innovation and wealth creation infrastructure; (4) the resulting pressures on every institutions, especially the universities, to directly participate in this policy – driven economic and technological development process. The details of these four points can be found in the previous chapter.

Still, as explained in the previous chapters in length, Gibbons et al. do not merely list these developments. They present them as the underlying reasons for the emergence of a totally new mode of knowledge production. More than that, they argue that this new mode is visible in the entire spectrum of knowledge production without any exceptions whatsoever. As soon as they do this, however, there arise divergences, contestations and questions in various fronts.

First of all, some writers question the apolitical and overly naturalist stance of Gibbons et al. Many commentators question the existence of the supposed link between the above mentioned political and economical developments and the emergence of a totally new mode of knowledge production. Since the arguments of Gibbons et al. are not substantiated empirically, these critics rightfully assert that the existence of 'pressures to change' does not necessarily imply 'actual changes'. Second, another set of authors emphasizes the inadequacy of the overly generalized message of Mode 2 thesis. They claim that, even if there are some changes in the

way knowledge is being produced, the universality and the generality of Mode 2 is quite questionable. In this respect, the mostly limited scope of the other claims of change presented earlier also supports these critiques. The third set of critical studies further question the validity of the historical perspective of the Mode 2 analysis. They critically comment on the fundamental dichotomy between Mode 1 and Mode 2, by claiming that the practices of both modes have been present side by side throughout the history of the modern science.

4.2.1 An Apolitical Diagnosis; An Implicit Political Value

Dominique Pestre states that he acknowledges Gibbons et al.'s overall stance that dynamics of knowledge production should not be studied independently from the dynamics of a broader society.[28] However, he asserts, the authors do not elaborate on this perspective sufficiently. In this respect, he points out the lack of active, "alternative and conflicting social, economic and political" actors in the analysis of Gibbons et al.[29] He argues that the authors present their thesis in such a way that, the emergence of the new mode of knowledge production appear as if it is the outcome of a natural evolution. And this way, says Pestre, the Mode 2 diagnosis clearly underestimates the presence of dynamic political and social *choices* in the social shaping of knowledge production.

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[28] D. Pestre, "The Production of Knowledge between Academies and Markets: A Historical Reading of the Book, 'The New Production of Knowledge'", *Science, Technology and Society*, 5 (2000): 169-81. And D. Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading", *Minerva*, 41 (2003): 245-61.

[29] D. Pestre, "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading", *Minerva*, 41 (2003): 245-61.

Krücken agrees with this evaluation of Pestre.[30] He sees a certain gap between the current discourse of change in the higher education institutions and the real organizational and structural changes happening in the universities. In this respect, he argues that "though one can witness far-reaching changes on the discursive level, institutional structures and practices seem to be much more resistant to change,"[31] and criticizes Gibbons et al. with not going beyond the rhetoric of change. He also confirms his point in an empirical study on German Universities, which yields a quite interesting result: One of the reasons why the demands for change fail in these universities is the prevalence of another discourse among the academicians: the Humboldtian idea of the university.[32]

The diagnosis of academic capitalism, presented earlier in detail, makes the points of Pestre and Krücken more visible. Unlike Gibbons et al., Slaughter and Leslie explicitly refer to the political and social agents who deliberately want to shape knowledge production, especially the university as an institution. In contrast to Mode 2 analysis, which remains at a very broad level, they go deeper into the details: "Rather than looking only at the foreground where powerful social, political, and economic actors and organizations shape policy, our post-structural approach allows us to pay attention to the background where subversive, recalcitrant, or unengaged actors and organizations pursue their own R&D and academic agendas".[33] In this

[30] G. Krücken, "Panta Rei - Re-thinking Science, Re-thinking Society", *Science as Culture*, 11 (2002): 125-30.
[31] Krücken, "Panta Rei - Re-thinking Science, Re-thinking Society," 129.

[32] G. Krücken, "Learning the 'New, New Thing': On the Role of Path Dependency in University Structures", *Higher Education*, 46 (2003): 315-39.

[33] S. Slaughter and G. Rhoades, "The Emergence of a Competitiveness Research and Development Policy Coalition and the Commercialization of Academic Science and Technology", *Science, Technology & Human Values*, 21 (1996): 303-39.

regard, they also distinguish the agendas and discourse of these different agents from the actual status and condition of the academic institutions. In fact, as noted by Hessels and Van Lente, their empirical studies conducted in four countries (US, UK, Australia, Canada) further confirm this situation: "In all four countries they have studied, governments promoted academic capitalism as a means of stimulating economic growth. Except for Canada, they all succeeded in developing promoting policies. However, there is no clear indication for the success of market-activities."[34]

Weingart, Shinn and Hayrinen-Alestalo also confirm with the importance of complex processes of social shaping of knowledge production and its institutions.[35] However, they further accuse Gibbons et al. with implicitly advocating and promoting the language of neo-liberal political agendas based on innovation policies. For example, as explained earlier while the concept of finalization in science is summarized, Weingart associates the substantial acceptance of Mode 2 thesis in both academic and policy circles with the changing context "both in terms of the ruling ideology and of the relevant institutional arrangements".[36] In the same way, Hayrinen-Alestalo identifies Mode 2 thesis as a "meta-theory" with full of programmatic biases.

Whether Gibbons et al. have an implicit political agenda or not cannot be tested in this study. However, from the perspective of this study, it is important to recognize the place of academics and scholarly studies/discussions themselves in the social

[34] L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.

[35] Weingart, "From 'Finalization' to 'Mode 2': Old Wine in New Bottles?"; Shinn, "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology".; M. Hayrinen-Alestalo, "The University Under the Pressure of Innovation Policy - Reflecting on European and Finnish Experiences", *Science Studies*, 12 (1999): 44-69.

[36] P. Weingart, "From 'Finalization' to 'Mode 2': Old Wine in New Bottles?", *Social Science Information*, 36 (1997): 591-613.

shaping of knowledge production. In fact, Mode 2 thesis itself is a good example in this sense. As noted by Hessels and Van Lente, it did not only create an academic discussion, it also influenced the policy makers, who by nature have the agency to shape the processes and practices of knowledge production.[37] Interestingly enough, this means that by describing the changing nature of knowledge production, Mode 2 analysis indirectly changes it. Can this situation be extended into the whole discussions about the social identity and function of the university?

4.2.2 Disregard for the Diversity

Another very important critique directed towards Mode 2 thesis is related with the universality and generality of its claims. As elucidated several times before, Gibbons et al. explicitly argue that Mode 2 is a complete and coherent system of knowledge production and it is visible in the whole spectrum of knowledge production. In this sense, throughout their study they do not present any single exception, even on the basis of the very broad categories they identify: science, technology, social sciences and humanities. Let alone they mention a possible diversity inside these categories; for example regarding the differences that might arise in different disciplines, in different academic traditions or universities, or in different national contexts and so forth.

This stance, however, is seriously questioned by several commentators. Krücken, for example, rightfully questions the lack of the cases which might show counter

[37] L.K. Hessels and H. Van Lente, "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda", *Research Policy*, 37 (2008): 740-60.

evidence in the whole treatise of Gibbons et al.[38] As a likely answer to him, Weingart assert that the Mode 2 knowledge production can be said to exist only in a small section of the whole range of scientific activities, namely, in "the complex of technology assessment, risk research and climate research, for which uncertainty of knowledge, complexity of subject matter, policy orientation and value-ladenness are typical."[39] In this respect, the results of Albert's empirical study on sociology and economics departments of two Canadian universities further support this case of Krücken and Weingart.[40] Albert, in his study finds out that in these specific departments and universities there are no signs of Mode 2 activities, rather Mode 1 type research seem to be prevalent. Accordingly, he posits that it would be wrong to assume a monolithic and uniform scientific enterprise. Similarly, based on his empirical research on a plant-biotechnology research group facilitated by a traditional Finnish university, Tuunainen emphasizes the importance of "the local and dynamic character of academic life."[41]

Furthermore, even though their studies also aim at showing changes in the character and structure of the universities, the empirical studies of the writers of 'academic capitalism' and 'enterprise universities' also confirm the significant diversity among disciplines and universities. According to the findings of Slaughter and Leslie,

[38] G. Krücken, "Panta Rei - Re-thinking Science, Re-thinking Society", *Science as Culture*, 11 (2002): 125-30.
[39] P. Weingart, "From 'Finalization' to 'Mode 2': Old Wine in New Bottles?", *Social Science Information*, 36 (1997): 591-613.

[40] M. Albert, "Universities and the Market Economy: The Differential Impact on Knowledge Productionin Sociology and Economics", *Higher Education*, 45 (2003): 147-82.

[41] J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98. Background to this conclusion of Tuunainenare presented in J. Tuunainen, "Reconsidering the Mode 2 and Triple Helix: A Critical Comment Based on a Case Study", *Science Studies*, 15 (2002): 36-58. And J. Tuunainen, "Contesting a Hybrid Firm at a Traditional University", *Social Studies of Science*, 35 (2005): 173-210.

academic capitalism is much more pronounced in the disciplines that are closer to the market because of their subjects' nature.[42] And, Marginson and Considine show that the particularity of the universities plays a decisive role in their responses to pressures of change.[43] In this respect, they find out that, despite the severe cutbacks in funding and increasing pressures of professional managerial attitudes, the old, established universities with strong academic cultures and collegial loyalties manage to maintain their standings. But, newer universities, especially the ones that are strong in applied sciences, are more inclined to become enterprise universities.[44]

Some commentators further assert that the authors of Mode 2 not only neglect the diversity inherent in universities and disciplines, but also in broad categories such as public, state or industry. For example, Krücken argues that "the public as an aggregate of individuals does not exist. It is rather composed of groups or organizations, who manage to mobilize intellectual and material resources", and mostly in contradictory directions.[45] From a similar perspective, Alestalo criticizes Gibbons et al. with taking the state as a "one-dimensional actor".[46] Along the same line, Etzkowitz and Leydesdorff's study show an example of non-uniformity in policy circles: "The Swedish Research 2000 Report recommended the withdrawal of the universities from the envisaged 'third mission' of direct contributions to industry.

[42] S. Slaughter and L.L. Leslie, *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Baltimore: The John Hopkins University Press, 1997).
[43] S. Marginson and M. Considine, *The Enterprise University: Power, Governance and Reinvention in Australia* (Cambridge: Cambridge University Press, 2000).

[44] This point is further supported by the analysis of Grit Kor Grit, "The Rise of the Entrepreneurial University: A Heritage of the Enlightenment?" *Science Studies 10*, no. 2 (1997) 3-22

[45] G. Krücken, "Panta Rei - Re-thinking Science, Re-thinking Society", *Science as Culture*, 11 (2002): 125-30.

[46] M. Hayrinen-Alestalo, "The University Under the Pressure of Innovation Policy - Reflecting on European and Finnish Experiences", *Science Studies*, 12 (1999): 44-69.

Instead, the university should return to research and teaching tasks, as traditionally conceptualized."[47]

Thus, in fine, all the other treatises studied in this thesis ask for taking into account the possible diversity in broader categories of science, society, public, state or industry in the studies on the social dynamics of knowledge production. However, not all of them do this explicitly. Some show it implicitly through their analysis.

4.2.3 Wrong Historical Perspective

As emphasized before, one of the most striking characteristic of Mode 2 thesis is the radical discontinuity it depicts. The authors identify the Mode 1 as the original and sole form of science which has been present to this present day from the beginning, and propose an entirely opposite mode of knowledge production to describe the current conditions. Thus, for them, science 'was' entirely Mode 1 before, and 'is' Mode 2 now. However, as such, this linear historical account receives severe criticisms.

The first of the several critics who commented on this issue are Etzkowitz and Leydesdorff, who, themselves, have proposed a transformation thesis as ambitious as Gibbons et al. In brief, they reject the idea of a science characterized by clear-cut boundaries; both external and internal: First, they claim that "science has always been organized through networks. Centuries before 'Mersenne' was transmogrified into an Internet site, he was an individual, who, by visits and letters, knitted the European scientific community together. The Academies of Science played a similar

[47] Etzkowitz and Leydesdorff, "The Dynamics of innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations".

role in local and national contexts from the 16th century."[48] Thus, they refuse viewing scientists and disciplines as disconnected from each other. Second, they also turn down the newness of practical concerns in knowledge production. Through several historical examples they show the coexistence of theoretical and practical concerns throughout the history of science. In this respect, they even propose the Mode 2 type of practices as original format of science.

Godin also thinks that the thesis of Gibbons et al. is founded on a too linear and ahistorical perception.[49] According to him, the distinction between fundamental and applied research is quite a synthetic one. In actual research practices, he claims, basic and applied perspectives always coexist. And it has been so for the whole history of science. In this sense, he emphasizes that the fundamental vs. applied dichotomy presented in Mode 2 diagnosis is not about the actual nature of research practices, but rather about the fight between the rhetoric of 'autonomous science' with the discourse of 'useful science'. And in this respect he claims that the latter is not a new phenomenon as described by Gibbons et al. On the contrary it is present from the very beginning of science.

In the same way, Muller claims that, by "presenting it as two discrete ideal types that probably never exist in their pure form in the real world,"[50] Gibbons et al. assume a radical ahistorical perspective. And Shinn and Pestre concur with him, and through

[48] Ibid.
[49] B. Godin, "Writing Performative History: The New New Atlantis?", *Social Studies of Science*, 28 (1998): 465-83.

[50] cf. J. Tuunainen, "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University", *Higher Education*, 50 (2005): 275-98.

different theoretical and historical analyses they both reject the fundamental dichotomy and radical discontinuity presented in the analysis of Gibbons et al.[51]

4.3 Summary

At the beginning of this chapter, it is emphasized that Gibbons et al.'s account of the social shaping of the university is at a very generic level. In fact, as regards to the specifics of this social construction it remains rather vague. It identifies some broad and too abstract categories like industry, state, public and academia as the actors of this process. But, it does not provide an empirically-based detailed account of which dynamics are involved in such a social formation of the university.

Accordingly, the main purpose of this chapter is set as achieving a better articulated, detailed and more tangible account of this social construction. To this end, that is, to move from a generic level towards particular details, a set of questions, which elaborates on the generic issues, is evoked, so that, it would also function as the framework of analysis. In addition to this, these questions are intended to act also as a guideline to examine both the other diagnoses of change and the critiques of Mode 2, in accordance with the primary purpose of the chapter.

[51] The following body of literature which concetrates on revealing the characteristics of 'hybrid practices' in which social/practical and fundamental/theoretical concern coexist, futher support the cases of the authors examined in this section: T.F. Gieryn, *Cultural Boundaries of Science: Credibility on the Line* (Chicago: The University of Chicago Press, 1999).; K. Knorr-Cetina, "Scientific Communities or Transepistemic Arenas of Research? A Critique of Quasi-Economic Models of Science", *Social Studies of Science*, 12 (1982): 101-30.; B.A. Kimmelman, "Organisms and Interests in Scientific Research: R.A. Emerson's Claims for the Unique Contributions of Agricultural Genetics," in *The Right Tools for the Job: At Work in Twentieth-Century Life Sciences*, ed. A.E. Clarke and J.H. Fujimura (Princeton: Princeton University Press, 1992), 198-232.; R. Miettinen, "Object Construction and Networks in Research Work: The Case of Research on Cellulose-Degrading Enzymes", *Social Studies of Science*, 28 (1998): 423-63.; D.L. Kleinman, *Impure Cultures: University Biology and the World of Commerce* (Madison: The University of Wisconsin Press, 2003).

Based on the list of topics analyzed within the confines of the transformation debate; the issues addressed with these questions were (1) the possible diversity inherent in the broadly categorized social spheres of science, government and the industry, (2) the accuracy of the historical and sociological considerations in Gibbons et al.'s analysis, (3) and the likely impact of the university studies on the shaping of the knowledge production system (and the university) itself.

In this respect, the analysis of this chapter yielded the following conclusions.

To begin with, one can evidently argue that, the issue of the social formation of the university should not be treated in a too linear and overly generalized fashion, like Gibbons et al. do. Even though they are helpful as descriptive and explanatory terms; broad categorical terms like state, science, public, industry, university, or more importantly, the 'mode of knowledge production' do not provide a rigorous framework to understand the actual practices and processes. First of all, these social realms or institutions are not some big homogeneous, monolithic and 'one dimensional' entities. They show a great deal of inherent diversity. Likewise, it is historically and sociologically inaccurate to talk about a 'complete and coherent' system of knowledge production. Such a system has never been witnessed. Throughout the history of the modern science, several scientific practices or processes which are described by Gibbons et al. under the common headings of Mode 1 and Mode 2, have existed side by side, even in a visibly contradictory fashion. Failing to respect this diversity, in this sense, involves a certain risk of remaining at a level of pure speculation and prescription. And in that case, it would be rather hard to differentiate whether a particular analysis about the social identity

of the university is concerned with the question of ‘what is’ or instead it suggests an answer to ‘what should’.

Based on this understanding, this chapter more specifically argues that the following considerations ought to be taken into account carefully. (1) The intrinsic natures and the particularities of different disciplines and fields of study. For example, the differences between social, applied and natural sciences, and their specific methods, organizations and ways of work. (2) Similarly, the importance of the variation in the types of universities, their historical and cultural inheritance, and their particular modes of operation. (3) The likely impacts of the national and local contexts on the characteristics of the university. (4) The presence of active and contradictory social/scientific *choices* in the complex process of realization of the knowledge production practices and the universities. In this respect, the ideological dimension which is inherent in the decision making processes and the formation of the paradigm of knowledge and science. (5) Along the same line, the complex dynamics of policy-making and policy-implementation; that is, the difference between setting a policy agenda and the actual realization of it. For example, policy makers might want to steer the universities in a certain direction, but by itself this does not necessarily mean that it is achieved automatically. On the contrary, the historical and empirical evidence clearly shows that the academia has always been an active agent in the shaping of the knowledge production system. In this respect, one can certainly argue that, the scholarly studies themselves which has a bearing on the university; especially the ones which are explicitly or implicitly concerned with the question of ‘what should be the social function of the university’ play a significant role in the social formation of the university. The debate on the ‘what should be the founding

principles of the University of Berlin' which is witnessed at the beginning of the 19th century and involved major figures like Kant, Von Humboldt, Jaspers, Newman and so on, is a good example of this.

Such an account which asks for the addition of a carefully examined dimension of diversity to university studies has an important implication, however: As it is evident, the universities usually house more than one type of disciplines and they still operate within strong national and local contexts. Especially, in the larger ones one can find almost every kind of scientific fields of enquiry which are different by nature. This might simply mean that one should be careful in treating even a particular university as a homogeneous entity; let alone in dealing with the broad concept of 'the university'.

Following the above mentioned points, a final consideration that needs to be emphasized, however, is the following: Being involved with too many local dimensions, on the other hand, can equally mask the 'global and paradigmatic' character of the university. This should also be taken into account. In fact, one can argue that, the past two century history of the academic studies on the university have mostly materialized at around two extremes: Overly-generic speculative and normative issue of what should be social function of the university on one hand, and on the other, too-local and specific treatment of the university. In this respect, this study urges the necessity of finding a middle ground, that is, of connecting such too-generic formulations and treatments of the university with the actual local phenomena.

The focus of this study, that is, the transformation debate, implicitly suggests following this direction. However, it certainly fails to provide a comprehensive solution. As such, the task is assigned to further studies, and in this respect, they definitely have to go beyond the confines of the transformation debate.

CHAPTER V

CONCLUSION

This text starts with a simple question: What is the social identity, role and function the university?

The main purpose of it, however, is not to provide a direct answer to this question. Rather, it is to scrutinize and elaborate on *how* to effectively address this issue of the social character of the university in the first place.

To this end, the study has raised the following questions at the very beginning and aimed at answering them throughout the entire text: What ought to be the defining characteristics of a conceptual framework of a research method the aim of which is to understand the social nature of the university? Which theoretical and methodological analyses, considerations or baselines should reside at the foundation of such a research method? In this respect, which issues, concepts, questions, social dynamics, factors and so on are related and should be addressed and carefully examined while constructing such a method? How can these related issues be identified in the first place? And through what kind of an analysis can they be incorporated into this research agenda and method formation?

As it is evident in the nature of these questions, the intention of the study is to lay out the groundwork of a research method/agenda which is concerned with the main issue of the study depicted above. In this respect, the whole analysis has concentrated on identifying a certain collection of issues and considerations which have to be dealt with before attempting to create such a research method. As such, this thesis is definitely a preliminary study; because the purpose of it is not directly building this

research agenda, but rather preparing its foundation. In this respect, it implicitly suggests going two levels deeper than the original question: First, it urges the necessity of constructing a conceptual framework to rigorously deal with this issue, and second, it points out the requirement of establishing a sound theoretical and methodological foundation for this framework.

This task at hand, however, in its full form certainly goes well beyond limits of a thesis study, since it involves a wide range of theoretical and methodological considerations. More than that, the nature of the problem is inherently far-reaching and thus open-ended. For these reasons, the method and the focus of the analysis has been chosen in such a way that they would establish the boundaries of the study neatly and in the mean time provide a context which can yield an adequate amount of tangible results.

In this respect, to confine the study within a manageable scope, the focus has been set on a specific topic of discussion among all the other scholarly studies that are directly or indirectly concerned with the social identity of the university. Hence, a recent and ongoing debate on the nature of the contemporary social system of knowledge production has been selected as the main area of investigation.

Specifically; the participants of this discussion are, on one side, the theses known as ‘Mode 2’, ‘finalization in science’, ‘post-normal science’, ‘academic capitalism’ and ‘triple helix’, which, from different perspectives, claim that various aspects of contemporary social system of science has recently undergone a profound transformation, and on the other, the critics of these diagnoses of change. Among these transformation theses, however, one of them, the Mode 2 thesis by Gibbons et

al., stands out remarkably, due to the scope and extent of its claims and the enormous reactions it received in the literature. For this reason, for the most part of the study, it has been at the centre of analysis and has been examined in great length and depth.

Since the universities are institutions of knowledge production by nature, the relevance of this discussion with the purpose of the study is obvious. Nevertheless, the contributing treatises, especially the Mode 2 thesis, do not address the issue of the social role and function of the university directly and explicitly; with the notable exception of 'academic capitalism' and 'triple helix'. That is, the topic of this debate is apparently different from the main issue of this text.

Accordingly, the method and structure of the study has been shaped as follows: In an analytical exploratory fashion; first, the Mode 2 thesis has been examined in length to identify its mostly implicit reflections on the nature of the university and the social formation of it. That is, the Mode 2 diagnosis has been investigated and interpreted from a perspective as if it is explicitly referring to the issue of this study. This means that, for the most part of the study, the Mode 2 treatise itself has been talking about the social formation of the university, but not Gibbons et al. Then, using a similar strategy, the other diagnoses of change and the direct critiques of Mode 2 thesis have been examined to find out what they have to say about the issue at hand. Hence, by employing such a method, this study, in a sense, has attempted to create a virtual discussion on the subject of the social nature and function of the university among the studies on the social dynamics of knowledge production, even though, in the majority of the cases, the discussants have not been talking to each other directly.

In the end, the following conclusions have been reached as answers to the main questions of the study.

There is a strong connection with knowledge production and the identity of the university. The paradigm of knowledge and science is especially important in this respect, because it basically supplies the university with its founding principles. This has been the case at the onset of the 19th century when Von Humboldt was following his quest to found the University of Berlin on the idea of an 'autonomous knowledge production for its own sake'. And today, it is evident that another paradigm, one which represents the idea of 'knowledge production for use' is attempting to gain prominence. For this reason the concept of the idea of knowledge/science and how in actuality it shapes the university should certainly be addressed in any research framework which aims to understand the university.

Going one level deeper, it is also evident that such ideas and ideals of knowledge and science are shaped by very complex social processes which involve a diverse range of social factors, agents and considerations. Thus, one can argue that the paradigm of knowledge is a socially constructed phenomenon, and various political, economic, scientific, cultural and ideological elements are at play in this social construction. In this respect, this phenomenon, that is, the social formation of the paradigm of knowledge and science should also be incorporated into the creation of a research agenda which investigates what is the social function of the university.

Regarding the concerns of this study, however, this phenomenon of the paradigmatic social formation of the university should not be analyzed in a too linear and overly generalized fashion, like Gibbons et al. do. Broad categorical terms like state, public,

science, industry, system of knowledge production, academia and so on may have uses in generic descriptive contexts, but they are inadequate in the construction of a solid conceptual framework. The social spheres, realms and institutions these terms supposedly represent are not homogeneous, monolithic and do not articulate themselves in an unequivocally manner. On the contrary, there is a great deal of diversity in all these categories. Thus, by themselves they do not provide a framework to understand the actual process of the social formation of the university. More importantly, if a treatise on the university fails to take into account the significance of this diversity, it would be hard to identify whether it is concerned with the question of 'what is' or 'what should'.

In this respect, this study urges to descend from a generic and abstract level to a more tangible one, by taking into account the following considerations: (1) The inherent diversity in the scientific activities, practices, processes and disciplines; (2) In the same way, the diversity in the type and character of particular universities; (3) The impacts of the national and local settings; (4) Likewise, the diversity in the political, economic and cultural realms; (5) The complexity of the social formation and implementation of a paradigm of knowledge; especially the existence of clashing active choices and agendas in this process; (6) The complex processes of policy setting and implementation; In this sense, the relationship between the mechanisms of policy realization, like rules and regulations, between the reaction mechanisms of universities to them.

In this respect, this study concludes that a research method to find out the social character, role and function of the university, should find a concrete way to

incorporate the above listed considerations into its conceptual framework. Thus, it has to articulate a theoretical and methodological base which fully grasps the complex social dynamics of the social formation of the university. Accordingly, it has to find a way to deal with the issue of the university without going into the extreme directions of either 'generic formulations' or 'too local and concentrated analyses'.

These are the findings of this study. However, there are some final words to be stated: The analysis presented here is the result of a study which is strictly confined to a particular body of literature. Because of this it does not touch the issues outside the transformation debate and this is in fact a serious weakness. As such, it has certain limitations. It fails to provide an investigation of some equally important issues related with the social formation of the university. First of these issues is the absence of any analysis on the 'education' side of the universities. In fact, education is the other mission of the university besides knowledge production. And it is related with knowledge production in various ways. For example, it is how the paradigm of science is passed onto the next generations of researchers. The second one is the 'cultural' dimension of education and university life. Even if one considers the university education as only professional training, the universities, especially the traditional ones, house a considerable amount of students who are culturally 'mixed' and create their own forms identities and behavioral patterns. The third issue which is not addressed in this study is the broader dynamics of 'political economy' of knowledge and knowledge production which is a field of study by itself. And finally, an account of the issues related with scientists, or the academics in more broad terms, as active individuals, is also absent in this study.

BIBLIOGRAPHY

Albert, M. "Universities and the Market Economy: The Differential Impact on Knowledge Productionin Sociology and Economics." *Higher Education* 45, no. 2 (2003): 147-182.

Böhme, G., W. Van den Daele, W. Krohn, and W. Schaeffer. *Finalization in Science: The Social Orientation of Scientific Progress.* Dordrecht: D. Reidel Publishing, 1983.

Charle, C. "Patterns." In *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, edited by W. Rüegg, 33-80. New York: Cambridge University Press, 2004.

Clark, Burton R. "Development of the Sociology of Higher Education." In *Sociology of Higher Education: Contributions and Their Contexts* , edited by P.J. Gumport, 3-16. Baltimore: The Johns Hopkins University Press, 2007.

Clarke, A.E., and J.H. Fujimura, . *The Right Tools for the Job: At Work in Twentieth-Century Lİfe Sciences.* Princeton: Princeton University Press, 1992.

Craye, M., and S.O. Funtowicz. "A Reflexive Approach to Dealing with Uncertainties in Environmental Health Risk Science and Policy." *International Journal of Risk Assessment and Management* 5 (2005): 216-236.

Delanty, G. *Challenging Knowledge: The University in the Knowledge Society.* Buckingham: SRHE and Open University Press, 2001.

Delanty, G. "The Idea of the University in the Global Era: From Knowledge as an End to the End of Knowledge." *Social Epistemology* 12 (1998): 3-25.

Delanty, G. "The Sociology of the University and Higher Education: The Consequences of Globalization ." In *Handbook of International Sociology*, edited by C. Calhoun, C. Rojek and B. Turner, 530-545. London: SAGE, 2005.

Etzkowitz, H. "The Norms of Entrepreneurial Science: Cognitive Effects of the New University-Industry Linkages." *Research Policy* 27 (1998): 823-833.

Etzkowitz, H., A. Webster, C. Gebhardt, B. Regina, and C. Terra. “The Future of the University and the University of the Future: Evolution of Ivory Tower to Entrepreneurial Paradigm.” *Research Policy* 29 (2000): 313-330.

Etzkowitz, H., and L. Leydesdorff. “The Dynamics of innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations.” *Research Policy* 29, no. 2 (2000): 109-123.

Etzkowitz, H., and L. Leydesdorff. "The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University-Industry-Government Relations." *Research Policy* 29 (2000): 109-123.

Etzkowitz, H., and L. Leydesdorff. “The Endless Transition: A Triple Helix of University-Industry-Government Relations.” *Minerva* 36 (1998): 203-218.

Etzkowitz, H., and L. Leydesdorff. "The Future Location of Research and Technology Transfer." *Journal of Technology Transfer* 14, no. 2 (1999): 111-123.

Etzkowitz, H., and L. Leydesdorff. “The Future Location of Rsearch: A Triple Helix of University-Industry-Government Relations, II.” *EASST Review* 15, no. 4 (1996): 20-25.

Etzkowitz, H., and L. Leydesdorff, . *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations.* London: Cassell, 1997.

Frank, D.J., and J.W. Meyer. "Worldwide Expansion and Change in the University." In *Towards a Multiversity? Universities between Global Trends and National Traditions*, edited by G. Krücken, A. Kosmützky and M. Torka, 19-44. Bielefeld: Transcript, 2007.

Fuller, S. "Rethinking the University from a Social Constructivist Standpoint." *Science Studies* 7, no. 1 (1994): 4-16.

Funtowicz, S.O., and J.R. Ravetz. "Science for the Post-Normal Age." *Futures* 25 (1993): 735-755.

Funtowicz, S.O., and J.R. Ravetz. “The Emergence of Post-Normal Science.” In *Science, Politics and Morality. Scientific Uncertainty and Decision Making*, edited by R. von Schomberg. Dordrecht: Kluwer, 1993.

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott, and M. Trow. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies.* London: SAGE Publications, 1994.

Gieryn, T.F. *Cultural Boundaries of Science: Credibility on the Line.* Chicago: The University of Chicago Press, 1999.

Godin, B. "Writing Performative History: The New New Atlantis?" *Social Studies of Science* 28, no. 3 (1998): 465-483.

Gowda, M.V. Rajeev. “Review.” *Journal of Policy Analysis and Management* 15, no. 3 (1996): 461-466.

Gumport, P.J., ed. *Sociology of Higher Education: Contributions and their Contexts.* Baltimore: The Johns Hopkins University Press, 2007.

Hayrinen-Alestalo, M. "The University Under the Pressure of Innovation Policy - Reflecting on European and Finnish Experiences." *Science Studies* 12 (1999): 44-69.

Hessels, L.K., and H. Van Lente. "Re-thinking New Knowledge Production: A Literature Review and a Research Agenda." *Research Policy* 37 (2008): 740-760.

Hessels, L.K., and H. Van Lente. "The Mixed Blessing of Mode 2 Knowledge Production." *Science, Technology and Innovation Studies* 6 (2010): 65-69.

Kimmelman, B.A. "Organisms and Interests in Scientific Research: R.A. Emerson's Claims for the Unique Contributions of Agricultural Genetics." In *The Right Tools for the Job: At Work in Twentieth-Century Life Sciences*, edited by A.E. Clarke and J.H. Fujimura, 198-232. Princeton: Princeton University Press, 1992.

Kleinman, D.L. *Impure Cultures: University Biology and the World of Commerce.* Madison: The University of Wisconsin Press, 2003.

Kloprogge, P., and J.P. Van der Sluijs. “The Inclusion of Stakeholder Knowledge and Perspectives in Integrated Assessment of Climate Change.” *Climate Change* 75 (2006): 359-389.

Knorr-Cetina, K. “Scientific Communities or Transepistemic Arenas of Research? A Critique of Quasi-Economic Models of Science.” *Social Studies of Science* 12 (1982): 101-130.

Koch, P.K. “Review.” *The British Journal for the History of Science* 19, no. 1 (1986): 116.

Krücken, G. "Learning the 'New, New Thing': On the Role of Path Dependency in University Structures." *Higher Education* 46 (2003): 315-339.

Krücken, G. “Panta Rei - Re-thinking Science, Re-thinking Society.” *Science as Culture* 11, no. 1 (2002): 125-130.

Krücken, G., A. Kosmützky, and M. Torka, . *Towards a Multiversity? Universities Between a Global Trend and National Traditions* . Bielefeld: Transcript, 2007.

Kuhn, Thomas S. *The Structure of Scientific Revolutions.* Chicago: The University of Chicago Press, 1962.

Leydesdorff, L., and H. Etzkowitz, . *A Triple Helix of University-Industry-Government Relations: The Future Location of Research?* New York: Science Policy Institute, State University of New York, 1998.

Leydesdorff, L., and H. Etzkowitz. “Emergence of a Triple Helix of University-Industry-Government Relations.” *Science and Public Policy* 23 (1996): 279-286.

Leydesdorff, L., and H. Etzkowitz. “Technology Innovation in a Triple Helix of University-Industry-Government Rlations, Asia Pacific Tech.” *Monitor* 15, no. 1 (1998): 32-38.

Leydesdorff, L., and H. Etzkowitz. “The Triple Helix as a Model for Innovation Studies.” *Science and Public Policy* 25, no. 3 (1998): 195-203.

Leydesdorff, L., and H. Etzkowitz. “Triple Helix of Innovation: Introduction.” *Science and Public Policy* 20, no. 6 (1998): 358-364.

Lowe, R., ed. *The History of Higher Education.* 5 vols. New York: Routledge, 2009.

Marginson, S., and M. Considine. *The Enterprise University: Power, Governance and Reinvention in Australia.* Cambridge: Cambridge University Press, 2000.

Meyer, J.W., F.O Ramirez, D.J. Frank, and E. Schofer. "Higher Education as an Institution." In *Sociology of Higher Education: Contributions and Their Contexts*, edited by P.J. Gumport. Baltimore: The Johns Hopkins University Press, 2007.

Miettinen, R. "Object Construction and Networks in Research Work: The Case of Research on Cellulose-Degrading Enzymes." *Social Studies of Science* 28, no. 3 (1998): 423-463.

Nowotny, H., P. Scott, and M. Gibbons. *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty.* Cambridge: Polity Press, 2001.

Oliveira, L. "Commodification of Science and Paradoxes in Universities." *Science Studies* 13, no. 2 (2000): 23-36.

Pestre, D. "Regimes of Knowledge Production in Society: Towards a More Political and Social Reading." *Minerva* 41 (2003): 245-261.

Pestre, D. "The Production of Knowledge between Academies and Markets: A Historical Reading of the Book, 'The New Production of Knowledge'." *Science, Technology and Society* 5, no. 2 (2000): 169-181.

Pfetsch, Frank R. "The 'Finalization' Debate in Germany: Some Comments and Explanations." *Social Studies of Science* 9, no. 1 (1979): 115-124.

Rothblatt, S. *The Idea of the Idea of a University and its Antithesis.* Vol. II, in *The History of Higher Education*, edited by R. Lowe, 178-221. New York: Routledge, 2009.

Rothblatt, S., and B. Wittrock, . *The European and American University since 1800: Historical and Sociological Essays* . Cambridge: Cambridge University Press, 1993.

Rüegg, W. "Themes." In *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, edited by W. Rüegg, 3-31. New York: Cambridge University Press, 2004.

Rüegg, W., ed. *Universities in the Nineteenth and Early Twentieth Centuries, 1800 - 1945.* Cambridge: Cambridge University Press, 2004.

Schopman, J. "Finalization and Functionalization." *Journal for General Philosophy of Science* 11, no. 2 (1980): 347-353.

Schroyer, T. “On Finalizatin in Science.” *Theory and Society* 13, no. 5 (1984): 715-723.

Shils, E., and J. Roberts. “The Diffusion of European Models Outside Europe.” In *Universities in the Nineteeth and Early Twentieth Centuries, 1800 - 1945*, edited by W. Rüegg, 163-230. New York: Cambridge University Press, 2004.

Shinn, T. "Change or Mutation? Reflections on the Foundations of Contemporary Science." *Social Science Information* 38, no. 1 (1999): 149-176.

Shinn, T. "The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology." *Social Studies of Science* 32, no. 4 (2002): 599-614.

Slaughter, S., and G. Rhoades. "The Emergence of a Competitiveness Research and Development Policy Coalition and the Commercialization of Academic Science and Technology." *Science, Technology & Human Values* 21, no. 3 (1996): 303-339.

Slaughter, S., and L.L. Leslie. *Academic Capitalism: Politics, Policies, and the Entrepreneurial University.* Baltimore: The John Hopkins University Press, 1997.

Tuunainen, J. “Contesting a Hybrid Firm at a Traditional University.” *Social Studies of Science* 35, no. 2 (2005): 173-210.

Tuunainen, J. "Hybrid Practices? Contributions to the Debate on the Mutation of Science and University." *Higher Education* 50 (2005): 275-298.

Tuunainen, J. “Reconsidering the Mode 2 and Triple Helix: A Critical Comment Based on a Case Study.” *Science Studies* 15, no. 2 (2002): 36-58.

Van der Sluijs, J.P., M. Craye, S.O. Funtowicz, P. Kloprogge, J.R. Ravetz, and J. Risbey. “Combining Quantitative and Qualitative Measures of Uncertainty in Model-based Environmental Assessment: the NUSAP System.” *Risk Analysis* 25, no. 2 (2005): 481-492.

Weingart, P. “From 'Finalization' to 'Mode 2': Old Wine in New Bottles?” *Social Science Information* 36, no. 4 (1997): 591-613.