

# What can we do with the Research Institute for Social Complexity Sciences in Indonesia?

Bandung Fe Institute Perspective

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*Is there any method to predict the stock market index for tomorrow? Why do we have so many languages around the world? How can we arrange our investment portfolio in order to avoid bigger risk? What can we do to win an election or voting? Why is it very difficult to make a fair distribution of wealth in order to fairly make a welfare and prosperous society? How can we stop the epidemic of the spreading bird flu? Why are social norms so robust? Why is there always new mode of fashion that makes me exhausted to follow? How can I even think of those? Those and a lot more questions can arise in any of us regarding who and what we are while the more challenging is how to design a research institution cope with those issues.*

## 1. Initial Points

It is inevitable that intellectuals are those the latest hope for the betterment of society – especially in Indonesia whose a lot of historical moments were signed by the roles and social activities of intellectuals. It is not an exaggeration to say that in the dictatorship era of Suharto, a lot of people were relying on student movements for the democratic aspiration through intra-parliamentary channels was plugged. Nonetheless, in the era of reform, a lot of hardships are being still there and grievances are being still heard, a big challenge must be faced by the intellectuals. While the conventional theoretical rules of thumb are used to rebuild the nation, some things do not work, and the moment has come to question the theoretical references.

As understood by some of contemporary social theorist<sup>1</sup>, there are a lot of traps in establishing social theory that came from not tight predefinitions and preferences among different theorists. Social theorist are often trapped in *crossword puzzle trap* as social analyst occasionally manipulate the nature of social problems in order to fit any general ‘paradigm’ depicted in the social theory they are holding to. Moreover, there is also the *brain teaser trap*, while the social analyst is frequently teased into secondary problems instead of main core of research for the lack of tight pre-description of problems. While the “logic” of social nature are often different with those use in literary speaking of social theories, analyst frequently fails to capture the social dynamics she is adhering – the so called *logic trap*. Eventually, it is not a secret that conventional social theorists are often jailed in the *description trap*, while sometimes we cannot distinguish the comprehensive explanation with the merely descriptive tautological propositions.

It is a fortune that we are now living in the world understands, recognizes, and realizes about such things. The era we are living now lay upon the moment that the cutting edge scientific endeavors are running through the interdisciplinary works. The well-known phrases like econophysics, sociophysics, evolutionary economics, computational sociology, social dynamics, and so on are now decorating the celebration of a lot of scientific state of the art. Those give a lot different colors in the way social analysts think nowadays and as the new kinds of science work on giving some corrections, verification, and probably falsifications to their predecessors, we change our perspective in our main goal to build a society a new:

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democratic, just, and revived from social crises. This mission has brought the Bandung Fe Institute to Indonesia and the world for the whole previous four years in the umbrella of social complexity sciences.

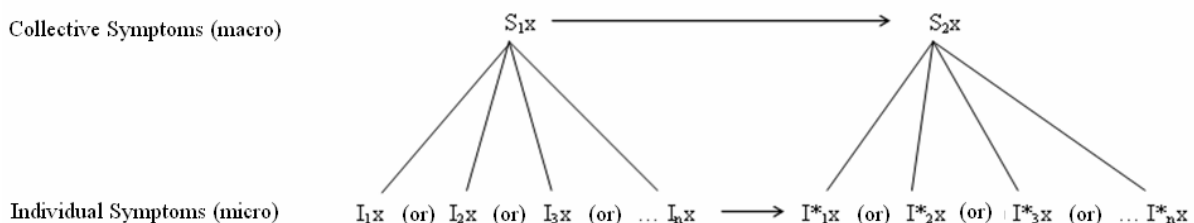
Furthermore, those questions presented early describe that we live in a great complexity of life and bring good opportunities to the institute. Natural as well as social science to day still questions on a lot of things, while problems to be solved are more and more everyday. In fact, the quests for solving problems and analyze the complexity of all phenomena have invigorated the birth of scientific methodology since the beginning, or probably science itself.

## 2. Invigorating Insights

Social system is so complex whatsoever. A complex system is a system which is difficult, if not impossible to restrict its description to a limited number of parameters or characterizing variables without losing its essential global functional properties<sup>2</sup>. It coalesces from many components or sub-units interacting each other interestingly but not too obvious when only the outcome of the interactions observed<sup>3</sup>. Even challenging, the elements of the social system are human being, while an individual is also (and can be more) complex.

Traditional scientific methods have brought us many faculties of scientific discipline. In fact, this is a characteristic of modern civilization separating not only many aspects of life but also practically one individual to another: specialization<sup>4</sup>. But still the problem will be still further from its final post to be solved and overcome. Our question now is what and how our today academic institutional stances regarding to this?

The Cartesian style of analytical reductionism<sup>5</sup> is however cannot cope with the complex nature of social system. In other words, it will be hard to solve the complex system by involving only one discipline. When we talk about unemployment, we cannot avoid talking about crime rate, the skill and mental values of our workforce, *et cetera* instead of just eyeing at numbers of aggregate economic data and variables<sup>6</sup>. When we discuss about a case of epidemics, we should concern about the social network, the aspects of habit and culture, economic hardship, migration, and so on<sup>7</sup>. We should let the gate among disciplines wide-opened hence political problem cannot be separated with cultural, economic, psychological and anthropological aspect of the social entity. This is what we call interdisciplinary and here is where the cutting-edge scientific stage now herds. Broader transgressing boundaries of conventional approach even should let the social analysis take advantage from mathematical and natural sciences. There are so many models and analytical tools in natural science that can give very good insights. Some interdisciplinary fields, e.g.: econophysics<sup>8</sup>, sociophysics<sup>9</sup>, evolutionary economics<sup>10</sup>, and more have presented outstanding contribution to understand a lot of perplexing things previously among social scientists<sup>11</sup>.



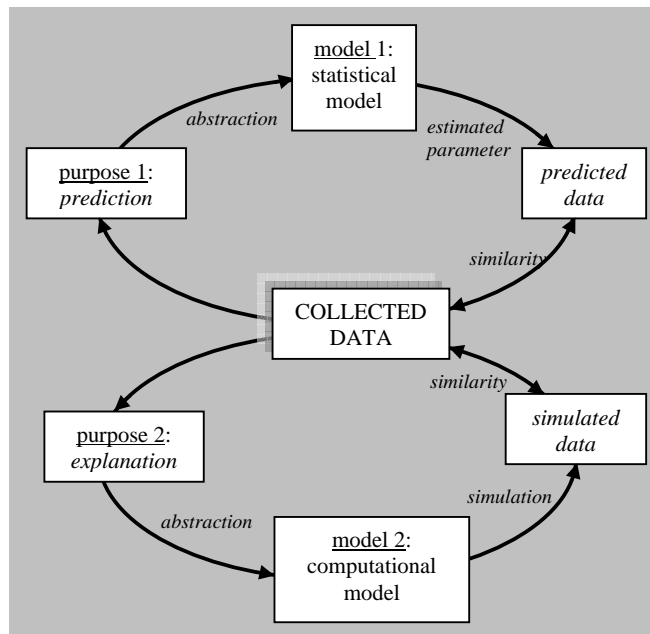
**Figure 1**  
Collective symptoms (macro-properties) emerge from various individual symptoms (micro-properties) in non-linear causality.

However, the problem of social sciences to day is not only that they are separated that far one another and the distances emerged between social sciences and mathematical and natural sciences in general. There have been some approaches showing that social sciences cannot be separated with particular ideology since they are (frequently) lack of formalism and in advance different with natural sciences respect to experiments and laboratory where good

and well-recognized theories built and laid upon<sup>12</sup>. It is not strange for us hearing about certain streams of sociological, psychological, and economic theories. Most theories came from different assumptions that strangely become an ideology-like among social researchers and analysts. Thus, we have to concern about these two oblivions on our way to the social complexity sciences.

So, what are the social complexity sciences? Social system can be differed into several descriptive levels as objects we can observe (see *fig. 1*). On macro level we can fairly say that, for instance, one collective behavior  $S_{1x}$  causing collective behavior  $S_{2x}$ , with  $x$  is a dynamical form of localized community or society. Either  $S_{1x}$  and  $S_{2x}$  occurs by “random” interactions of individuals constitute it (say  $I_{1x}, I_{2x}, \dots, I_{nx}$ ). Statistical analyses or conventional social theories commonly approach these macro-view data *an sich*, as objects of observation rarely concerning the causing micro-view. In this perspective, commonly  $S_{1x}$  and  $S_{2x}$  can be correlated spuriously or in the manner of causation that can absolutely mislead the analysis. Since  $S_{1x}$  is emerged from  $I_{1x}, I_{2x}, \dots, I_{nx}$  and  $S_{2x}$  from  $I^*_{1x}, I^*_{2x}, \dots, I^*_{nx}$ , it is obvious that causation or direct correlation between  $S_{1x}$  and  $S_{2x}$  yields prone to failure conclusions theoretically – however, when we talk about the conclusion to be used as a basic of social policy, it can be disastrous<sup>13</sup>.

The social complexity sciences – as inspired from many analytical models from physics to biology – understand that from causation of micro-level and macro-level presents such non-linearity showing the evolution of the system. Adaptive process and micro-structural self-organization emerges the global dynamic of the system ( $S_{1x} \rightarrow S_{2x}$ )<sup>14</sup>. The question is how can we understand this solely by using the traditional methodology?

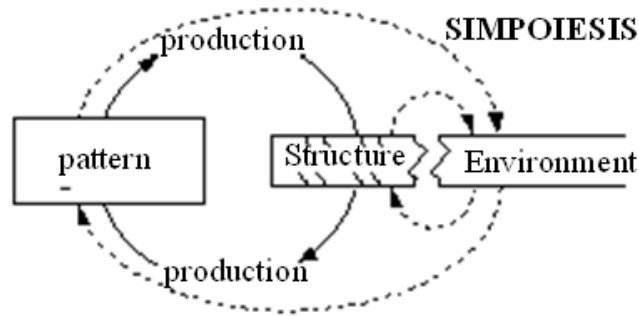


**Figure 2**

The different purposes on macro-macro properties (prediction, etc.) and micro-macro properties (explanation) in social research (see Situngkir, 2004b).

Social scientists, Joshua Epstein and Robert Axtell<sup>15</sup> showed that a way to do this is by taking advantage from computational simulation, a methodology often used in natural (mathematical) sciences. In order not to be confused by possible wrongful theoretical conclusion on the dynamic relation between  $S_{1x}$  and  $S_{2x}$ , we can generate the computational world of  $I_{1x}, I_{2x}, \dots, I_{nx}$  that emerge  $S_{1x}$  in such a way the dynamically changes to  $S_{2x}$  by the changes in its micro-properties. This is an algorithmic and mathematical endeavors demanding interdisciplinary collaboration between social researchers and mathematical ones.

However, how to concur such emergence from micro to macro description level, the interdisciplinary works among social scientists is a must. Pioneering this approach became a reason of recent Nobel Prize for Economic Sciences 2005 bestowed to Thomas C. Schelling<sup>16</sup>. And it is a simple way showing how the interdisciplinary of social complexity sciences works (see *fig. 2*)<sup>17</sup>.

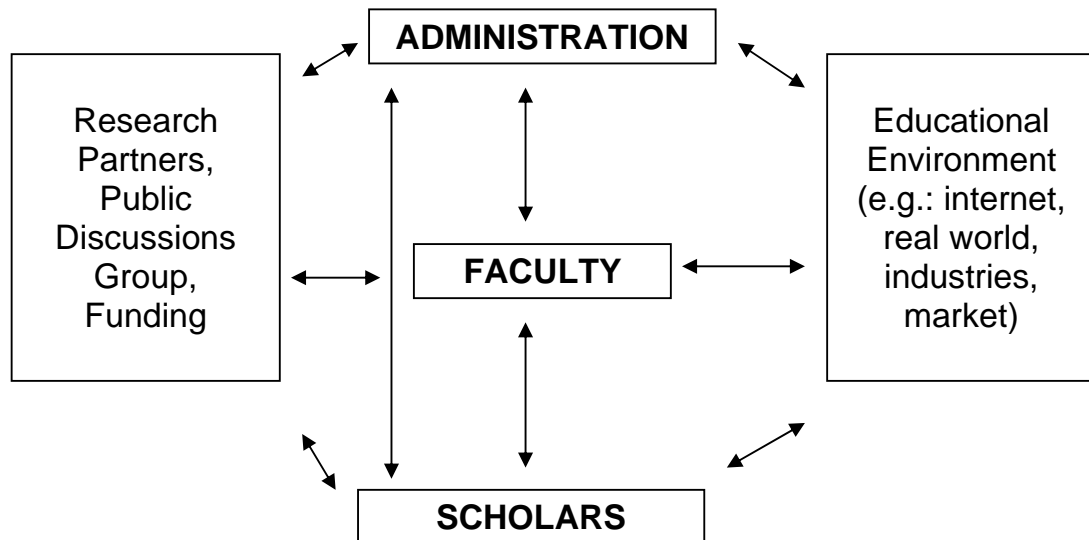


**Figure 3**

The problem of the social complexity research institute is that she is the object and simultaneously the subject to the complex adaptive system

### 3. Establishing & Managing a Social Complexity Research Institute

The way Bandung Fe Institute has been established and managed are more or less must be laid upon the principles that are quite different regarding issues as described in the initial points section above. Independency is a key word on order to keep the researcher's eyes wide open to new research findings. This, I suppose, a thing that is specifically needed in Indonesian research centers. A research institute is not a company, not also a kind of enterprise as to the understanding that good science is always useful but not also saleable. Good research must be done in the spirit of humanity endeavors and never should be other things. But that is just when we talk about motives that, of course, hardly to measure.



**Figure 4**

The design of the self-organized complex research institute.

In the sense of complex research system, some things must be carefully figured out, e.g. adaptability and evolvability of persons and organizations, the emergence of discoveries and state of the art. Social research institute as a part of the society – that is becoming her observing object – must work in a fashion of self-organization. The world is not out there, but we are within the world. A suitable popular evolutionary views to capture this, probably is the modification of the autopoietic system (self-organized system) interact dynamically with it's surroundings<sup>18</sup>. There should be a chance that the structure of the research institute changed as an organic response to it's environment without leaving aside the scientific principles.

The way to do this is by designing the institute into a faculty based organization in which there should be two different bodies: research faculties and the administration managing the organization<sup>19</sup>. As seen in figure 4, the highest authority of organization act should be stated in the communication among the scientific board (as a place of research aspiration sourced) and the administration (as the executive force). The communication is however, becomes the key in the institute, and any dynamical structural changes regarding to environmental responses may evolve in the institute. The executive administration cannot claim the institute while they are connecting to the real world as the faculties always overheard everything about it and may change upon it. As the faculties are the key stone of the arrow of the organization, the administration may adjust the whole system in the institute.

Speaking of the implementation, the faculties in Bandung Fe Institute are made of three departments observing in different spectacles upon the society: Computational Sociology, Dynamical System Modeling, and the Cognitive Science. These are three departments in which scientific endeavors are to be made in the fashion of complex system. While previously we see how the grand design of the institute to be made upon the self-organization and dynamical adaptability to the environment, among the faculties, those should also be fulfilled persistently. This, however, will bring the expansions of the things to be approached by the institute. Yet, a lot of things and wide fields of study should be emerged from the interactions amongst.

This is the way we establish and manage the research institute for social complexity in Indonesia as we have seen also the potentials of what we can do with this institute for the whole society.

#### **4. Closing Words**

Social complexity is social sciences with hands open wide accepting computational innovation as a background, sometimes, a backbone. Having warned by the fear of too much digitalized reduction, it has a spirit to fairly adjust the quantitative and qualitative approach, either as a frame of deduction or induction. The world today has been the witness for the genesis of many scientific novelties, and social complexity is just one that crawls around the evolutionary scientific.

Indonesia today is a country with critical points appearing in all over the frame of its self-organization. Social transitions occur so clearly and perpetually, as it jolted out from repressiveness and abruptly moves toward democracy in which creativity is still a promise of infinite space of thoughts. Newspapers headlines still reflect anger that comes out of ill-definitions about state and statesmanship, freedom of press and information, democratization and democracy, ideology and its abuse, people and citizenship, and more.

Is there still a hope given by linear and closed-minded social sciences looking-glass to observe such Indonesia ubiquitous non-linearity? Academically, social complexity might be the only existing alternative, as it is kind of science well-prepared coping with the complexity of our social realm. Henceforth, let us begin with opening the doors of our faculties in the term of interdisciplinarity and see what we can contribute in the name of science and research to answering one by one of questions above.

## End Notes:

- <sup>1</sup> Craib, I. (1992). *Modern Social Theory: From Parsons to Habermas*. 2nd ed. Harvester-Wheatsheaf. See page 10-12.
- <sup>2</sup> Pavard, B., and Dugdale, J. (2002). *An Introduction to Complexity in Social Science*, GRIC-IRIT, Toulouse, Perancis, On-line Publication, URL: <http://www.irit.fr/COSI/>. For readers without background in mathematics can also see Waldrop, M. (1993). *Complexity: The Emerging Science at the edge of order and chaos*. Simon & Schuster.
- <sup>3</sup> See Parwani, Rajesh R. (2002), *Complexity*, on-line publication, URL: <http://staff.science.nus.edu.sg/~parwani/>
- <sup>4</sup> Descartes, R. (1628) in his seminal work *Rules for the Direction of the Mind* stated one of scientific rules as to "...reduce complex and obscure propositions step by step to simpler ones and then try to advance by the same gradual process from the intuitive understanding of the very simplest to the knowledge of all the rest". Differently in sociology, social theorist Max Weber saw this as a natural symptom of modern society especially in modern scientific works (see Weber, M. (1930). *The Protestant Ethic and the Spirit of Capitalism*. Transl. Talcott Parsons. Charles Scribner's Son.). Furthermore, modern bureaucracy is in general a result of "scientific specialization and technical differentiation" in modern culture as the guiding principle behind it and the increasing division of labor (see Freund, J. (1968). *The Sociology of Max Weber*. Vintage Books). More on this in Weberian sociology, see Coser, L. A. (1977). *Masters of Sociological Thought: Ideas in Historical and Social Context* 2<sup>nd</sup> ed. Harcourt Brace Jovanovich.
- <sup>5</sup> Analytical reductionism is a type of reductionism to analyzing problems in terms of sub-problems that will yield solutions which will describe the whole. Thus, here we explain a system in terms constituent entities. Refer to entry of "reductionism" in *The Oxford Companion to Philosophy*. Oxford University Press (1995).
- <sup>6</sup> The relation between macrosocial and macroeconomic aspect of crime and unemployment is elaborated in Calvou, A.A., and Zenou, Y. (2002). "Does Crime Affect Unemployment?: The Role of Innovations with Network Effects". *Annales d'Economie et de Statistique* 2002. This is followed by the analysis in the perspective of dynamical system and complexity in Hariadi, Y. (2003). "Dynamical Bifurcation: Diffusion of Crime on Labor Force". *Journal of Social Complexity* 1(2):16-23. Bandung Fe Institute.
- <sup>7</sup> Situngkir, H. (2004a). *Epidemiology with Cellular Automata: Case of Study the epidemics of avian flu in Indonesia*. Working Paper WPE2004. Bandung Fe Institute. Pre-print:[arxiv:nlin.CG/0403035](http://arxiv.org/abs/nlin.CG/0403035).
- <sup>8</sup> See Surya, Y., Situngkir, H., Hariadi, Y. and Suroso, R. (2004). *Aplikasi Fisika dalam Analisis Keuangan: Mekanika Statistika Interaksi Agen*. Sumber Daya MIPA chapter 2.
- <sup>9</sup> See Stauffer, D. (2002). "Sociophysics: the Sznajd model and its Applications". *Computer Physics Communications* 146:93-98. See also Galam, S. (2004). "Sociophysics: a personal testimony". *Physica A* 336:49-55.
- <sup>10</sup> See Krugman, P. (1996). *What Economists can Learn from Evolutionary Theorists*. Talk given to the European Association for Evolutionary Political Economics November 1996. URL: <http://www.mit.edu/~krugman/evolute.html>. This concept is contemporarily and formally elaborated as Agent Based Computational Economics; see Tesfatsion, L. (2003). "Agent-Based Computational Economics: Modeling Economies as Complex Adaptive Systems". *Information Sciences* 149:263-269.
- <sup>11</sup> The recent Nobel prizes for economic sciences have been implicitly given to works in the sense of interdisciplinary. It is not strange to see that someone with background of physics and mathematics awarded the economic prize.
- <sup>12</sup> Some of interesting facts in the history economics showing this are elaborated in Keen, S. (2002). *Debunking Economics: The Naked Emperor of the Social Sciences*. Pluto Press.
- <sup>13</sup> For more about macro-micro linkage in social analysis, see Sawyer, R. K. (2003). "Artificial Societies: Multiagent Systems and Micro-Macro Link in Sociological Theory". *Sociological Methods & Research* 31(3). Sage Publications. An example of the theoretical implementation to economic and financial system see Situngkir, H. & Surya, Y. (2004c). "Stylized Statistical Facts of Indonesian Financial Data: Empirical Study of Several Stock Indexes in Indonesia". *Proceeding National Physics Symposium XX Pekanbaru, 25-26 August 2004*:173-8. Himpunan Fisikawan Indonesia.
- <sup>14</sup> The concept of "emergence" is a fundamental concept in complexity sciences for the door to understand the non-linearity between macro and micro description level. How we understand the concept in sociological terms, see Smith, T. S. and Stevens, G. T. (1996). "Emergence, Self-Organization, and Social Interaction: Arousal-Dependent Structure in Social Systems". *Sociological Theory* 14(2):131-153. For more about this, see Axtell, R. (2000). *Why Agents? On the varied Motivations for Agent Computing in The Social Sciences*. Working Paper No.17. Center on Social Economics Dynamics, The Brookings Institution

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<sup>15</sup> Epstein, J.M., and R. Axtell. (1996). *Growing Artificial Societies: Social Science from the Bottom Up*. The Brookings Institution Press dan MIT Press.

<sup>16</sup> Schelling, T. C. (1978). *Micromotives and Macrobehavior*. W. W. Norton pioneered the use of simulation to explain the segregation phenomena. He placed pennies and dimes on a chess board and moved them around according to various rules and interpreted the board as a city, with each square of the board representing a house or a lot. He interpreted the pennies and dimes as agents representing any two groups in society, such as two different races of people, smokers and non-smokers, etc. The neighborhood of an agent occupying any location on the board consisted of the squares adjacent to this location. Thus, interior agents had eight neighbors while boundary agents had either three or five neighbors. Rules could be specified that determined whether a particular agent was happy in its current location. If it was unhappy, it would try to move to another location on the board, or possibly just exit the board entirely. Thus, he found that the board quickly evolved into a strongly segregated location pattern if the agents' "happiness rules" were specified so that segregation was heavily favored. Surprisingly, however, he also found that initially integrated boards tipped into full segregation even if the agents' happiness rules expressed only a mild preference for having neighbors of their own type. The computer simulation by Chris Cook (2003) can be seen in URL: <http://www.econ.iastate.edu/tesfatsi/demos/schelling/>

<sup>17</sup> Situngkir, H. (2004b). "How Far can We Go Through Social System?". *Journal of Social Complexity* 2(1):57-64. Bandung Fe Institute.

<sup>18</sup> See Maturana, H., and F. Varela (1992), *The Tree of Knowledge: The Biological Roots of Human Understanding*, Shambhala. See also: Dempster, B. (1999), *Post-normal science: Considerations from a poietic systems perspective*, School of Planning, University of Waterloo, online publications, <http://www.fes.uwaterloo.ca/u/mbl Dempster/pubs/futures1999/index.html>

<sup>19</sup> An interesting design that we may adapt is shown in Pines, D. (1998). *Designing a University for the Millenium: A Santa Fe Institute Perspective*. Working Paper WP 98-09-083.