

Mathematical Representation of Social Capital and Human Bonds shown for the Great East Japan Earthquake

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Abstract. Directly after the Great East Japan disaster, various acts for mutual aid among victims and also between victims and non-victims spread out in different places throughout Japan. This paper presents a mathematical formulation of social capital regarded as existing as the background to these actions, with application to refuge phenomena in the aftermath of the accident at the Fukushima Daiichi Nuclear Plant.

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1. Introduction

On March 11, 2011 at 1:30 pm, the first author[†] and his wife finished golf at their home course. They went down, as usual, to a restaurant near a fishing port. After lunch they left for home along a coastal road, and at 2:46 pm an earthquake struck as they were driving. They stopped the car and waited for it to end. During that time, houses at the road-side fell and telephone poles shook. The spectacle appeared to be one taken right out of a movie.

Around 3:00 pm, they set off for home again. The car radio warned of an impending tsunami, and they had to choose either to leave for home by the seaside or to go up into the hills. In an instant, they chose the second alternative, which separated life from death for them. If they had chosen to return to their house, they might have been engulfed by the tsunami. Around 3:15 pm, the tsunami struck the shore, creating a dreadful panorama. When the tsunami had ebbed away, cars, huts and other debris were drifting and being

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carried away offshore. Fortunately, their house remained largely intact, but the interior of the first floor was completely destroyed by the waves.

For a few days thereafter, they stayed at the gymnasium of a high school as a place of refuge. A warm-hearted exchange of human feelings, which reminded them of the Japanese old and good life, arose among the people gathered there. It was a valuable experience for them.

As described in this paper, we explore the question of “How is life space filled with the exchange of human feelings and the rule of reciprocity created in the extreme situation described above?” We attempt to build a mathematical model describing it. The fundamental idea to address the question is to use the concept of social capital, together with the study of steps to address regional regeneration from economic depression. The concept of social capital is presented in the next section.

2. Social Capital

2.1. History of social capital

The conceptual origin of social capital appeared in the 1910s, during the World War I era. When the traditional sense of cooperation and public goodness (welfare, common weal) prevailing in village communities was collapsing with industrialisation and urbanisation rising in America in that era, the education specialist Hanifan discussed the situation from the perspective of social capital [1]. Putnam made Hanifan’s approach famous by developing his results [2, 3]. Putnam inquired, “Why do democratic governments succeed or fail in carrying out their policies?” In particular, he explained the difference of performance in administration of local governments in Italy, using the concept of social capital based on the accumulation of case studies on that question over a period of 20 years. Theories and applications of the social capital concept have since progressed in fields such as politics, economy, social welfare, environmental sanitation, education, and criminology [4, 5].

2.2. Definition of social capital

Regional societies have confronted various difficulties including aging, a declining birthrate, concurrent worldwide recession, and extension of production abroad. Some have succeeded in planning strategies to invest in human resources, the environment, and relationships among inhabitants in places of public enterprise. The common phenomenon is to use the power of community effectively. The fundamental source of power to act is social capital — a community rich in social capital has sufficient possibilities to solve difficult problems. Social capital is defined by an accumulation of networks, built up and based upon reliability and reciprocity among community members. “In the community linked together with reliability, people take action with others, expecting to receive a return in future. By repeating these exchanges, reciprocity is developed. And then the reciprocity is raised to a kind of social precept with time. That becomes a model of good behaviour.”