

An Exploration on On-line Mass Collaboration: focusing on its motivation structure

Jae Kyung Ha, and Yong-Hak Kim

Abstract—The Internet has become an indispensable part of our lives. Witnessing recent web-based mass collaboration, e.g. Wikipedia, people are questioning whether the Internet has made fundamental changes to the society or whether it is merely a hyperbolic fad. It has long been assumed that collective action for a certain goal yields the problem of free-riding, due to its non-exclusive and non-rival characteristics. Then, thanks to recent technological advances, the on-line space experienced the following changes that enabled it to produce public goods: 1) decrease in the cost of production or coordination 2) externality from networked structure 3) production function which integrates both self-interest and altruism. However, this research doubts the homogeneity of on-line mass collaboration and argues that a more sophisticated and systematical approach is required. The alternative that we suggest is to connect the characteristics of the goal to the motivation. Despite various approaches, previous literature fails to recognize that motivation can be structurally restricted by the characteristic of the goal. First we draw a typology of on-line mass collaboration with ‘the extent of expected beneficiary’ and ‘the existence of externality’, and then we examine each combination of motivation using Benkler’s framework. Finally, we explore and connect such typology with its possible dominant participating motivation

Keywords—On-line Cooperation, Typology, Mass Collaboration, Motivation, Wikinomics.

I. INTRODUCTION

ONE of the most important criteria for dividing an era is a change in mode of production. Though it has been quite long since we started calling contemporary society “information society”, where knowledge and information becomes commodities, scholars have not reached a conclusion as to when it all started, or even whether it started or not. However, one undeniable thing is that technology is developing in an unprecedented speed and has become an indispensable part of our lives. Undoubtedly, E-mail is now the official communication channel in many places, and the Internet is even becoming ubiquitous. Admitting that technology cannot be separated from values, what are the changes that this technological development brought?

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What we are witnessing these days is the “crowd.” The crowd began to lead the development and innovation. Before one realized, mass crowd of people voice their opinion on BBS, share everyday lives through blogs, and take part in production beyond their traditional role as consumers. The keyword of such trend is “participation.” Then, why do people participate? How could the knowledge on Wikipedia accumulate so fast and effectively and why do people participate in the Gutenberg project? It might be fun or lucrative, but it is not the whole story. Paying attention to this phenomenon, some wonder whether it might become a new mode of production and carefully look into the mechanism that leads to participation. The recently published book, “*Wikinomics*” (Tapscott and Williams [20]), implies that the whole economy might be organized in the way shown in Wikipedia, i.e. mass collaboration. The term ‘Wikinomics’ was coined by combining the words Wikipedia and Economics. This means, the way people move and act is generated from an unprecedented structure in human history. To go back to the past, the critical difference that distinguishes the 19th century reasoning from the 18th century reasoning is the newly discovered power of community. Along with the advent of the market, rent-seeking behavior is separated from previous social relations. If industrial society is something that accompanies the changes from stable, moral local communities to atomic, individual relationship, new attention on structure of recent surge on on-line mass collaboration is asking if forth coming information society could change the social relationship of previous days.

However, what we would like to make clear at this point is whether we are doing adequate categorizing and classifying of ideas in such discussion. Can simple expression of “mass collaboration” properly carry the whole meaning? If any chance, are we making a huge mistake of ignoring diverse aspects behind the phenomena by combining things, which shouldn’t have combined?

Starting from definition of “cooperation” provides an agreed starting point for the whole discussion. After examining classical issues on cooperation, I further explore theoretical changes of web-base, on-line environment. The final goal of this research is to systematically categorize mass collaboration in relation with the motivation of participation. If mass collaboration can be drawn into typology, we can assume such it would move in accordance with the motivating mechanism. Therefore, major contribution of this research is theoretical exploration on typology of on-line mass collaboration and

discussion on its relationship with the motivating structure.

II. WHAT IF COOPERATION?

There has not been much academic interest on "cooperation." In Sociological theory, cooperation has been indirectly defined through other ideas. Simmel defines competition as "parallel effort" for common object (Simmel [19]). If conflict refers to dyadic and direct hostility between two agents, competition is an indirect relationship mediated by the goal. There lies a similarity between the agents, in that they aim for the same goal. Therefore, cooperation would refer to the dissolution of conflict within such similarity.

In explaining such dissolution, there have long been two opposite traditions, namely *Utilitarianism* and *Functionalism*. In Leviathan, Hobbes claimed that people cannot voluntarily dissolve conflicts (Hobbes [10]). Human competition toward limited resources cannot be solved naturally without external power. Such Hobbesian tradition has been further developed by Economic theory. On the other hand, Locke argued such conflict can be dissolved through social contract. Along with such Sociological tradition, Durkeim viewed that 'non-contractual elements of contract', i.e. morality and agreements among individuals, can solve the problem of unequal aspects of social division of labor (Durkeim [4]). He argues that cooperation per se is moral. In his perspective, it is natural that cooperation grows in the process of organic division of labor.

In Sociological tradition or in Economic tradition, the definition of cooperation shares some common characteristic. It is clear that cooperation is based on the summation of individuals' voluntary actions and its result is beyond a single individual's effort. When discuss about cooperation, it starts from common goal, which is shared by all participants. Thus, it puts more emphasis on the result, rather than the process. In addition to the fact that Utilitarian approach is more result-oriented, in reality, cooperation is not a natural phenomenon, but an event that need to be explained. Therefore, we believe utilitarian approach is more useful and powerful tool in explaining cooperation that we witness nowadays. Rather than entirely ignoring the process that leads to the cooperation, this research intends to show a diverse spectrum of cooperation based on individual's rationality, in relation of action and the result.

Generally, cooperation, which shows public good-like characteristic, has been thought to produce the problem of free-riding. Since each individual's contribution to the whole is trivial but the benefit is not exclusive to everybody, a rational person would not pay the cost while enjoying the benefit of participants' efforts. In aggregate, as Harding puts it, this results in "the tragedy of the commons"(Hardin [7]).

Answers to solve this dilemma have long been proposed by diverse aspects: Olson argues selective interest to participation or coercive tool or punishment is strongly required to put rational, self-interest oriented individuals (Olson [15]). But he failed to answer why people do participate in situations without

selective interest (Lim [14]). Such debate can be either supported or contradicted by empirical cases: Ostrom shows us examples of self governed and well organized Common-pool Resources (CPR hereafter) without external fiat (Leviathan) or privatization. By examining forest or meadows in Japan, Switzerland, Spain etc., she suggests several rules that supports self-governing (Ostrom [16]; Rheingold [18]). However, those rules, such as limiting the boundary of the group, sustaining homogeneity within group and relying on reputation and punishments, still remains in Utilitarian boundary. Both Olson and Ostrom's solutions are no more than the internalization of fiat and order, based on Hobbesian assumption of conflict nature of human behavior. Also, Axelod adopted computer simulation to show how reputation can be included in rational choice in repeated game (Axelod [1]). More radically, the idea that cooperation or altruism is simply the result of natural selection has been raised from the field of social biology (Hamilton [6]; Dawkins [3]).

III. COOPERATION AND NETWORKED ENVIRONMENT

While there always been oppression throughout history, why are revolutions so rare? Utilitarian theories, based on methodological individualism, regard cooperation as an 'exceptional event.' It that tradition, cooperation has always been something to be explained and as a result, various theories have developed to explain actual cases of cooperation in the history. However, these days on the web, cooperation has become ubiquitous: articles asking for a help get instant replies and answers and large number of people gets involved in online movements for a social value. Not only frequency has surged but also spatial and time range of participation has been incomparably extended. If someone tries to explain contemporary on- line cooperation with previous cooperation and collective action theory, he or she will face two major questions: 1) what environmental changes have made online cooperation easy? 2) Why do people participate? To answer to these questions, it is of high importance to know the possibilities enabled by recent technological development. In chapter 3, we will review such changes, and then we will argue how an on-line, web-based environment relates to the problem of public good in chapter 4.

What we produce on-line are non-tangible knowledge/information goods. Just as public goods are, it is non-rival, non-exclusive and non-transparent¹. Kollock analyzes that because the costs and benefits of providing some types of public goods change radically in on-line environments, so too do the dynamics of motivation and coordination (Kollock [11]). He further divided such changes into three: production cost, benefits and production function, and here we extend each dimension. First, technological advance provided us with ample possibility of reduction in marginal production cost and coordination cost. Second, digital public good offers

¹ Goods are non-transparent if and only if its value is understood when it is experienced. Movies or books are good example. We can say marginal cost of production for these good is extremely low.

non-exclusive benefit in increasing return to scale. As Lawrence Lessnig puts it, network does not discriminate people but makes it easier to connect to innovative ideas. Relationship happens not in the aggregate of person-to-person dyadic relations, but in the whole network where everybody can be connected to everybody². Metcalfe's law well articulates this phenomenon: the potential value of network is proportional to the square of the number of nodes. Also, this characteristic has brought the implication of "social" network. Barry Wellman argues computer networks are inherently "social networks" (Wellman [21]). The advance of computer networks provided fertile possibility for individuals to develop a social network, friendship, support, identity, and belongingness formed a community spirit on-line (Wellman and Guilia [22]; Rheingold [18]). Such social meaning enabled moral obligation and social sanction in such on-line network communities. Finally, production function itself also has been transformed. Before the advent of on-line environment, provision of public good by a 'privileged group', in Olson's terminology (Olson [15]), in a large-size organization has been extremely rare. However, under web-based technological environment, a normative, social value that cannot be explained in Economic utility has become a part of production function, showing "a marriage of altruism and self-interest (Hemetsberger [8]).

TABLE I
CHARACTERISTICS OF ON-LINE COOPERATION AND ITS EFFECT

dimension	characteristic	results and meaning
Cost	Public good-like Characteristic of the product	Decrease in marginal cost Decrease in coordination cost
Benefit	Networked structure	Utility in Increasing Return to Scale Community Spirit
Production Function	Altruistic norm in use	Changes in motivation "marriage of altruism and self-interest"

"Partly, this tradition goes back to the institutional tradition in the history of the Internet. Linus Torvalds, the developer of open source OS Linux, describes "Hacker Ethic" as having stages of survival, social life and entertainment. This implies self-efficacy, intrinsic interest and normative motive that cannot be explained with the cost-benefit approach (Himanen, Torvalds et al. [9]). Therefore, production of public good in on-line environment requires extensive approach that includes both utilitarian and normative perspective.

² It should be acknowledged that this possibility of relationship ($n*(n-1)/2$) in network is theoretical. In reality, actual relationship would be much less than that.

IV. LITERATURES ON MOTIVATION STRUCTURE OF ON-LINE MASS COLLABORATION

What we have showed so far can be summarized as characteristics of cooperation on-line. We next question, then, how does it actually happen? Recently, several literatures have been focused on this mechanism. Recognizing that production of public good on-line is related to both self-interest and altruism, these researches tried to embrace both dimension. Yet, there is no established, agreed framework so far. Kollock argued that anticipated reciprocity, reputation and efficacy comprises the motivation for on-line cooperation (Kollock [11]). Anticipated reciprocity means that people who help other people expect to receive useful information and help in return at some point in the future. Such 'generalized exchange' produce trust within group. Reputation is more of an immediate factor. Individuals would acquire prestige and it becomes a major motivation for contribution to the public, according to Rheingold. While "anticipated reciprocity" refers to exchange of contribution for contribution in the long run, "reputation" is tacit exchange of contribution for prestige (Rheingold [17]). Ghosh also emphasized reputation as utmost motivation in on-line collaboration, describing it as an implicit barter economy with asymmetric transaction (Ghosh [5]). Third possible motivation is that a person contributes valuable information because the act results in a "sense of efficacy", a sense that one has some effect on this environment (Kollock [11]). In this aspect, the more change one can expect and the bigger the size of the group, thereby increasing the individual's potential effect, the stronger one will be motivated.

Benkler explains motivation for on-line cooperation (collaboration) in the framework of monetary rewards, intrinsic hedonic rewards and social psychological rewards (Benkler [2]). By separating monetary incentive, distinction of market-oriented cooperation from pure voluntary cooperation has become possible, and by separating intrinsic aspect from social aspect, intention and social implication of cooperation has become clear. Similarly, Lakhani and Hippel suggest three reasons why people get to join in provision of "necessary but mundane" work. It becomes rational behavior if the information has low competitive value and/or if information providers think that other users know the same thing they do, and would reveal the information if they did not (Lakhani and Hippel [12]).

On the other hand, Lerner and Tirole distinguish such motivation into immediate payoff and delayed payoff. Immediate payoff is calculate by spontaneous use-value and opportunity cost for time, whereas delayed payoff is calculated by reputation and job offer one might acquire from on-line activity (Lerner and Tirole [13]). Delayed payoff works as a signal, thus, environment in which signals can function properly would provide fertile soil for cooperation. This framework contributes to show implicit and explicit aspects of motivation and possibility of discount for future rewards. No matter how devoted to economic utilitarian perspectives, it does not include social and normative aspects. As a result, it fails to provide systematic explanation to complex and diverse

structure of real phenomena.

As we have summarized so far, motivation structure for on-line cooperation has been probed from various perspectives. It can be divided into intrinsic motive vs. extrinsic motive, immediate payoff vs. delay payoff, or individual utility vs. normative, social obligation, and so on. All these dividing provide useful explanation in understanding complex phenomena. However, it is not a good strategy to adopt all these criteria, which would possibly end up explaining nothing by explaining everything. Therefore, what is more important is to adopt a well-defined criterion that best suits the researcher's viewpoint. Further from this discussion, we would like to draw a systematic structure of motivation in accordance with the characteristic of the goal (or result) of that cooperation. This approach starts from acknowledging that each on-line space for certain goals has limits and constraints by itself, making a critical condition for participants' motivation. It provides an important cause why on-line cooperation (collaboration) should be discussed both from the goal and the participants.

V. ALTERNATIVE APPROACH TO ON-LINE MASS COLLABORATION: CONSIDERING BOTH THE RESULT AND THE ACTOR

In on-line cooperation, the motive of the actor and the result are inseparable. Therefore, making sense of a certain motivating mechanism is one thing, and actually observing such possibility is another. Therefore, it is necessary to explore both sides of cooperation to reach an appropriate and practical understanding. Among the literature we've mentioned previously, we would like to adopt Benkler's three dimension approach. He divides it up into monetary rewards (M), intrinsic hedonic rewards (I) and social psychological rewards (SP). As we've pointed out already, social-psychological rewards do not separate efficacy in individual level and reputation, and moral obligation in social level. Nevertheless, it is most useful for this discussion, since it enables us to extract altruistic motives beyond monetary incentives and to judge the intention of the action and its social meaning.

Of course, it should be fully acknowledged that every individual who takes part in cooperation does not have the same motive and homogeneous production function. In developing Linux, there might be someone who finds excitement by just doing it, whereas other people might be motivated by the reputation he/she gets. Nevertheless, what we argue here is that some of the motivations are structurally constrained from the beginning. For example, in Wikipedia, where the author is not recognizable and the boundary of the group is totally vague, it would be hard to say people are participating for reputation. In short, people participating in mass collaboration might have different motivations, but the structural difference of the space would limit possibility or degree of those motivations. That is to say, each participant's motivation is a problem of not only the individual but also characteristic of the field it happens in.

To make a typology of cooperation by its result, we adopted two criteria: externality of action and the extent of expected

beneficiary. Even though I have divided these standards in two discrete degrees (Exist/Almost none, specific/general), this is only an ideally typical distinction for theoretical discussion. The reality would lie at some continuous point between such two extremes.

The extent of expected beneficiary refers to how specific the group of people who benefit from one's contribution is. This is to distinguish when one cannot expect whom the readers will be, just as in Wikipedia, and when one writes for some specific group, or even a particular individual. It can also be as a boundary of the group. The thinner the boundary, the harder it is to ascertain anticipated reciprocity and therefore, the power of reputation and social sanction will be weaker. Externality of action can be judged whether the summation of cooperation results to more than simple aggregation of individual action or not. For example, to an individual, the usefulness of a specific article in Wikipedia is trivial but it becomes important when aggregated, as 'a place one can look up information whenever needed.' However, none of the cooperation can be perfectly reduced to the individual level. Even if it is extremely specific and dyadic knowledge, as 'a space for certain kinds of behavior' it still shows external meaning. Therefore, here we limit the externality only to the way the action is organized.

TABLE II
TYPOLOGY OF COOPERATION BY CHARACTERISTICS OF THE RESULT

		Extent of Expected Beneficiary	
		Specific	General
Externality of Action	Exist	Parochial Cooperation (Linux)	Active Cooperation (Wikipedia)
	Almost none	Market Alternative Cooperation (Innocentive.com)	Unintended Cooperation (Amazon)

Table II summarized four types of cooperation. When the result of cooperation is boosted by externality towards unspecified individuals, we call it "Active Cooperation" (e.g. Wikipedia). If the result becomes more specific, it is named "Parochial Cooperation", just as the case of Linux OS developers. In this case, the boundary of the group is relatively clear so that community spirit and reputation has a strong presence. On the other hand, when there hardly exists an external effect of action, on-line cooperation becomes a selectable alternative, not an indispensable condition. Therefore, if the beneficiary is general, it might refer to market space, when many-to-many transaction happens (e.g. Amazon) and achieves "Unintended Cooperation" and if it is specific, "innocentive.com³" would be an example of "Market Alternative Cooperation."

Next step is to categorize cooperation by the motivation of the participants. As previously noted, we adopt Benkler's

³ Innocentive.com is a web site that organizations/individuals register scientific problems they are experiencing. Anybody who suggests practical solution to the problem would get the monetary rewards from the seekers (www.innocentive.com, last retrieved on June 14, 2008)

framework of monetary rewards (M), intrinsic, hedonic rewards (H) and social psychological rewards (SP). Unlike the three prerequisites, these aspects are shown in combinations. In this study, each category is dichotomized and then I explore eight possible combinations.

Since the sum of these motivations should be positive, Type. 8 cannot produce cooperation. Monetary reward defines egoistic cooperation vs. altruistic cooperation, whereas Intrinsic/Hedonic reward distinguishes hard-core cooperation and soft-core cooperation. On the other hand, Social Psychological reward makes an indispensable condition. This includes a wide range of motivation from self-efficacy, reputation to moral obligation and responsibility at societal level. If someone has none of these motivations, it is hard to say common goal and collective action are of any meaning to that individual. Therefore cooperation without Social psychological motivation is simply a by-product of action, something like an unintended consequence or extension of the market. Now there are four possible structure of motivation left: Type.1, 3, 4 and 7.

TABLE III
TYPOLOGY OF COOPERATION BY STRUCTURE OF PARTICIPATING MOTIVES

	Monetary reward	Hedonic reward	Social -psycho. Reward
Type.1	O	O	O
Type.2	O	O	X
Type.3	O	X	O
Type.4	X	O	O
Type.5	O	X	X
Type.6	X	O	X
Type.7	X	X	O
Type.8	X	X	X

The last thing is to apply these motivations to each type, which is drawn from the characteristics of the goal (result). In Parochial cooperation, the most distinctive aspect is recognition of the group boundary. This is crucial to build reciprocal relationship or community spirit. So we expect Type. 3 would be dominant in this type of cooperation. In the case of Active Cooperation, it has intrinsic hedonic utility and is based on wider extent of community. Therefore type 4 will be a major motivation. In Market Alternative cooperation or in Unintended Cooperation where externality of action is close to none, each individual cannot expect the effect of others' behavior in increasing return to scale, meaning individuals are not connected in networked relationship but atomic, dyadic relationship. In such cases where community spirit and social motivations barely exist, monetary reward is required to make cooperation happen. Market-Alternative Cooperation has some intrinsic hedonic aspects in the sense that it utilizes one-to-one relationship searched on-line. On the other hand, Unintended Cooperation does not gain such characteristics, simply by transferring off-line market to on-line space. Therefore, we assume, for these two kinds of cooperation, type 2 and type 5 of motivation will be dominant for each of them.

TABLE IV
TYPOLOGY OF COOPERATION BY DOMINANT PARTICIPATING MOTIVES

Type	Example	Dominant Motive
Parochial Cooperation	Linux OS	Type 3
Active Cooperation	Wikipedia	Type 4
Market-alternative Cooperation	Innocentive.com	Type 2
Unintended Cooperation	Amazon.com	Type 5

VI. CONCLUSION

Cooperation refers to the achievement of common goals, which cannot be produced by a single person, by collective action. In this research, we argue 'cooperation' should be defined from the shared goal of the participants, which retains the characteristic of public good. Since the effect of individual contribution to the whole is trivial, rent-seeking rational individual would 'free-ride', enjoying the production of other participants without his/her own effort. As a result, 'common pasture' will undergo a 'tragedy of commons'. Thus, it has been a popular subject of academic debate to solve the problem of public good. Olson argued that introducing selective interest and coercive instrument could solve it, and Ostrom showed empirical examples of those who successfully organized their public good by enhancing their boundary and internalizing the rule of regulation and punishment. Also, by computer simulation, Axelrod proved that reputation would generate cooperation in iterated situation.

Production in on-line space, which development of technology made possible, once again raised the problem of public good. In the mean time, however, it also suggests to us that it requires overall revision of previous discussion. The changes web-based environment has brought are roughly three-fold: by reducing production cost and coordination cost, it generated "knowledge good (information good)" which has public-good characteristic. And network structure enabled its benefit to be spread over in IRS (Increasing Return to Scale), along with normative characteristic. As a consequence, it has brought a new production function, which integrates individual selfishness and altruism. At this point, here we attempted a theoretical exploration on the structure of individual incentive on web-based mass collaboration and how it can be realized. Previous researches have been tried to analyze individuals' incentive in several aspects: intrinsic motive and extrinsic motive, immediate payoff and delayed payoff, or personal utility and social obligation, and further as individual or group level utility, monetary or non-monetary utility. However, limits of such theoretical distinction lies in that it only exists as itself without systematic interaction with the characteristics of the result of the cooperation so that it fails to show motive of participation might be applied differently according to diverse forms of cooperation.

This research, therefore, 1) developed a typology of "on-line cooperation", according to its goal or result, 2) explored each

individual's incentive in three dimensions and its realizable combination, 3) and observed what the dominant individuals' incentive for each type of cooperation are. Cooperation has been categorized into parochial cooperation, active cooperation, market-alternative cooperation and unintended cooperation, by on the one hand how specific expected beneficiaries are and whether it has external effect, on the other hand. To further analyze individuals' incentive, we adopted Benkler's three dimensional framework—monetary rewards, intrinsic/hedonic rewards, and social-psychological rewards—and explored its meaning and validity. Monetary rewards have been interpreted as a measure of altruistic/egoistic behavior, while Intrinsic/Hedonic rewards is used for dividing hard-core cooperation and soft-core cooperation. Psychological rewards, which I argue most substantial, are the indispensable point to make a web-based collaboration.

The last part of this research then questions how the typology of on-line cooperation and individual participation can be connected. By doing this, we tried to show the structural context of each action and motivation, which was hidden behind such indiscriminate reference. However, this is still a theoretical exploration, which connects one abstract 'ideal type' to another. Moreover, it has been fully acknowledged that individual motives are uneven. Therefore, to test the compatibility of our argument, empirical study on adequacy of such typology, and topology of individuals' motive should be followed.

REFERENCES

- [1] Axelod, R. (1985). *The Evolution of Cooperation*. New York, Basic Books.
- [2] Benkler, Y. (2002). "Coase's Penguin or Linus and the Nature of the Firm." *Yale Law Journal* 112.
- [3] Dawkins, R. 1989[1976]. *The Selfish Gene*. Oxford University Press.
- [4] Durkeim, E. (1984). *The Division of Labor in Society*. New York: Free Press
- [5] Ghosh, R. A. (1998). *Cooking Pot Markets: an Economic Model for the Trade in Free Goods and Services on the Internet*. *First Mondays*. 3.
- [6] Hamilton, W. (1963). "The Evolution of Altruistic Behavior." *The American Naturalist* 98: 354-356
- [7] Hardin, G. (1968). "The Tragedy of the Commons." *Science* 162: 1243-1248.
- [8] Hemetsberger, A. (2002). "Fostering Cooperation on the Internet: Social Exchange Process in Innovative Virtual Consumer Communities." *Advances in Consumer Research* 29: 354-356.
- [9] Himanen, P., L. Torvalds, et al. (2001). *Hacker Ethic, and the Spirit of the Information Age*. London, Secker and Warburg.
- [10] Hobbes, T. (1958). *Leviathan*, The Liberal Art Press.
- [11] Kollock, P. (1999). *The Economies of On-line Cooperation: Gifts and Public Goods in Cyberspace*. *Communities in Cyberspace*. M. A. Smith and P. Kollock. London, Routledge.
- [12] Lakhani, K. and E. v. Hippel (2000). "How Open Source Software Works: "Free" user-to-user Assistance." MIT Sloan School of Management Working Paper 4117.
- [13] Lerner, J. and J. Tirole (2002). "Some Simple Economics of Open Source." *The Journal of Industrial Economics* L(2): 197-234.
- [14] Lim, H. (1999). *Theory on collective action and social movement*. Seoul, Korea University Press.
- [15] Olson, M. (1965). *The Logic of Collective Action*. Cambridge, Harvard University Press.
- [16] Ostrom, E. (1990). *Governing the Commons: the Evolutions of Institutions for Collective Action*. Cambridge and New York, Political Economy of Institutions and Decisions.
- [17] Rheingold, H. (2000). *The Virtual Community: Homesteading on the Electronic Frontier*. Cambridge, MA, the MIT Press.
- [18] Rheingold, H. (2003). *Smart Mobs: the next social revolution*. Cambridge, MA, Basic Books.
- [19] Simmel, G. (1955). *Competition. Conflict and the Web of Group-Affiliations*. New York, Free Press.
- [20] Tapscott, D. and A. D. Williams (2006). *Wikinomics: how mass collaboration changes everything*.
- [21] Wellman, B. (2001). "Computer Networks as Social networks " *Science* 293: 2031-2033.
- [22] Wellman, B. and M. Guilia (1997). *Net Surfers Don't Ride Alone: Virtual Communities as Communities*. *Communities and Cyberspace*. M. Smith and P. Kollock. New York, Routledge.