This will be followed by the procedure of analysis of the complex system in contagion, based on the initial model, shown below.

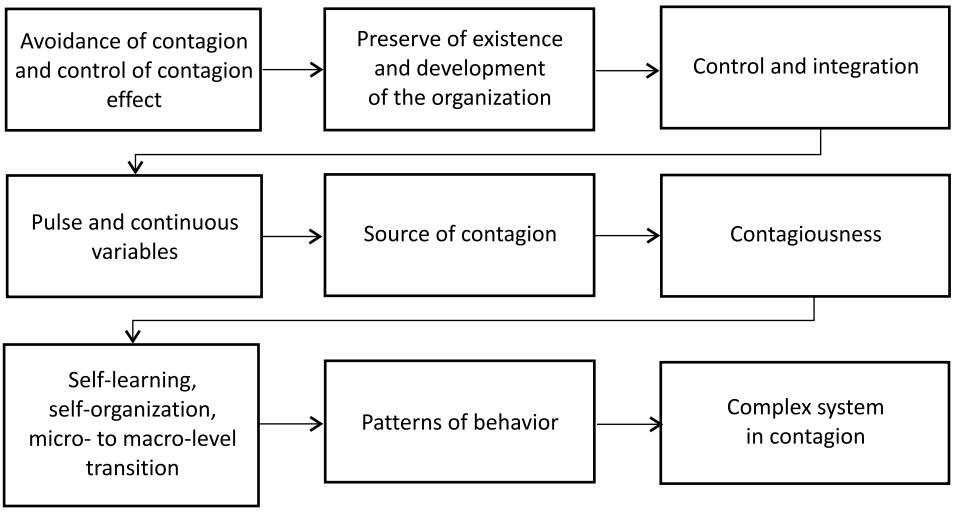

Figure 2. *Complex system in contagion.*

Source: based on Wyciślak, 2013, p. 51.

4. System identification

For analysis of contagion in the complex system it will be crucial to understand mechanism behind self-learning, self-organization, micro- to macro-level transition. This, in turn, will pave the way to construction of different patterns of behavior within the system (Figure 3).

Leaders emerge in a variety of contexts and dimensions. Values, goals, leaders, cultural identity are interrelated and evolve. Subjectivity of agents provides a framework for the constitution of the absorbers. The subjectivity of agents is determined to the large degree by perpetration and reflexivity. At the same time, the level of awareness of agents is determined largely by reflexivity. Reflexivity of agent makes the tensions during the attraction. Tensions between absorbers and agents can be divided into substantive and emotional. On the other side, with the low levels of reflexivity, agents are inertial. By including reflexivity and inertia, we obtain various variants of modules constitution (Figure 4).

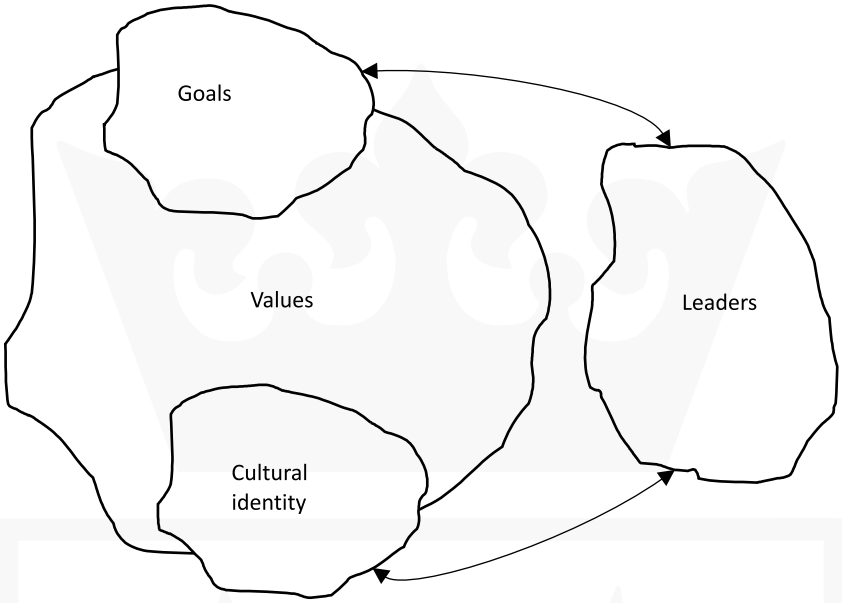

Figure 3. *Leading absorbers within the self-organization process.*

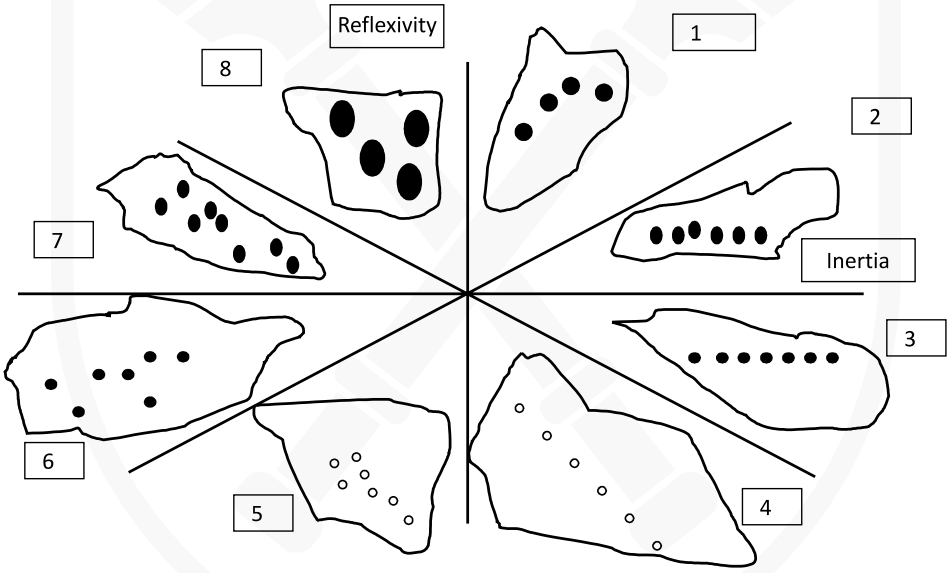

Figure 4. *Matrix of modules as effects of self-organizing.*

By high reflexivity level and relatively high inertia level, agents question leaders' rules, however due to the ad hoc needs for security they are on the trajectory dictated by the leader (1). By relatively high reflexivity level and high inertia level, the pattern of behavior follows the successive actions slightly deviating from the leader values (control norms) (2). By relatively low level of reflexivity and high level of inertia, we are dealing with an ordered set of actions (3). By low level of reflexivity and relatively high inertia level, there is an ordered set of actions of low level of consciousness (4). By low level of reflexivity level and relatively low level of inertia (5), there are actions that don't follow leader values (control norms), however they are of random, indeterminate character. By low level of inertia and relatively low level of reflexivity (6) there is an increasing number of activities of random character, not determined by leader. By low inertia level and relatively high reflexivity level, actions are increasingly conscious, which means an increase in potential of going beyond trajectory determined by values set by leader. By low inertia level and high reflexivity level (8) there is a set of activities of high degree of awareness, which define and implement own domain or in a conscious manner follow values set by the leader.

Researching reflexivity and inertia of agents will result in identification of emerging patterns of behavior. The role of reflexivity and inertia within the casual loops (feedbacks) between agents and absorber will allow us to answer how emerging patterns of behaviour evolve on the back of self-learning process.

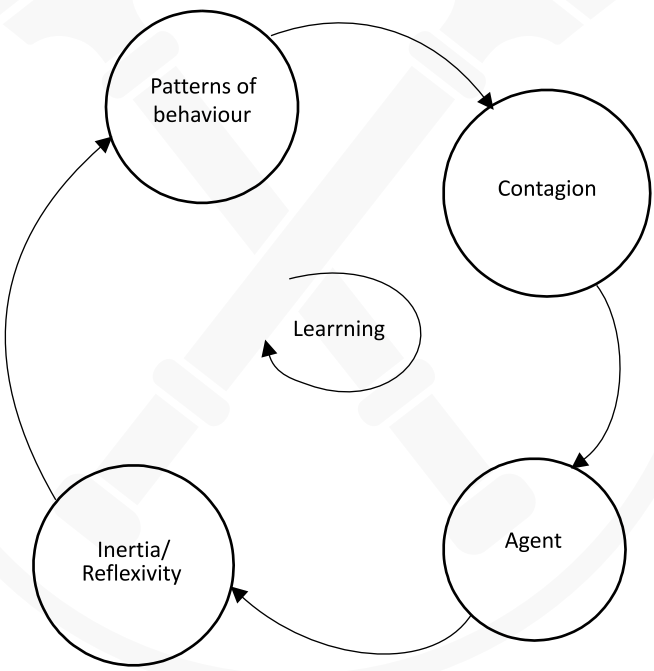

Figure 5. *Casual loops agents and absorber and self-learning process.*

Agents learn from the widespread of contagion effects and alter its attitudes (ratios of inertia and reflexivity), which in turn results in new patterns of behaviour. Emerging patterns of behaviour mean various levels of centralization in complex systems.

5. Centralization

From the system approach perspective, the centralization/decentralization problem is discussed by including optimization and suboptimization principles. When the whole system optimum prevails, not all subsystems are at their optima. As a result, it is hard to expect that the sum of subsystems' optima will necessarily lead to the total system's optimum. In other words, if the subsystems suboptmize but work towards the whole systems optimum, they will in aggregate reach a better total system optimum than if each tries to optimize its own system separately. The principle of suboptimization means that when the individual subsystems optimize its actions, the whole system doesn't work optimally. There is no contradiction in promoting on the hand, solutions worked out on a centralized basis, and on the other, implementation carried out by the decentralized decision units (van Gigch, 1991).

For example, in business practice, there are cases that the period after 27th day of the month sees 25–30% of the total monthly sales. It comes from the separate goals followed by subsystems including sales, marketing, finance, logistics. Whilst, the primary goal for the sales department is sales growth, the reduction of costs and fuelling the distribution centres and vehicles is the main goal for logistics.

6. Practical implementation

Based on Figure 1 (system identification procedure) we may briefly construct an analytical model for multinational corporation in contagion. There is a set of approaches towards the system itself, multinational corporation-centric approach will be taken into account in this paper. Therefore multinational corporation will be analyzed as a system. Problem identified here is naturally the contagion in complex system (being a multinational corporation), but at this stage the corporation itself, especially its structure is analyzed.

The purpose of the system in case of multinational corporations is bringing benefits for both shareholders and building fair relations with stakeholders. In case of shareholders, the research focuses mostly on financial benefits from stocks (increased value, often short-term and dividends). As for stakeholders it is more complicated. For one thing, the fair relations are hard to quantify, for another are of very high complexity levels.

As for system functions, components, interactions and structure, should provide profits/benefits for both shareholders and shareholders, but also preserve the system itself, providing its development. It means the ability to control and integrate internal activities.

System borders are marked with the legal structure of the corporation – we presume, legal entity, known as multinational corporation is a system to be analyzed. For this purpose the environment is multidimensional, including economic environment (financial, fiscal, monetary, etc.), social environment, as well as political environment. Feedback between system and environments is provided both by stakeholders, and it includes among others contracts, informal relations, and by set of incentives like regulations (from political environment), access to capital (from financial environment), etc. When it comes to contagiousness control, one of the key focus should be on protecting reputation for example as a reliable partner with which to trade.

Based on the aforementioned system features include self-learning mechanisms, self-learning, self-organization, micro- to macro-level transition.

The very core sense of systems features is micro – to macro transition. Resilience helps navigate the agents patterns of behavior. Equally, a resilient system is better able to translate the energy and engagement of its agent into immunity to contagion.

Patterns of behavior depend on system operation. There is a set of models of system operation, generally associated with models of multinationals centralization starting from centralized system (usually associated with multinationals, having headquarter in one country where the key decisions are taken and branches in other countries) to network structure (where hubs play the pivotal role, i.e. Logistics hub, R+D hub, the Operational hub, headquarter-hub). Multinationals only apparently follow the decentralization processes, by transforming themselves into network organizations. In reality, multinational corporations became integrators within value chains, and access to unique knowledge is the theirs' key competency.

Therefore, system, understood as a multinational corporation should be defined as set of elements, interactions and structures, separated from the environment (all what is not-the-given multinational corporation), however facing feedback from the environment because of stakeholders and regulations. System aims at providing highest possible profits for its shareholders and build fair relations with stakeholders, adjusting its patterns of behavior thanks to self-learning mechanisms.

Based and Figure 2 (complex system in contagion) we can refer to a set of events understood as contagion in a complex system of multinational corporation. Presuming the fact both system and the environment are in equilibrium, system of multinational corporation created set of mechanisms preventing from contagion and controlling contagion effects. In case of lack of the equilibrium our given system of multinational corporation tries to use this mechanism as the first step and primary defense mechanism. In case, it's impossible the next step is securing vi-

tal interests, hence existence and future development of the multinational corporation. For this sake mostly cost-reduction policy is applied, with different approaches, including reduction of non-profit operations, reduction of fixed costs, reduction of personnel, sale of lower-performing branches and outsourcing or outsourcing of certain processes. All of aforementioned aims at control and integration of company and contagion effect (including constant analysis of pulse or continuous variables). Source of contagion should be identified (either internal or external, it can affect all branches, all hubs, certain products, certain branches, the whole company). Based on those, we can assess the contagiousness of given operations/branches/products and react precisely where contagion effect is strongest. Self-learning mechanism supports multinationals in building better mechanisms supporting contagion-avoidance for the future, including proper patterns of behavior.

Discussion and conclusions

The final stage should answer, to what extend centralization (or central control) in complex system influence contagion effect and what is the role of self-learning mechanisms in preventing future crises.

Having in mind, both system identification procedure, but especially complex system in contagion and self-learning mechanisms, we may conclude as follows. If the multinational corporation system is decentralized, each branch can build its own model of prevention against contagion. However, it should be based on mechanism of self-similarity and redundancy.

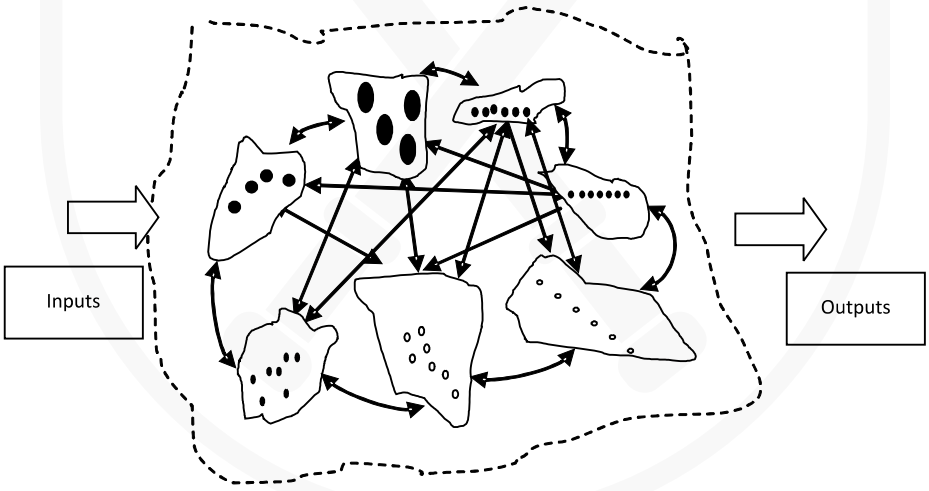

Figure 6. *Multinational corporation as a complex system (modules of various behavior patterns).*

In the case of global crisis, different branches are usually affected to different degree. In case of external source of contagion (like financial markets, limiting access to cheap credits), most branches may be affected. Such a global crisis is usually unlikely. In the second stage, however, certain local branch, can introduce self-organization, responding to the crisis and the model may be applied by other branches or each branch may create its own model (see Figure 4). Naturally, such a development requires relatively high level of reflexivity, hence at least operational level of management in a given branch.

In case of regional or given market crisis, this mechanism is even stronger. Hence, presuming each branch in decentralized structure may operate as an agent, possessing tools for high reflexivity, self-learning mechanism is faster and more efficient. Having this in mind, we may presume, decentralized system (as depicted in Figure 6) may react on inputs (bringing contagion) in a more efficient way than centralized system, with higher level of inertia. The best structure for the decentralized system, which is resistant to contagion, is fractal simultaneously cross-functional and has redundancies. The absorbers play the crucial role in ensuring and sustaining abovementioned structure.

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Notes about the Authors

Marcin Grabowski, Ph.D. is an Assistant Professor at the Institute of Political Science and International Relations of the Jagiellonian University in Kraków. He graduated from the Jagiellonian University in Kraków with a degree in International Relations. He also studied at Columbia University in the City of New York (School of International and Public Affairs), George Washington University in Washington (Sigur Center for Asian Studies), and University of California, San Diego, where he completed the Global Leadership Institute program. Marcin's research interests focus on the Asia-Pacific Rim, especially institutional arrangements of the region (APEC, ASEM, ASEAN, EAS, ARF, SAARC), U.S. and Chinese foreign policies and the International Economics. Marcin has authored numerous scholarly journals' articles, edited three books and authored a monograph: *Wiek Pacyfiku: Polityka Stanów Zjednoczonych wobec regionu Azji i Pacyfiku po 1989 r.* (The Pacific Century: U.S. Policy towards the Asia-Paci fic since 1989).

Sławomir Wyciślak obtained his doctorate from the University of Economics in Kraków. He has over 10-years' experience of working with companies of various sizes, including mid-sizes firms and multinationals. His academic interests focus on the analysis of companies response models towards crisis and complexity, and in particular international management, supply chain management, risk management, international financial markets.