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**AN INSTITUTIONAL APPROACH TO THE
CREATION OF INNOVATION
ECOSYSTEMS AND THE ROLE OF LAW**

Toshiyuki Kono and Kazuaki Kagami***

INTRODUCTION

Innovation is considered a source of social development, and the promotion of innovation has been encouraged all over the world. The methods for which innovation can be achieved, however, have not been clearly identified. The concept of an “ecosystem” has recently emerged as a tool to illustrate the organizational aspects of innovation, but the conditions and mechanisms necessary to create and manage a successful innovation ecosystem remain unclear.

Many countries, including Japan, have been trying to create an ecosystem similar to Silicon Valley by inviting and accumulating venture companies, research institutions, and universities, and by providing special measures for tax reduction, new funding schemes, and opening new facilities. However, one important aspect seems to have been overlooked: even if each player is innovative, if they do not create relationships that lead to innovations, the area as a whole cannot function as an innovation ecosystem. When an ecosystem is established, the conditions of its autonomous functioning are not automatically fulfilled. Hence, we are interested in the role of law, which might contribute to the development of these conditions. In particular, we will focus on a factor that would lead to the

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establishment of innovation ecosystems and functions—we¹ call it “mode,” which we understand as those factors that determine the direction of the player’s thinking and activities—and analyze the role of law to facilitate the sharing of modes by relevant players.

To illustrate the goal of this article, let’s have a look at the Ohta Ward in Tokyo. In Ohta Ward, many diverse small and mid-sized companies have gathered and countless innovations are continuously created. In this area, a number of voluntary interactions among these companies take place. Furthermore, networks between these companies, research institutes and governmental agencies are well established. Importantly, in Ohta Ward, laws and rules have played a crucial role in establishing these networks and their management. An innovation ecosystem, along with the supporting infrastructure, is firmly established in Ohta Ward. The supporting infrastructure includes not only measures related to tax and finance, but also measures aimed at development and education of human resources, the supply of human resources into the ecosystem, support for matching players, and the reduction of friction related to the establishment of networks and their management. In short, various types of support focusing on specificities of the ecosystem are offered as institutional bases of this well-functioning ecosystem.²

I. INNOVATION ECOSYSTEM AND THE ROLE OF LAW

Many policymakers and other governmental authorities have focused on innovation. Various policy measures have been introduced and implemented to achieve innovation. Industrial policies, particularly centralized industrial policies, are often adopted by developing countries to “catch up” with developed countries. Such policies are

¹ This refers to the authors of the article and is used throughout this article.

² Chiiki ni okeru sangyō shūseki no keisei oyobi kaihatsu ni kansuru hōritsu shinki jigyō ritchi no sokushin o tsūjite-tō [Act on Formation and Development of Regional Industrial Clusters through Promotion of Establishment of New Business Facilities, etc.], Act No. 40 of May 11, 2007 (Japan).

inadequate to create new technologies or ideas, or to develop new types of market. Instead, open and decentralized systems have recently been attracting the attention policymakers. This is the so-called “ecosystem.”

We share the view that an ecosystem is one of the most important keys for innovation.³ Although a well-established and widely shared definition of the concept of an ecosystem does not yet exist, there is one shared understanding of the ecosystem:⁴ an organization or system where continuous and dynamic interactions among various players take place. Inherent in this definition is the idea that innovative outcomes cannot be obtained solely by a single “genius” individual or through a well-controlled and uni-linear evolution process. Rather, it is presumed that outcomes can be obtained as a result of multi-layered and voluntary interactions among various players.⁵

Various policy measures have been implemented to promote innovations, including education policies to build the capacity of (potential) players in the ecosystem, cultural policies to promote innovation-oriented minds, intellectual property (IP) protections and tax policies to incentivize players, accumulation policies to raise the degree of players’ density, and subsidization policies. If these policy measures are successful, we would find a number of successful innovation ecosystems. The reality, however, is that despite many countries’ efforts to create a second Silicon Valley, their trials often yield unsuccessful results. This failure implies that the proper

³ See *infra*, note 6.

⁴ Ecosystem is defined as “a multi-faceted and continual interaction among many aspects of our economy and society.” COUNCIL ON COMPETITIVENESS, INNOVATE AMERICA: NATIONAL INNOVATION INITIATIVE SUMMIT AND REPORT 46 (2005).

⁵ Regarding the evolution of the innovation concept, see RICHARD S. ROSENBLUM & W. J. SPENCER, ENGINES OF INNOVATION: U.S. INDUSTRIAL RESEARCH AT THE END OF AN ERA (1996); ANNALEE SAXENIAN, REGIONAL ADVANTAGE: CULTURES AND COMPETITION IN SILICON VALLEY AND ROUTE 128 2-4 (1994) (comparing the independent firm-based system and the regional network-based system, and asserting that the latter is more suitable).

understanding of the conditions and means necessary to create innovative ecosystems is still lacking.⁶ Why is that so?

Our view is that policy measures have tended to target individual players themselves, and have failed to focus on the *interaction between players*. Even if excellent inventors, scholars, and entrepreneurs had populated a particular area, that area would not function well as an ecosystem if their interactions are ineffective. This idea reflects the shortcomings of previous research on ecosystems. It is a widely accepted belief that networking, communication, and collaboration are crucial, but how to facilitate this remains somewhat unclear. In short, the conditions of a well-functioning ecosystem has not been a topic of significant research.

A key factor of a well-functioning ecosystem is the transaction costs caused by interactions among players.⁷ If transaction costs are high, interactions stagnate and the ecosystem remains ineffective. Further, if transaction costs matter, a law and economics approach might contribute to a clarification of the conditions. What can law do to promote interactions among players to create successful ecosystems?

II. INNOVATION ECOSYSTEM AND MODE

A. Mode of Thinking and Behavior

1. *Generally recognized facts on innovation.* – As already mentioned, innovations are created through interactions among multiple players under specific conditions. Such interactions can be affected by players' internal nature and external environment. Players' internal nature includes their knowledge, technical strength, passion, financial power,

⁶ In this context, see VICTOR W. HWANG & GREG HOROWITT, *THE RAINFOREST: THE SECRET TO BUILDING THE NEXT SILICON VALLEY* 304 (2012).

⁷ For a discussion of transaction costs related to communications, see KENNETH J. ARROW, *THE LIMITS OF ORGANIZATION* (1974); OLIVER E. WILLIAMSON, *MARKETS AND HIERARCHIES* (1975).

way of thinking, and behavior. These elements of a players' internal nature might be so player-specific that trying to determine an "average type" or "typical features" is unhelpful. In addition, these elements are usually formed within each player and become quasi-inherent. Therefore, a players' internal nature is not easily changeable, and any change would require significant time and costs.

A player's external environment consists of external factors that influence his activities and performances, but that cannot be directly controlled by the player. Such factors include other players' capabilities, types of players, or the density of players; funding systems; legal systems to protect contracts and/or property; the quality and quantity of lawyers; the credibility of the judicial system; macro-economy and industrial structure; and consciousness on invention or entrepreneurship in society.

Recognizing the fact that a number of factors affect innovations, we propose to focus on mode and to clarify the role of law in relation to mode because mode has been neglected in preceding scholarly works and has not been integrated into policy measures.

2. The concept of mode and its functions. – In this paper, we understand mode as those factors that determine the direction of each player's thinking and activities. This understanding of mode considers each player's internal nature, but excludes purely innate factors such as IQ. Mode overlaps to some extent with personal character; however, mode is not identical to individual personality or philosophy, since personality and philosophy remain individual and internal. Instead, mode has such aspects that affect performances and outcomes of collaborative works with other players. Focus should be placed on such factors that can be acquired after birth and that are to some extent adjustable, such as language. Even if an individual is honest,

industrious and has good sense of humor, he cannot contribute to innovation if he does not have a mode to work with others.

Mode is also closely linked to organizational cultures.⁸ Schein defines organizational cultures as:

[A] pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.⁹

This definition is very close to our understanding of mode. However, mode in our view has a larger scope than that of organizational culture. Analysis of organizational cultures has often focused only on a single corporation, where the membership is fixed and has to follow the top-down authority. But mode is not limited to a single corporation. Mode as specific patterns of thinking and activities can apply to several organizations. In addition, even if an organization has a fluctuating membership, it could have its own mode. In addition, although studies on organizational cultures often presume that organizations can stand-alone without being affected by the outer world, this presumption seems unrealistic. Organizations cannot remain unaffected from interventions from outside, and mode is a useful tool to explain such situations.

The mode of a community or a region may have similarities to socio-cultural norms. In preceding discussions on socio-cultural norms, socio-cultural norms tend to be understood as unilaterally

⁸ For a discussion of organizational culture, see TERRENCE DEAL & ALLAN KENNEDY, *CORPORATE CULTURES: THE RITES AND RITUALS OF CORPORATE LIFE* (1982); EDGAR H. SCHEIN, *ORGANIZATIONAL CULTURE AND LEADERSHIP* (4th. ed. 2010). For an analysis from an economics perspective, see David M. Kreps, *Corporate Culture and Economic Theory*, in *PERSPECTIVES ON POSITIVE POLITICAL ECONOMY* 90-143 (James E. Alt & Kenneth A. Shepsle, eds., 1990).

⁹ SCHEIN, *supra* note 10, at 18.

influencing individuals or organizations, while feedback from individuals or organizations to such norms tends to be neglected. Even if such feedback would be taken into consideration, the self-organizational nature of society is so emphasized that little attention is paid to the laws or powers that would intervene from outside of the society.¹⁰ In addition, such focus on the self-organizational nature might lead to an overlook the fact that societal relationships are more complex: such relationships include those between one society and other societies, between a society and a supra-society, or between a society and a partial society.

The concept of mode helps us to pay due attention not only to each component of a society, i.e., mode of individuals, modes of organizations, inter-organizational relationships, and composite situations with these components,¹¹ but also to relationships between a society and its outer world.

Each player's mode can be adapted to his external environment. Thus, his mode is influenced by the cultures, values, religions, norms, customs, and fashions of society as a whole.

3. Interactions between different players with different modes result in high transaction costs. – If each player's personal mode and the mode of his organization, community, and region (locale) are different, it is extremely difficult for such an organization or community to function as an ecosystem.¹² In other words, members of an organization or community must share a specific mode. However, in order to foster innovation in an ecosystem, sharing specific modes by members will

¹⁰ See ROBERT C. ELLICKSON, *ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES* (1991).

¹¹ See Robert Sugden, *Spontaneous Order*, 3 J. ECON. PERSP. 85 (1989); Jon Elster, *Social Norms and Economic Theory*, 3 J. ECON. PERSP. 99 (1989); H. Peyton Young, *The Economics of Conventions*, 10 J. ECON. PERSP. 105 (1996); Randal C. Picker, *Simple Games in a Complex World: A Generative Approach to the Adoption of Norms*, 64 U. CHI. L. REV. 1225 (1997).

¹² See JOHN P. KOTTER & JAMES L. HESKETT, *CORPORATE CULTURE AND PERFORMANCE* (1992); JIM C. COLLINS & JERRY I. PORRAS, *BUILT TO LAST: SUCCESSFUL HABITS OF VISIONARY COMPANIES* (1994).

not suffice. Each member's mode should be adapted to the external environment and should be consistent with the purpose of the community. For example, Toyota has not only been trying to let its employees share the same modes (organizational modes), irrespective of the location of subsidiaries, but has also been creating the modes in their supply chains (community modes). In Silicon Valley, there exists explicit or implicit modes to conduct business.¹³ To be noted here is the fact that a mode in an organization (e.g., Toyota) or in a region (e.g., Silicon Valley) is usually different from other organizations (e.g., General Motors) or regions (e.g., Ohta Ward). In other words, each ecosystem should have its own mode to function well.

To create an open innovation ecosystem or meta-national ecosystem beyond one organization or one region, several communities with different modes or individuals from different communities must interact, for example, merger and acquisition between private companies; joint venture; collaboration between private company and university or private company and government. Also, with regard to merger and acquisition between private companies, many unconventional collaborations might occur, such as collaboration between manufacturer and distributor. This situation, however, would lead to constant conflicts of modes. Many failed merger and acquisition cases (e.g., *Daimler Chrysler*¹⁴ and *AOL-Time Warner* merger¹⁵) imply that, in such conflicted circumstances, no innovation ecosystems can be created.

¹³ For a discussion of the history and institutions of Silicon Valley, especially functions as ecosystem and relations to external environment, see MARTIN KENNEY, *UNDERSTANDING SILICON VALLEY: THE ANATOMY OF AN ENTREPRENEURIAL REGION* (2000).

¹⁴ Roberto A. Weber and Colin F. Camerer, *Cultural Conflict and Merger Failure: An Experimental Approach*, 49 *MGMT. SCI.* 400 (2003).

¹⁵ Tim Arango, *How the AOL-Time Warner Merger Went So Wrong*, N.Y. TIMES, Jan. 11, 2010, <http://www.nytimes.com/2010/01/11/business/media/11merger.html?pagewanted=all>.

In a well-functioning innovation ecosystem, innovations are expected to occur autonomously and continuously. However, integrating (new) players with different modes into an ecosystem with its own mode may be difficult, since such integration could inevitably cause friction between the new players and the mode of the ecosystem. More difficult is the challenge of adjusting each community's mode and non-community-members' mode, because the mode of a community is usually so designed that the community functions well as an autonomous mechanism. Integration of such a mode and the mode of non-community-members would not occur autonomously. Hence, we need external interventions, such as law, to facilitate integration of different modes.

Here, then, is the question we must answer: how should law be designed as a useful tool to adjust to conflicts of modes? Roughly speaking, there are two possible directions: (1) to introduce a unified mode, disregarding players' different modes; and (2) to select appropriate modes on a case-by-case basis, maintaining the difference of modes.

III. ANALYSIS

A. Interactions in a Community: Hypothesis

We assume that players enter into a community voluntarily with an aim to do business, but they cannot predict who they will meet in the community. We will further assume that diverse players belong to the community. To illustrate this assumption in a simpler form, let us assume that two players 1, and 2, belong to the community. Players, 1 and 2, encounter each other by coincidence and create a relationship. The outcome of this relationship will depend on the players' modes and external environment, assuming each player chose his mode prior to the encounter and that his mode cannot be changed.

Innovations occur through players' voluntary interactions. Such successful interactions which can bring about innovations requires that the mode of each player matches with others' modes. If players' modes do not match, their relationships will not function as

an ecosystem. In such a case, investment would be wasted without any return. Therefore, in Table 1, we assume a negative outcome if players' modes do not match. Even if players' modes match, benefits are smaller if their modes are not consistent with external circumstances. In Table 1, it is assumed that modes of two parties are [i] in an environment [i], benefits 30 could be produced to each player. If such a match occurs in an environment [j], benefits would be only 5. If their modes do not match, frictions occur and benefits would be -10. Equally, if their modes are [j] in an environment [j], benefits would be 30, while benefits would be only 5, if their modes are [i].

Table 1: The pay-off matrixes of Players 1 and 2.

		external circumstance: i	
		mode i	mode j
1	2		
	mode i	30, 30	-10, -10
mode j		-10, -10	5, 5

		external circumstance: j	
		mode i	mode j
1	2		
	mode i	5, 5	-10, -10
mode j		-10, -10	30, 30

Strictly speaking, differences of modes are more complex. Let's assume that mode "i" represents a mode which is innovation oriented. We use [a] and [b] to illustrate two specific modes as variations of "i". For example, mode [a] puts more emphasis on production process, while marketing is more important in mode [b]; even though both modes do not hesitate to take risks, mode [a] prefers *ex ante* investigation and planning, while in mode [b] *ex post* risk management is more important; certain types of conflicts of modes are small and can be resolved through players' cooperative negotiations, but other types of conflicts of modes are so great that they need organizational reforms. In any case, such complexity is reflected in the size of transaction costs.

B. The Role of Law in Promoting Innovation

1. Traditionally recognized functions of law. – Even in a well-functioning ecosystem where relationships among players are autonomously established, law plays a crucial role as an element of the external environment.

First, law can be a tool to enhance each player's individual capacity. In addition, educational and training schemes can be introduced from outside of the ecosystem by law. If each player's knowledge, technique, and comprehension can be enhanced by these schemes, outcomes such as the figure 30 in Table 2 can be increased to fifty or one hundred.

Second, contracts and properties can be protected by law. To achieve the outcomes in Table 2—either thirty or five—contracts and property rights must be protected. Some ecosystems can offer protective functions by its traditional customs or social norms. However, they have a few shortcomings compared to law: it is more difficult to enforce these non-law customs and norms than it is to enforce law; there is no guarantee that such customs and norms would be appropriately designed and applied; and it is more difficult to amend or abolish customs and norms than it is to abolish law.

Third, law is necessary to develop and manage infrastructures, including financial systems, information systems, traffic systems, distribution systems, production systems, and legal systems, for innovations. These infrastructures improve the quality of each player's activities, and the contents and frequency of innovations, by enlarging and facilitating players' interactions.

These functions have traditionally been expected as the roles of law, and have been integrated into various policy measures. The important thing is to understand that the roles of law are not limited to these functions.

2. Autonomous adjustment by ecosystem and its limits. – As stated above, conflicts of modes are fatal for innovations. If modes of players

do not match, modes can be adjusted by autonomous mechanisms in the ecosystem to which they belong.

The simplest autonomous mechanism is named “cheap talk” in economic theory.¹⁶ Let’s take Table 1 again and assume that the external environment is [i]. If a player adopts mode [i], it is desirable that another player would also adopt mode [i]. In other words, both players want to cooperate, i.e., choose the same “mode,” if they know what the other player’s choice will be, but uncertainty about the other player’s choice will make such cooperation fail. Under such circumstances, the appropriate action for one player is to inform the other player of his choice of mode before the other player chooses his mode. Since both players wish to collaborate, they can trust that such notice is correct and the other player will take the same mode. Therefore, the desirable result, i.e., choice of mode [i] by both players in the environment [i], would occur through both parties’ voluntary actions. The problem, however, is that this situation does not often exist.

Another useful mechanism to adjust modes is an “evolutionary process.” This mechanism assumes that each player will choose his “mode,” which might bring about greater benefits. Then the player will look at his mode or the mode of other players in a close circle. These players would learn a better mode-to bring about more benefits-and try to imitate it. Repeating trials to imitate and learn other modes would lead to a situation in which the more beneficial mode would become dominant in society. This mechanism does not require players to be rational or perfect usable information. A number of trials to learn others’ modes and imitate them would lead to specific modes becoming dominant in the society.

Conditions of this mechanism, however, are not easy to fulfill. First, to learn or imitate a more beneficial mode (mode as objective), players should share the same learning mode or imitation mode (mode

¹⁶ See Joseph Farrell & Matthew Rabin, *Cheap Talk*, 10 J. ECON. PERSP. 103 (1996).

as method). To observe, understand, obtain, and apply other players' ways of thinking and behavioral patterns (mode) requires complex interactions between players on both the learning and teaching sides. If learning or imitation of others' mode is difficult, the entire to-be-evolutionary process may not evolve. Second, during the evolutionary process, the external environment should be stable. If the external environment changes, the evolutionary process will lose orientation. The external environment of innovations, however, often changes. Therefore, even if the evolutionary process evolves, it may not reach a desirable goal, i.e., to achieve expected benefits and create an ecosystem.

We cannot simply assume that an ecosystem would autonomously function to resolve conflicts of modes among players and promote innovations. When conflicts of modes occur, an ecosystem may not function and innovations will not occur. We should not fully depend on the autonomous adjustment functions of an ecosystem, and may have to use mechanisms and powers outside the ecosystem. Here, we see the potential utility of law, although preceding analysis overlooked this aspect.

C. Mode and Law

As we saw in Section A, there are three functions for which law has traditionally been performing in order to support the creation of an innovation ecosystem. However, we realized that the mode has been neglected and autonomous adjustment mechanism inherent in an ecosystem has limits. Here, we see a new role of law, i.e., adjustment of modes. This includes the following: First, law might encourage each player to change his mode before their encounter, which will prevent conflicts of modes in advance. This is unnecessary for players in the same region or industry; however, when private companies and authorities cooperate for innovations, or when small- or medium-size companies want to expand their business in foreign countries, adjustment of modes assisted by law might be necessary. In addition, when a special economic zone is created to promote innovations, modes of players should be adjusted prior to their involvement in the zone. Law can play a crucial role in facilitating such an adjustment.

Second, when players' share the same mode [j], although the mode of external environment is [i],¹⁷ such equilibrium between players does not bring about an optimal outcome; however a player will not be incentivized to change his mode [j] as long as other players retain mode [j], since maintaining mode [j] would be his best choice. To depart from such equilibrium is more difficult as the number of players gets larger, but a more appropriate mode will be adopted in order to achieve more innovations. Law can play a crucial role in facilitating the change of mode. To identify a more desirable mode might be costly for players, but if the law can identify the mode at a lower cost or more effectively, players might be encouraged to change their mode. A good example which illustrates the change of mode is the Meiji Restoration in Japan at the end of the nineteenth century. After the feudal system, begun under Tokugawa Shogunate in the seventeenth century was collapsed, the new Meiji Government sought a model of a modern State. After a thorough investigation, the Meiji Government decided to introduce the system from Prussia, and modeled the Imperial Constitution of Japan as well as important basic laws after the Prussian system.

Law can also synchronize the timing as a mode. For example, today's academic calendar in Japan begins in April and ends in March of the following year, which we could describe as the April-March mode. This was not the case, however, until the early twentieth century. In 1886, the academic year of elementary schools was changed to follow the State's fiscal year, which starts in April. The calendar of high schools was changed in 1919, and in 1921, when the academic calendar of universities was changed, all schools adopted the April-March mode. This change affected not only the life style of people, but also business customs. Thus the April-March mode became the standard calendar mode of Japan and it affected various investments.

¹⁷ This could happen if, due to the change of external environment, the optimal match between the mode shared by players and modes of the external environment is lost.

Third, previous discussions on innovation ecosystem seem to only focus on success stories. However, as there are few Silicon Valley ecosystems in the world, it is important to also analyze the many failed cases. We should look at these cases through the lens of the functions of law to adjust different modes of players and environment and facilitate the creation of ecosystems.

D. Modes Beyond a Community

Adjustment of modes in one community is relatively simple, and it is easier to understand how to solve conflicts of modes in one community. However, recent open-innovation and meta-national innovations imply interactions beyond one organization, one region, or one state. Today, it is necessary to solve conflicts of modes in a “beyond-one-community-context.” Law can serve this purpose.

In an ecosystem, innovations can be achieved when the majority of the ecosystem’s members share the same mode. Within an ecosystem the unification of modes can be promoted. However, in order to develop innovations beyond an organization or a State, we will inevitably face various modes of diverse stakeholders and environments. Multiple ecosystems with different modes will co-exist. A key question for us is how to cultivate mutually beneficial interactions among these ecosystems. It is incorrect to assume that there is one universal mode to which all ecosystems should be oriented.

Diversity of mode occurs because, first, an ecosystem tends to internalize modes which are adaptable to regional circumstances, and support by local policies accelerates this tendency.¹⁸ Second, if there can be several modes with equal desirability for innovations, the choice of mode to be shared in an ecosystem can be determined by coincidence. Therefore, two ecosystems facing the same external environment may choose different “modes,” and there would be plural equilibria. Third, sharing a mode is either path-dependent or history-

¹⁸ This idea was proposed by Charles M. Tiebout. Charles M. Tiebout, *A Pure Theory of Local Expenditures*, 64 J. POL. ECON. 416 (1956).

dependent. When a mode has been shared in an ecosystem at a point in the past, investments would have been made presuming this mode would remain shared in the ecosystem. Through these investments, this mode would fit to innovation better. For example, if this mode is shared in a community in which individual investors (“angels”)¹⁹ provide money to venture companies, various services to improve this mode would be developed, such as services to match angels and ventures; services to provide information to angels; services to support contracts between angels and ventures; and services to solve problems between angels and ventures. When these services are well-established, this mode is further strengthened.

Hence, it should be assumed that the mode shared in one ecosystem is usually different from modes of other ecosystems. However, as we saw above, how to cope with conflicts of modes is the key for innovations. Law can play a crucial role in this context. *Ex ante* adjustment and *ex post* adjustment are two possible designs of law to cope with conflicts of modes.

E. Legal System for *Ex Ante* Adjustment

Ex ante adjustment is inspired by the concept of uniform law; it establishes in advance a widely applicable mode and urges various players to adopt it. This approach can be further analyzed in detail: each community can retain its mode for internal interactions of players, but accept a widely applicable mode (mode [U]) for beyond-one-community-interactions among players (Table 2). Or, each community can force all players to adopt a universally applicable mode (mode [U]) (Table 3).²⁰

¹⁹ Individual investors who provide start-ups with capital for their business are called as ‘angels’. This term originally stems from those wealthy individuals who financially supported theatrical productions in Broadway which would have otherwise been shut down.

²⁰ In Japan, there is a good example of this model, i.e. JIS (Japanese Industrial Standards) based on Kōgyōhyōjunkahō [Industrial Standardization Law], Act No. 185 of 1949 (Japan). This law was enacted in 1949 with aims at unification

Table 2, Uniform-Law Approach I.

1 \ 2	mode i	mode j	mode U
mode i	30, 30	-10, -10	-10, -10
mode j	-10, -10	5, 5	-10, -10
mode U	-10, -10	-10, -10	12, 12

Table 3, Uniform-Law Approach II.

1 \ 2	mode i/U	mode j/U	mode U
mode i/U	?, ?	?, ?	-10, -10
mode j/U	?, ?	?, ?	-10, -10
mode U	-10, -10	-10, -10	12, 12

In Tables 2 and 3, we assume that benefits brought about by the shared mode [U] [12] are smaller than the biggest benefits in Table 1 [30]. If benefits to be achieved by the mode [U] are bigger than [30], each community will voluntarily introduce this mode into their ecosystem, and it would be unnecessary to unify modes. However, if

of industrial products and related technologies, designs, manufactures and managements in Japan. This law established unified modes on industries in Japan and facilitated transactions beyond individual organizations or regions and let to the improvement of the quality of industrial products. If this model is valid in international context or not, is our concern.

the mode [U] would bring about less than [5], the introduction of the mode [U] would be meaningless.

Table 3 illustrates that the modes applicable to intra-community and inter-community interactions mode are clearly separable. In reality, however, such clear separation is questionable, since an ecosystem usually consists of complex interrelationships of various players that include intra-community and inter-community interactions.

Unlike Table 2, Table 3 assumes that even if a policymaker forces an ecosystem to abandon its modes [i] or [j] and to apply the new mode [U], which does not necessarily match with their external environment. It is questionable whether a well-functioning ecosystem can easily abandon its original modes. Hence, applying a mode [U] that is applicable beyond a community would be difficult to implement.

In addition, although in these Tables we assume that both players would equally obtain benefits [12] by applying a mode U, in reality, each player's benefits are asymmetrical. Designing a mode and applying it would become a game among various players. Even if there is a mode [U] which could produce greater benefits as a whole, some players whose benefits would decrease by the mode [U] would oppose the mode. Such a power game would result in significant costs to societies, which could otherwise have been spent pursuing innovations.

F. Legal System for *Ex Post* Adjustment

We support the *ex post* adjustment system as the more functional approach. This system would modify modes and external environment only after conflicts of modes are recognized and the external environment of concerned interactions is investigated (Table 5). Whether players' modes would be modified or there would be an intervention into the external environment would be decided *ex post*. Modification of the external environment could also be made by law.

Different from the *ex-ante* adjustment system, the *ex post* adjustment system does not aim at the ideal solution. Of particular

importance is that this system is functional and there are less hurdles to overcome when introducing it. First, the *ex post* adjustment system would intervene only in the case of conflicts of modes. If the interaction of players is well-functioning, no costs would occur. Second, costs to consider all possible scenarios in advance, to negotiate with concerned players or communities, to develop a unified desirable mode and to disseminate it to related players or communities, would not occur. Finally, the *ex post* adjustment system does not affect already shared modes in a relevant ecosystem.

Table 4: Ex-post Adjustment approach.

1 \ 2	mode i	mode j
mode i	30, 30	-10, -10
mode j	-10, -10	5, 5

→

1 \ 2	mode i	mode j
mode i	30, 30	i: 10, 2 j: 2, 10
mode j	i: 2, 10 j: 10, 2	5, 5

CONCLUSION

To promote innovation, autonomous ecosystems in which various players are organically linked are crucial. Such ecosystems presume that specific mechanisms are shared among its closed membership. Introducing more open and universal mechanisms would hamper the original function of the ecosystem due to the conflicts of modes. Law would play a crucial role to adjust conflicts of modes between players and the environment, or among players. Under such conditions, we propose an *ex post* adjustment system by law. Such a system would enable both the maintenance of the diversity of the innovation ecosystem and, at the same time, the adjustment of interactions beyond one ecosystem.