The Dynamic Structure of Social Capital: How Interpersonal Connections Create Communitywide Benefits

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Abstract

Social capital is built via the network of connections among individuals in a community. Interactions among individuals within such a network make various endeavors more successful than they would be without such connections. The community becomes something more than a collection of individuals, because this structure has beneficial effects on economic and other efforts of community members, and provides benefits to the community as a whole. While benefits of social capital are well documented, the mechanisms of social capital -- how it produces such benefits -- are less well understood. Several mechanisms have been suggested, however, and these can form the basis for the structure of system dynamics models with which these various hypothesized mechanisms of social capital can be examined. One can more clearly define social capital by using the structure of these models.

Introduction

Social Capital – What Is It and Why Is It Important?

Social capital refers to intra-community connections among individuals which form a catalytic network by which individual, group and community wide efforts are made more effective. The substantive flow across such networks may take the form of knowledge and ideas, reciprocal labor or money sharing, and the formulation and execution of mutually beneficial endeavors. Societies with high social capital are generally believed to be better

off. From an international development perspective we might wish to examine potential methods by which social capital could be enhanced in order to improve economic and social conditions.

The term social capital was apparently first used with its current meaning in 1916 by L. J. Hanifan, a social reformer, and during the last 15 years has been revived, particularly with reference to the writings of Coleman (1988; 1990) and Putnam (Putnam 1995, 2000; Putnam *et al* 1993). However a number of authors have questioned the validity of the seemingly vague concept of social capital unless it can be shown to have a clear mode of operation (e.g., see Paldam and Svendsen 1999; Pantoja 1999; Torsvik 2000). These and other authors have suggested that there is a need for a better understanding of how social capital is formed and by what mechanism benefits are created. There is also the lingering need for better methods to accurately measure social capital. Some historical background information regarding social capital research is included in Woolcock and Narayan (2000) and in Falk and Kilpatrick (2000).

Several definitions of social capital have been used:

> "Social capital is defined by its function. It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors -- whether persons or corporate actors -- within the structure." Also " ... Social capital is less tangible [than physical or human capital] for it exists in the relations among persons" (Coleman 1988).
>
> "The social structure which facilitates coordination and cooperation" (Putnam *et al* 1993).
>
> "Social capital refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the glue that holds societies together and without which there can be no economic growth or human well-being" (forward by Ismail Serageldin in Grootaert 1998).
>
> "In the political science, sociological, and anthropological literature social capital generally refers to the set of norms, networks, and organizations through which people gain access to power and resources, and through which decision making and policy formulation occur" (Grootaert 1998).
>
> "By social capital we mean the quantity and quality of associational life and the related social norms" (Narayan and Prichett 1999).
>
> "Social capital ought … to be defined in terms of the measurable variables that create mutual trust and co-operation in a community" (Torsvik 2000).

Agreeing with that view Woolcock (2001) says " [first...] social capital refers to the norms and networks that facilitate collective action. Second, it is important that any definition of social capital focus on its sources rather than consequences, i.e., on what social capital *is* rather than what it *does*. This approach eliminates an entity such as 'trust' from the definition of social capital. Trust is doubtless vitally important in its own right but for our present purposes is more accurately understood as an outcome...". (But see comments below concerning the feedback relationship between social capital and trust).

Types of Social Capital

Various sub-types of social capital have also been discussed. One important typology identifies **civic social capital** and **governmental** (or **institutional) social capital** (Collier 1998; Torsvik 2000). These may be comparable to micro and macro views respectively. Civic social capital is typically used to describe interconnections among individuals at the community level, and it appears to be the type of social capital most investigated. On the other hand governmental or institutional social capital seems to be of more interest to those with concerns about national and international development, and may have direct relevance to the following dichotomy.

From a slightly different perspective Daubon and Saunders (2002) use the term **community** or **bonding social capital** for cohesion "applicable to acquainted individuals within circles of reciprocal trust and **public** or **bridging social capital** for cohesion "applicable to unacquainted strangers in a broader group …. across such circles of trust ..." They point out that "a society's political culture" refers to levels of bridging social capital, and stress that it is bridging social capital that is critical in building civil society.

Uphoff makes the important distinction between 1) **structural social capital** referring to the actual organization of society "particularly *roles, rules, precedents* and *procedures* as well as a wide variety of *networks* that contribute to cooperation…" and 2) **cognitive social capital** which is related more to how people think about their role in society, the "mental processes and resulting ideas, reinforced by culture and ideology, specifically *norms, values, attitudes and beliefs* that contribute to cooperative behavior". That is, "cooperation, once it is achieved, can provide cognitive and emotional scaffolding for cooperation in the future" (Krishna and Uphoff 1999; Uphoff 2000).

There is a general belief, as well as significant evidence, that societies or communities with strong social capital are also societies in which the inhabitants are significantly better off. From the point of view of national 'development' we need to ask: Can social capital be created? If so, how, and what types of social capital are most important? These questions are particularly important because social capital, once established, is self reinforcing with the potential to provide a relatively cheap intervention strategy. Give social capital a kick in the right direction and everything will be better. Or will it?

Unfortunately, social capital can also be a catalyst for "bad" activities. The best examples of this are Mafia-like organizations whose members benefit from the close connections within their group, while society as a whole is harmed. However, this effect can also occur within specific ethnic groups in a multiethnic society (for example see Bates 1999; Daubon and Saunders 2002; Pantoja 1999). While some workers prefer to define social capital as inherently good, this 'communitarian' view (Woolcock and Narayan 2000) is not realistic, given significant evidence to the contrary. We must consider that social capital, sometimes even when its main purpose is good, can generate harmful outcomes for non-included groups, and even for society as a whole.

According to Robalino (2000) "theory suggests the existence of a non-linear relationship between the level of social capital and welfare. Very high levels or very low levels of social capital are both undesirable outcomes". Dealing with a related issue (Daubon and Saunders 2002) note that "…. a complementary trust in the behavior of strangers … would allow transacting on a much broader range with greater and better choices and greater economies of scale than when operating just within the limited circle of acquaintances." In other words, from the point of view of overall development, it may be macro scale, or bridging, social capital that is important. Woolcock and Narayan (2000) address both these issues by examining both bonding and bridging social capital. At first benefits rise as bonding social capital rises, but then drop as influence of some groups increases at the expense of others. Finally if inter-group social cooperation (bridging social capital) becomes stronger, benefits will rise further.

Excessive government intervention can destroy social capital, sometimes replacing it with governmental/institutional social capital. However, if the government later collapses, then institutional social capital declines, and reliance on low levels of remaining bonding (or civic) social capital may reinforce splits in society making recovery even more difficult (Rose 1998) (see also Bates 1999; Collier 1998; Pantoja 1999). Putnam (1993) believes that social capital takes tens of years to develop, although other workers believe social capital can be built over significantly shorter periods.

Helping to confuse the various definitions of social capital is the fact that there are many different perspectives as to how social capital works. Woolcock and Narayan (2000) point to nine different areas of academic endeavor which investigate social capital or similar properties of society. Because of the wide-ranging examination of this issue, some authors have questioned the validity of the whole concept of social capital, saying that social capital is merely a repackaging of other social science concepts that have been around for many years. Regardless of what it has been called, and whether or not it is a repackaging of other concepts, the concept now called social capital, which typically emphasizes the role of the many connections among individuals within a community and how they influence the functioning of that and linked communities, should be of interest to system dynamics practitioners. This is particularly so for those who have an interest in promoting sustainable use of natural resources in cooperation with local people, or in larger settings of international development. As Woolcock (2001) states, the concept of social capital

"satisfies a conceptual void in both mainstream economic and social theories of development".

How Does Social Capital Produce Benefits?

If we are to construct functional models of social capital we need to know how social capital works. What are its mechanisms?

Coleman (1988) discusses three modes of operation for social capital. First, the concept of **reciprocity** involves favors, including monetary favors, which are given and owed. These create links of obligations and as those obligations are fulfilled links of trust are created. As more trust is created people are more likely to work cooperatively with their friends and associates, knowing that at some point such favors may be returned. There is not

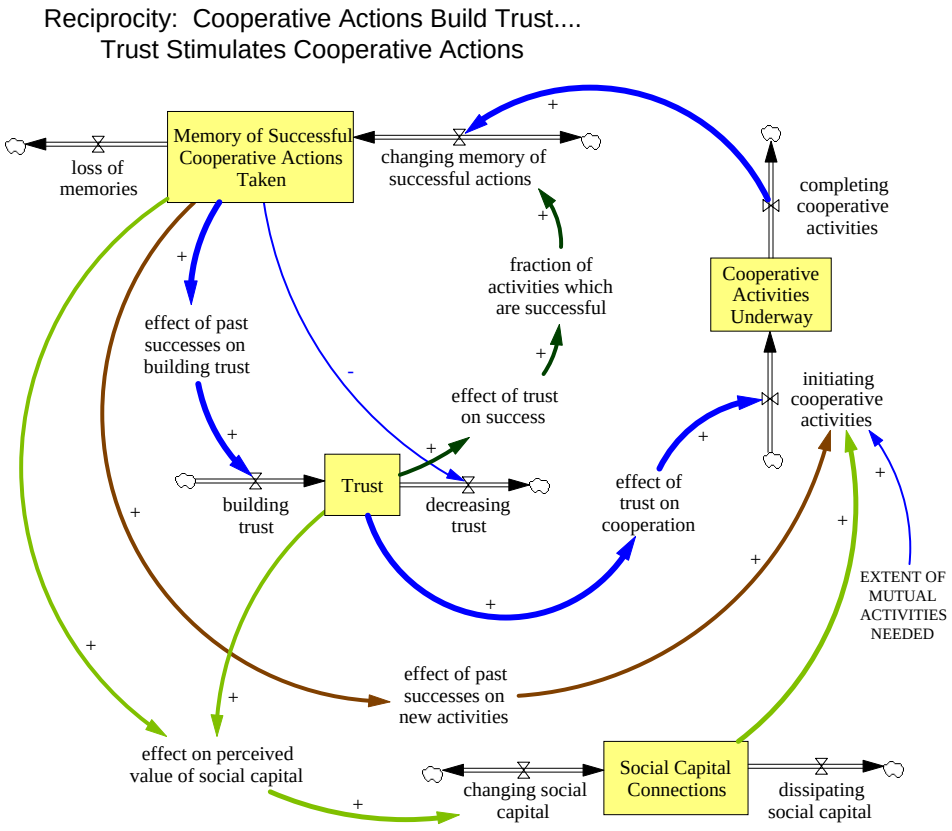

Figure 1. This simplified stock and flow diagram illustrates how social capital might build trust and cooperation. The diagram illustrates how social capital might enhance cooperative activities, and how the memory of successful cooperation will build trust. Increasing trust increases the likelihood of successful cooperative activities, and makes future cooperation more likely. The memory of these successful activities cycles back to reinforce and build social capital.

necessarily a requirement that a specific favor, or debt, be repaid, but there is an expectation that it will usually be repaid in some way.[1] (Fig 1).

Second, **information channels** permit people to obtain, or validate, information, which will help them with their economic, or other, activity. Such information may lower transaction costs (Paldam and Svendsen 1999), or help find a job. The role of information exchange is especially important when some individuals are known to be knowledgeable in certain areas. Knowledge sharing is related to the concept of group memory (see below) whereby each individual can rely on others for knowledge in certain realms (Fig 2).

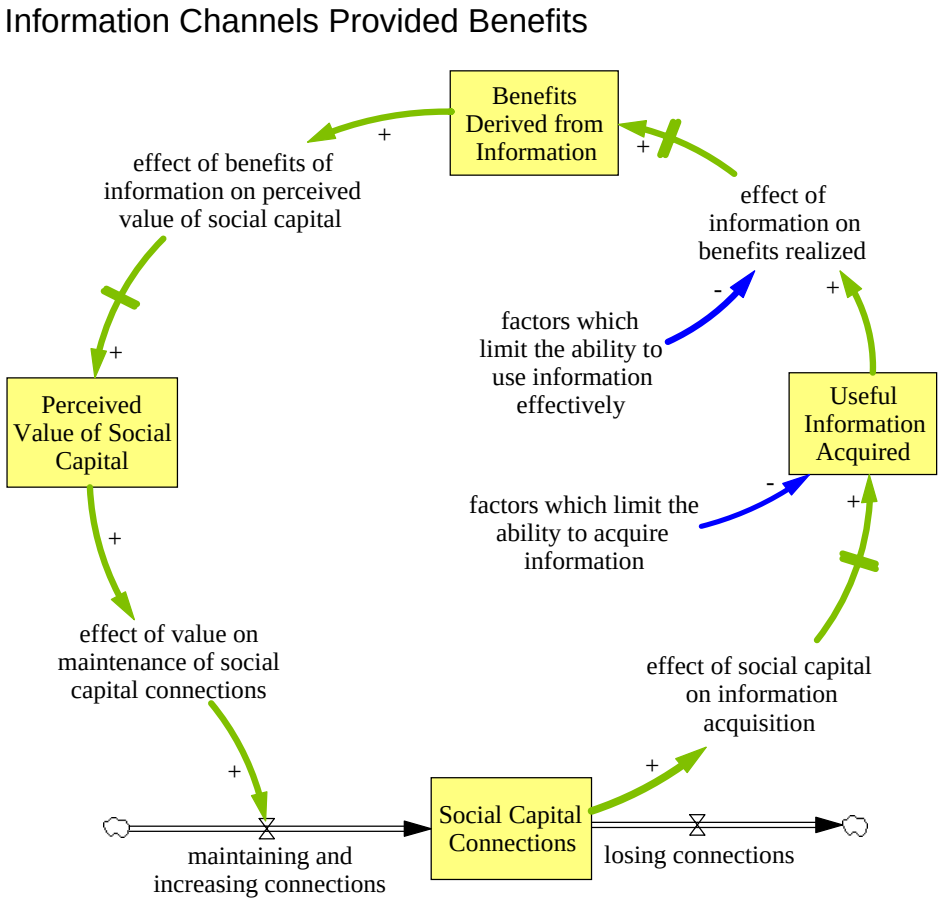

Figure 2. This simplified diagram illustrates how information channels within a community can generate benefits which reinforce social capital. Also illustrated here are possible model components which might limit the effectiveness of information channels. For example, low literacy within the community might be a factor that limits their ability to acquire, or use, information.

[1] Many authors seem to limit their discussion to the development of reciprocal trust, and how that trust leads to mutual benefits. This seems to be overly limiting given the other possible modes of action of social capital.

Third, **norms and effective sanctions** within a community place pressure on community members to behave in a certain, hopefully responsible, way. That is, the community expects certain types of 'responsible' behavior and will apply sanctions if this expectation is not met. This allows the community as a whole to benefit because people know in advance that others will usually conform to some socially acceptable behavior pattern (Fig 3). As Coleman (1988) points out, however, such pressure to conform is not always good. Acceptable behavior within a group may, for example, include racist attitudes and actions toward another group. Also while the idealized notion of group decision-making assumes that everyone has an equal role, group decision-making can be dominated by individuals (see for example Colfer 1983; Kameda *et al* 1997). Group norms might conceivably be overly influenced by religious leaders, charismatic individuals, or people having, are believed to have, authority.

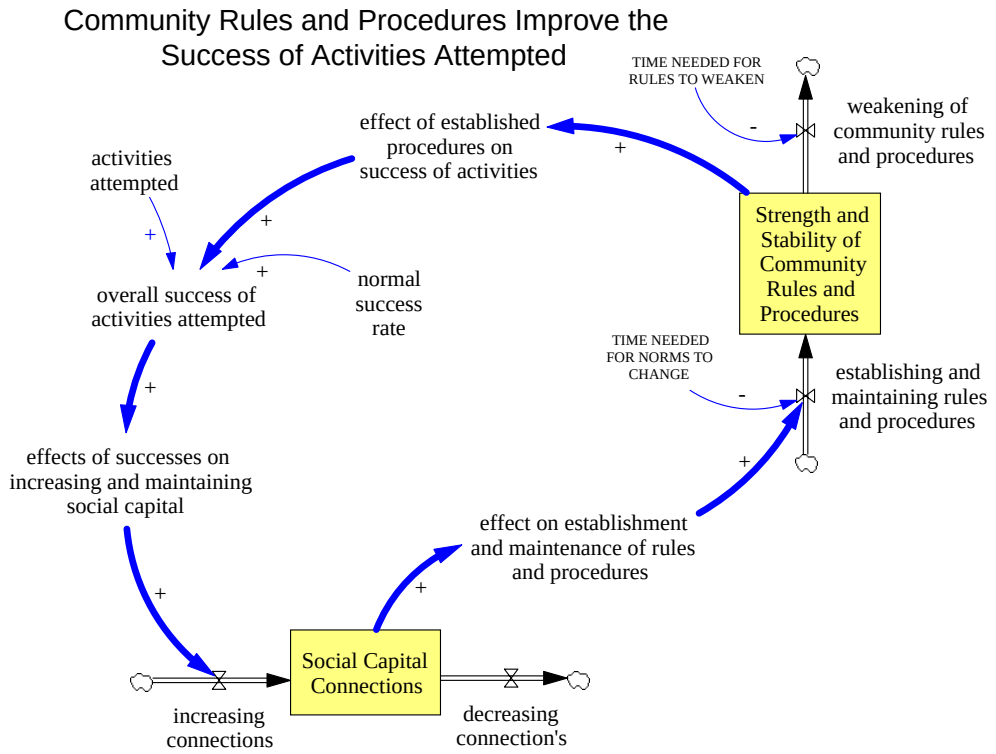

Figure 3. This diagram illustrates how the stability of community rules and procedures can lead to more successful activities which in turn will reinforce social capital. It is still a question, however, as to how social capital creates the *effect on establishment and maintenance of rules and procedures*.

Torsvik (2000) also discusses the mode of operation of social capital, focusing on the issue of trust. He considers that social capital is a result of the evolving trust within a network. This trust can be based on either 1) self interest involving **mutual gain** when future additional interactions are expected, or on 2) "**pro-social motivation**" which he believes consists of three types: motivation based on **altruism**, on **principle**, or **concern about**

one's own social status. Once transactions are carried out based on any of these motivations the system can become self reinforcing, assuming the outcomes are mutually beneficial.

Some Parallel Tracks –

Investigations of Successes in Common Property Resource Management

The work of Ostrom and others has taken a parallel look at factors affecting social capital when they examined factors promoting successful management of common property resources (Ostrom 1990). This much cited work examines situations where such management was successful, and the reasons for these successes were analyzed. The studies revealed that under certain circumstances the management of common property resources could be successful because the type of collective action employed produced mutual gains for the participants. The theoretical framework for this analysis was based on game theory and, as such, typically relied on 'rational' behavior of the resource user-managers. More recently Ostrom (1998) has called for a re-examination of this approach. She discusses findings that "show how individuals achieve results that are 'better than rational' by building conditions where reciprocity, reputation, and trust can help to overcome the strong temptations of short run self-interest." Although not mentioning system dynamics specifically, Ostrom provides a causal diagram which shows "theoretical scenarios of how exogenous variables combined to affect endogenous structural variables that link to the core set of relationships." This figure includes a reinforcing loop linking reciprocity, reputation and trust among individuals. That reinforcing loop was used as the basis for a system dynamics model examining participant management of a small scale fishery (Castillo and Saysel 2003). Multi-agent models have also been used to examine cooperation among participants in common pool resource use (Deadman 1999).

Studies of Connections among Individuals

Gladwell, in his book *The Tipping Point* (Gladwell 2000), examined some interesting aspects of connections among individuals, and these have a direct link to the concept of social capital. He cites others to point out that the maximum number of contacts an individual might normally have is about 150 and that the people we know most closely usually number only 10 to 15. Social capital appears to function best in relatively small groups, and it may be that the 150 person to person (and the 10 to 15 close person) limit has something to do with this. This may be why bonding social capital operates best in small groups. For example, enforcement of sanctions is usually considerably easier when group size is small and self enforcement more likely (Paldam and Svendsen 1999).

However, it is only when bridging social capital is also strong that larger societies can operate with strong social capital. There is an important role to be played by the interlinking of many smaller networks (Paldam and Svendsen 1999). This fact, coupled

with Gladwell's comments about 'connectors' (people specialists) and 'mavens' (information specialists) (Gladwell 2000 Chapter Three) gives us additional insights into how bridging social capital might work. Given that we can expect individuals, especially connectors and mavens, to be members of more than one group or network we can see how the larger networks of social capital might exist even when so-called bridging social capital is relatively weak. In fact, multiple-group membership may be one mechanism for bridging social capital of the "civic" rather than "institutional" type.

Milgram (1967) popularized the idea of the high interconnectedness of society. Although Milgram's original findings have been recently challenged by Kleinfeld (2002), the ongoing investigation of the structure of social networks and the "small world" or "six degrees of separation" problem is important to the discussion of social capital. This is because our definition of social capital is closely tied to the functioning of connections among people, and that is very tightly bound to the concepts of how these social networks might work. The work of Granovetter (1973), for example, emphasized the critical role played by weak ties among people -- connections between people who don't know each other very well. The special importance of these occasional weak ties is a result of the fact that excessively strong ties – high bonding social capital – often prevents people from making connections outside their small world of friends and family. That is, it prevents the formation of bridging social capital.

Although a discussion of the theory of small world networks is well beyond the scope of this paper, readers interested in its more technical aspects may wish to consult Watts and Strogatz (1998) .

Social Learning and Group Memory

Two additional areas of investigation important to the study of social capital are those of social learning and group memory. The informal knowledge attained and retained by a group of individuals is certainly more than that possessed by one individual. Wegner *et al* (1991) found that pairs of people who know each other well were significantly better at retaining learned information than those who didn't because they consigned certain types of remembering to each other. Thus it is quite likely that the efficiency of learning is enhanced when some individuals are considered to have, formally or informally, specialized areas of knowledge. These people become a knowledge resource for the community, and probably correspond, more or less, to the mavens mentioned by Gladwell (see above). Importantly, it is also through ordinary people that other people learn. Social interactions and associated learning, especially informal learning, create social capital in a community. Significant amounts of information are exchanged through ordinary conversation even in highly informal settings when people are "just having a little chat" (Falk and Harrison 1998; Falk and Kilpatrick 2000).

Social Energy

The concept of social energy (Hirschman 1984) has not been widely used. It appears to refer to the sudden awakening of a community to an issue and to the idea that some beneficial collective action might be taken. A sudden awakening might be interpreted in two ways. First it could mean that the network of social capital has reached a critical density, or abundance, of connections. Second, it could be considered a different measure; a measure of the activation energy traveling through an existing network of social capital, which might be interpreted as an improved quality of the connections. That is, the social capital network may exist in a latent state: people know each other and socialize, but they have never taken collective action. The social energy activates the existing network or increases the flow of activity within it. The triggers here may be a sudden need of the community, or a particularly dynamic individual or leader who manages to activate the network. Once activated the social capital continues on a self reinforcing track.

Social Capital and Policy

Woolcock and Narayan (2000) summarize some issues related to changing views of social capital within international development circles. In the past social capital has been viewed as an impediment to development. The idea was that people had to change their archaic ways of doing things; that they had to become more modern. Another, later, view held that social capital was merely a means whereby politicians and businesspeople managed, through "collusion", to maintain control for their own benefit. Today social capital is viewed as a tool for improving the likelihood of success of development projects. By linking into, and enhancing, existing social capital networks, this argument goes, development efforts will benefit from a two-way communication with the target population, and will be more likely to address people's real needs. This will, in theory, lead to a more effective development programs. However, Grootaert and Bastelaer (2001) caution that the building of social capital by external agents is difficult and not always successful. Also, social capital appears to be easy to destroy but hard to build, so there is an underlying danger for international donor agencies who wish to build up and tap into existing social capital.

Modeling Social Capital

Why Model Social Capital?

If we wish to use social capital to enhance the development process then we must have a better understanding of the specifics of its creation and its mode of producing benefits. Although there is a large literature on social capital, several authors have commented on the lack of understanding of its mechanisms. For example:

> "more work [is needed] on unbundling the mechanisms through which social capital works" (Woolcock and Narayan 2000).

> "the mechanisms through which [social capital] is supposed to work are not spelled out with enough rigor and clarity" (Torsvik 2000).

The system dynamics approach may be useful in examining these details while maintaining an understandable framework for policy makers. If we are going to try to stimulate the creation of social capital, and use it to deliver benefits to large numbers of people, then we need to know more about how that might be done, and what risks might exist. Also, once a reasonable working model of social capital is developed that model, and modifications of it, could be used to assist in the examination of researchable questions into the nature of social capital similar to those listed by (Debertin 1996)

Background for Model Building

Creation of Social Capital

In a restricted sense there are two major issues we need to address in a model of social capital: the creation of social capital and the creation of benefits from social capital.

From a feedback perspective, if endeavors making use of social capital connections tend to be more successful (in number, value or quality, etc) compared to endeavors attempted without such connections, then these extra successes will stimulate the creation of more connections (e.g., cooperative activities, networking for information), or at least will maintain or reinforce the existing social capital structure.

Most authors agree that social capital persists over time. However, some authors believe that it may take many years to form, and others taking note of that opinion have concluded that social capital should be considered a characteristic of a specific culture that is not readily changed: a constant. Nevertheless most authors believe that social capital can be created and destroyed over relatively short time periods, say tens of years, and this is the view I employ here: the connections which are one foundation of social capital are modeled as a stock with inflows and outflows corresponding to the creation and dissipation of these connections.

If increases in social capital connections are causally linked to the benefits realized, then we would conclude that there is a feedback relationship between connections and the benefits realized. On the other hand, if we believe that these connections are created by factors not directly related to the benefits, we will need to consider what other factors cause these connections to form and be maintained. Herein we will start with the assumption of a causal feedback relationship with the understanding that this assumption will need to be examined carefully in the future.

Most definitions of social capital refer to connections among people. However, we may find it more useful to think of these in terms of connections per unit of population, that is,

connections per person (see further discussion below). Also, we must consider the strength or quality of these connections. That is we will also need to think about how much benefit is provided per connection.

Benefits of Social Capital

Most authors agree that the benefits of social capital are caused by interconnections among people operating primarily through the three mechanisms already mentioned. These connections help build trust which makes cooperation among individuals more likely (Fig 1) , allow individuals to exchange useful information (Fig 2) , and help establish cultural norms and procedures which govern people's behavior (Fig 3). These three modes of action create opportunities for enhanced economic, and other activity, and these activities bring benefits to individuals and to the society as a whole. Assuming the feedback structure mentioned above, we would then assumed that these benefits encourage, and perhaps require, people to maintain interpersonal links.

In the full model it will be necessary to model these different modes of action separately (as indicated in Figs 1 through 3). We need, for example, a separate sub-model explaining how connections among individuals establish cultural norms of behavior. However it may be helpful to first construct a more consolidated general model (see below) whereby the benefits of social capital are lumped together as 'benefits', and the details of the specific modes of action are left out, to be reintroduced later.

Because we are interested in the value of connections among individuals, we will probably wish to measure the benefits of social capital in terms of benefits per unit of social capital, that is: 'value/connection'. It is tempting here to use units of currency (e.g. dollars per connection), but I prefer to stick with 'value' to emphasize that benefits and costs are often not monetary.

Costs of Social Capital

Social capital is probably not free, perhaps beyond some small amount. As the number of social connections increases, time and opportunity costs to create and maintain these connections increases, eventually reaching a limiting level. That is, above some smallish number of connections, further increases become increasingly costly due to time, opportunity costs, and perhaps other constraints. This would imply that there is some optimal number above which there are diminishing returns. This also reinforces the idea that we may wish to measure social capital connections in terms of connections/person. Costs of social capital can also be defined in terms of 'value', which we can imagine as the cost of maintaining connections (cost or value/connection).

It is probably not reasonable to dismiss completely the idea that social capital could be free. Certainly under some conditions connections among neighbors, friends, and family are free. Or are they? We spend time with these people regardless of whether we expect some

benefit or not, yet the literature indicates that we actually do benefit even from informal get-togethers. However, we might argue that we also invest time, and sometimes money, in these friendships. Nevertheless, we could conclude that very basic levels of social capital, which may vary from place to place, have very low or no cost. As social capital increases above some minimum level the cost per connection rises.

Costs associated with maintaining connections should include those aspects related to the quality of the connections. That is merely chatting with someone once in awhile, while beneficial, probably has less value than cultivating a true friendship. It is also likely that the second type of "connection" is more "costly" to maintain. Thus the quality of a connection is an important consideration.

Is Population Size Important?

There may also be a threshold level, a critical minimum number of connections that must exist, before the interconnections among people are able to produce the meaningful benefits associated with social capital. We can also imagine that a person living in a community can only have meaningful contact with a limited number of people. Above I cite Gladwell (2000) who summarizes information which indicates that typical individuals rarely have more than 150 contacts and only 10 or 15 contacts who are close friends.

Based on this information it would seem that population size should be a consideration, or at least it would be useful to think of social capital in terms of average 'connections/person' not in total 'connections' within a given community.

It may not be necessary to include population size in an initial model, but we should model social capital so that we may later examine questions about the size of particular communities and the effect of this on the functioning of social capital. For example we may later wish to investigate the situation in multiethnic communities where inter-ethnic strife is often common. If bonding social capital works best in small groups then we might hypothesize that smaller multi-ethnic communities would have a lower rate of inter-ethnic strife than larger communities with the same ethnic makeup, other things being equal. We would hypothesize that once a community grows above some minimum size most interpersonal bonds and connections will be within ethnic sub-groups, and there will be less room for inter-ethnic bonds.

We may also wish to consider at what point social capital connections start to produce extra benefits. Perhaps two, three, five or even 10 people do not develop true social capital dynamics, but rather deal with each other directly as individuals.[2] But once the group gets large enough say, more than 10 individuals, then there is an additional dynamics of

[2] This assumes that social capital somehow involves dealing with people via another person, not directly. That is, networking is important... not only knowing people, but knowing people who know people, especially those people who happen to have key useful information, or are interested in mutually beneficial activities.

belonging to the 'group'. If this were the case, then bonding social capital would be most effective in groups between 10 and 150 individuals.

There is also the question, given the apparent 150 individual limit, of the spontaneous splitting of groups into subgroups. We might expect that in a village of say 100 people there might be strong bonding social capital among all of them as a group. However once that village grew to say 300 individuals we might expect subgroups to form spontaneously, with each having its own bonding social capital. At this point the change from bonding to bridging social capital would become an important issue. This problem implies that at some (future) point we may need to define, within the models, both bonding and bridging social capital. To examine these issues a fairly detailed model will be needed, one which includes both population size and sub-models for dealing with bonding and bridging social capital.

It seems likely that bridging social capital can be thought of in terms of links between people within different subgroups. This might occur, for example, via bridging groups such as school committees where people from different ethnic groups, for example, would meet and get to know each other.

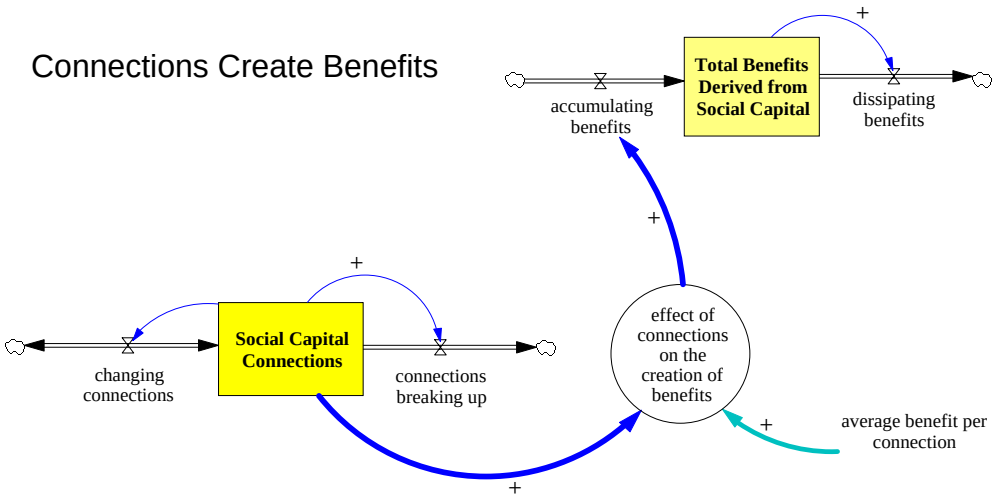

Figure 4. The basic building block of social capital is modeled as the stock of connections among individuals in a community. These connections, through mechanisms indicated in Figures 1 through 3 (shown here by the circle), create benefits which accumulate and dissipate over time. We can envision an average benefit created by a typical connection.

A Generic Model of Social Capital

The above ideas can be used to develop a generic model to define social capital. As a stock, social capital connections can gradually change due to various influences and can also dissipate over time. The key goal of an overall model is to explain how the

connections among people create benefits. Benefits also accumulate over time and dissipate as well. The detail of mechanisms by which social capital creates benefits were already examined in Figures 1 through 3. We will ignore those concepts here and will merely represent those as *effect of social capital on creation of benefits* (Figure 4).

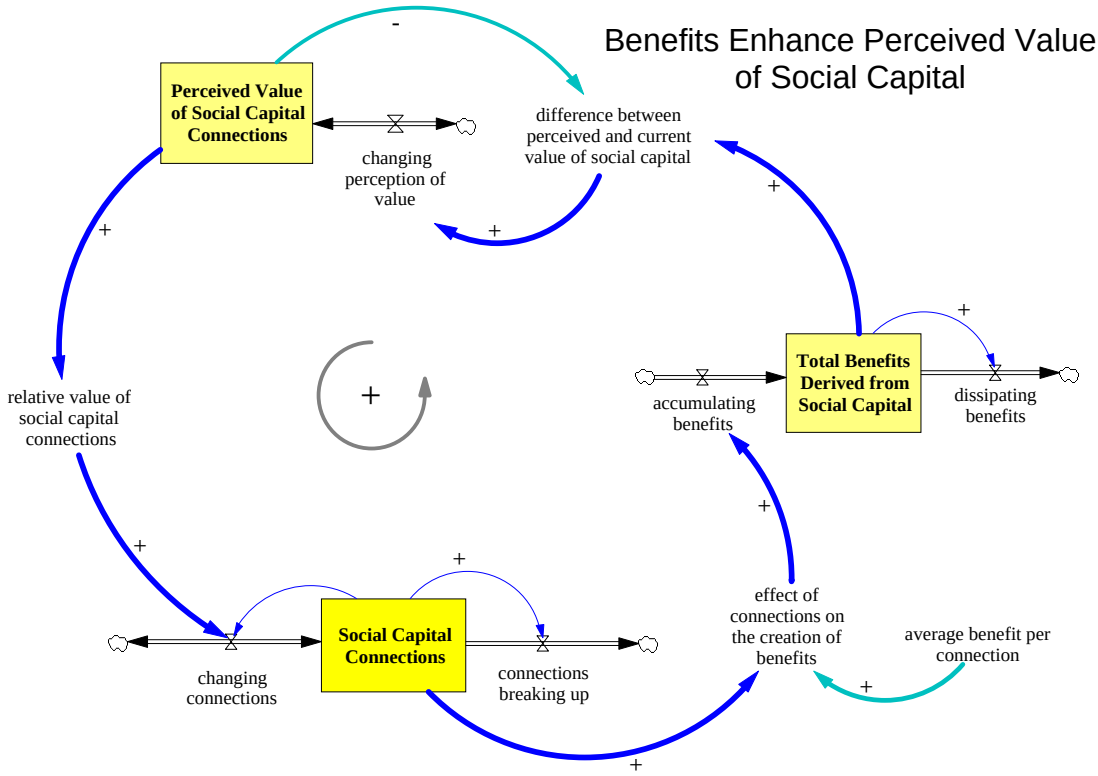

Figure 5. The benefits derived from social capital provide some value to the community and this value accumulates and persists over time. I hypothesize that this value is instrumental in increasing or maintaining social capital. However, as indicated in the text, it is conceivable that social capital connections are built and maintained by other mechanisms, and that feedback from the value of benefits created might not be important.

Social capital allows individuals to work together more smoothly producing benefits. Ultimately we would expect that somehow these benefits reinforce social capital connections. Most likely this reinforcement is not due directly to the benefits provided, but to the fact that the perceived value of these benefits is somehow linked back to social capital. As illustrated in Figure 5, the value of benefits determines the *perceived value of social capital* which will build up or dissipate fairly slowly. As the perceived value of social capital increases it may cause an increase in social capital connections depending on what additional costs are involved.

Critical here is the belief that the building and maintenance of connections is dependent on the perceived value of the benefits created. It is conceivable, and perhaps likely in some circumstances, that interpersonal connections are created by mechanisms other than those

linked to the benefits produced. On the other hand, if we define *benefits derived from social capital* very broadly then the model will be likely to fit more situations.

An obvious problem with Figure 5 is that it is a positive feedback loop, yet we certainly don't expect that number of connections will grow forever. Some factors must limit the growth, and the most obvious candidate is the cost associated with creating and maintaining connections. People spend time, and lose opportunities, when maintaining or creating social (capital) connections. We can assume that there is a *cost per connection*, and further that the average cost per connection increases as the number of connections increases. Also, the overall cost of maintaining these connections is a function of the number of connections.

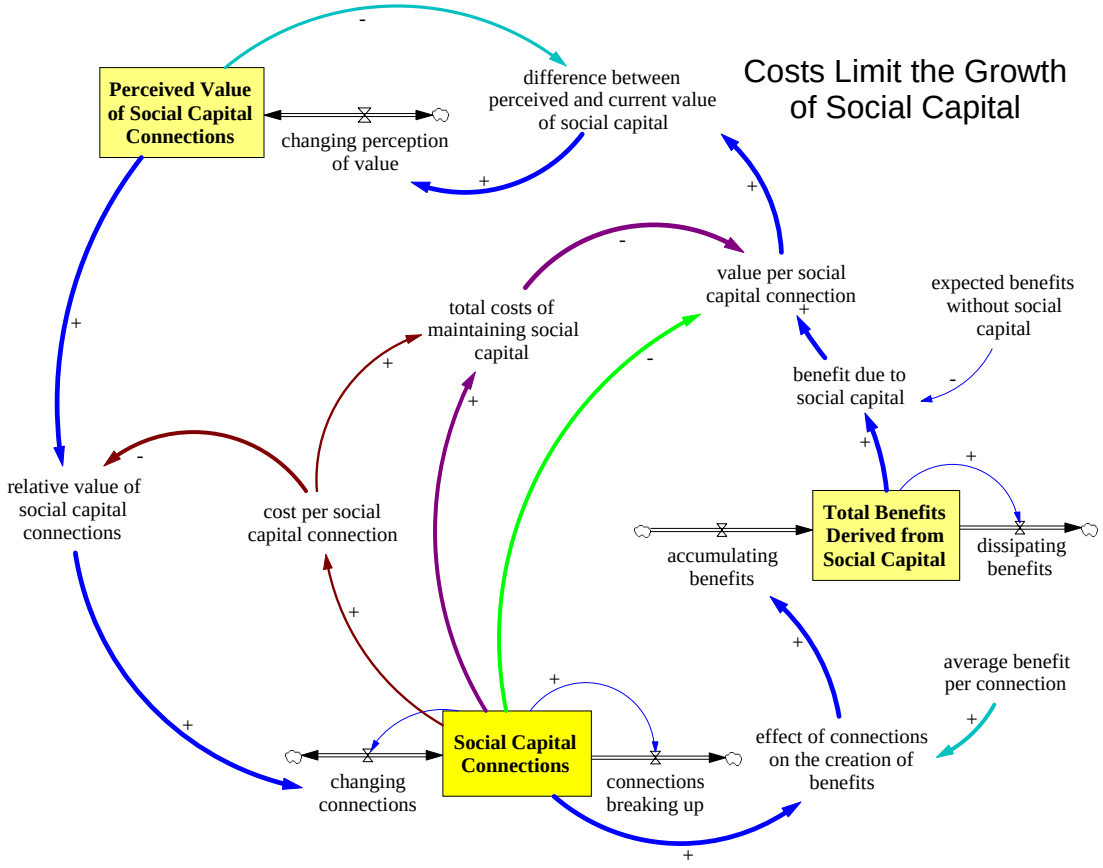

Figure 6. Since we don't expect social capital to grow forever there must be some factors limiting its growth. The most important of these is probably the costs of maintaining social capital connections.

We can also assume that the value of each unit of social capital is equal to the benefits derived from social capital minus the costs. We will want to calculate this value on a per-unit of social capital basis that is, the *value per social capital connection* (Figure 6).

Some Preliminary Results

Note: This draft paper is accompanied by one preliminary quantified system dynamics model corresponding to the generic view described above, and three stock and flow diagrams representing the preliminary structures of the modes by which social capital produces benefits, also shown in Figures 1 through 3. It is hoped that the final version of this paper will be accompanied by 4 quantified models linked together.

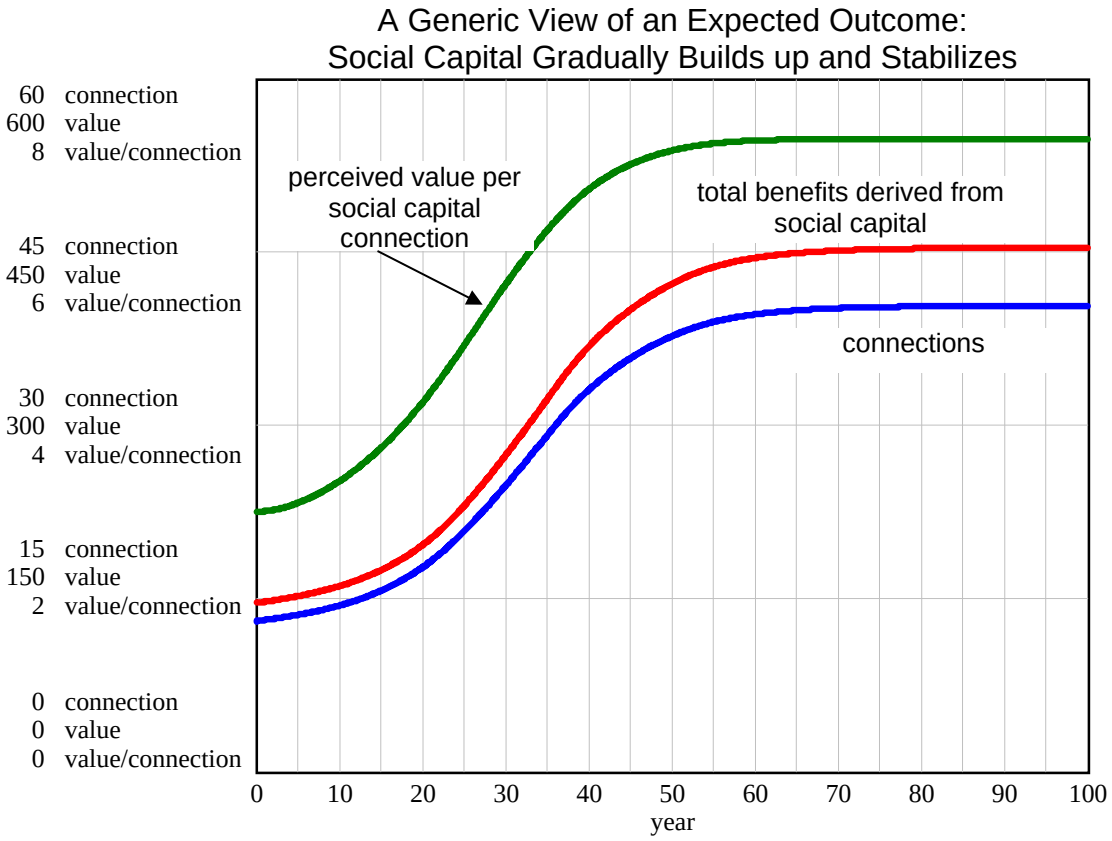

Figure 7. We might expect that in situations where social capital starts out at low levels the benefits provided will cause these levels to rise and stabilize. In some cases this is correct.

Using a model based on Fig 6 we can examine some aspects of social capital. Typically we would expect that starting with low levels of social capital we would see a build-up of benefits, perceived value, and social capital connections (Fig 7). This does occur under the right conditions.

In reality the situation can be quite a bit different. The outcome is dependent on a number of things including the initial number of connections, the value per connection and the time

constants (e.g., the time it takes for social capital connections to dissipate). Looking at one starting point and varying only the average benefit per connection we realize that there is a wide range of possible outcomes (Fig 8). Some trajectories immediately collapse and others rise and stabilize at a relatively high number of social capital connections.

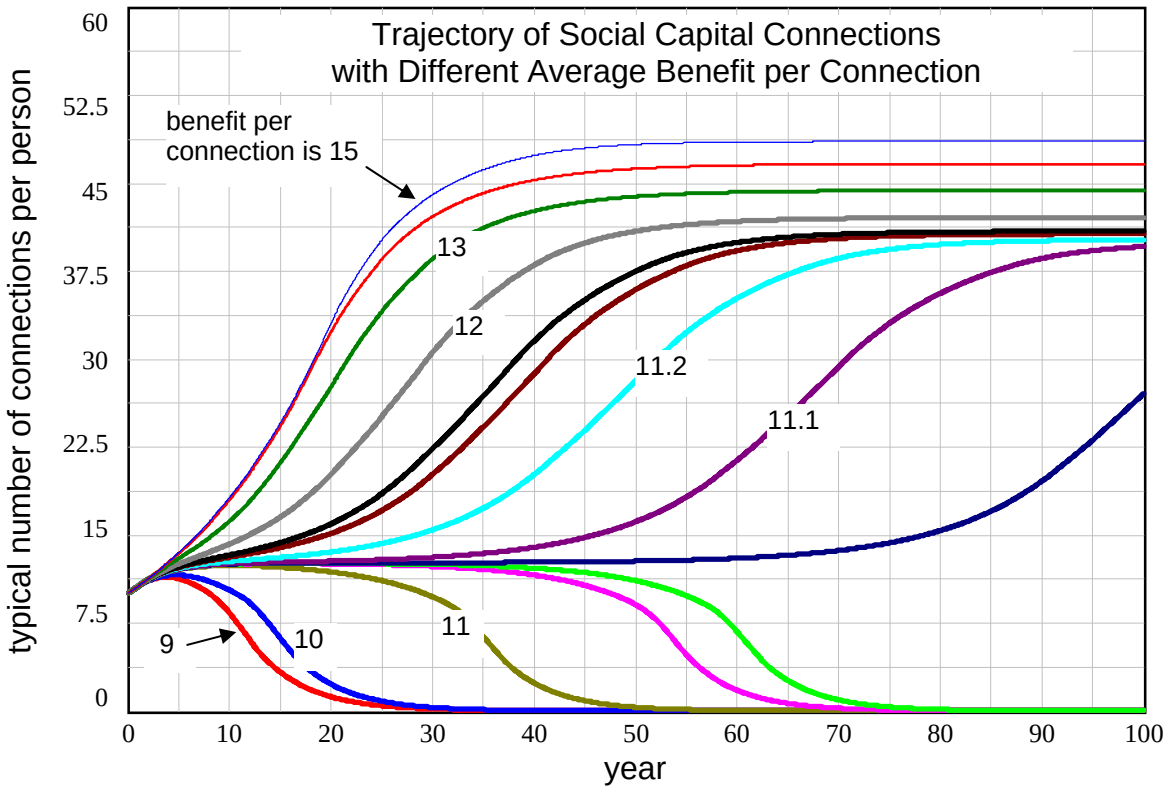

Figure 8. The importance of the value per connection on the formation of social capital is illustrated here. In cases with low value per connection social capital fails to maintain itself because the value of maintaining connections is less than the costs. In cases where the quality of the connections is high, in terms of benefits provided, social capital grows and reaches a stable level. In all runs shown here initial number of connections is 10.

One interesting question deals with the possible effects of a hypothetical development project. Here we can imagine that we have a project which will assist villagers in marketing fish they catch. Normally the villagers would use traditional connections via friends and relatives to learn about prices, modes of transport to the market, and who might be catching certain species at various times and locations. It is expected that a development project to improve fish marketing will overlap somewhat with the traditional marketing strategies, and may in some cases replace those. The effect of this overlap will be to diminish the value derived from social capital.

In our example the development project creates a value of 100 units per year compared to a stable stream of benefits of about 368 units per year from social capital connections:

roughly a 27% increase in benefits. If we assume a 100% overlap in the benefits provided by the project and those provided by existing social capital, then the outcome is as indicated in Fig 9. The project will decrease the perceived value of social capital leading to a reduction in social capital connections. Even though the project lasts only five years it takes many more years for the social capital connections to build back to the original level.

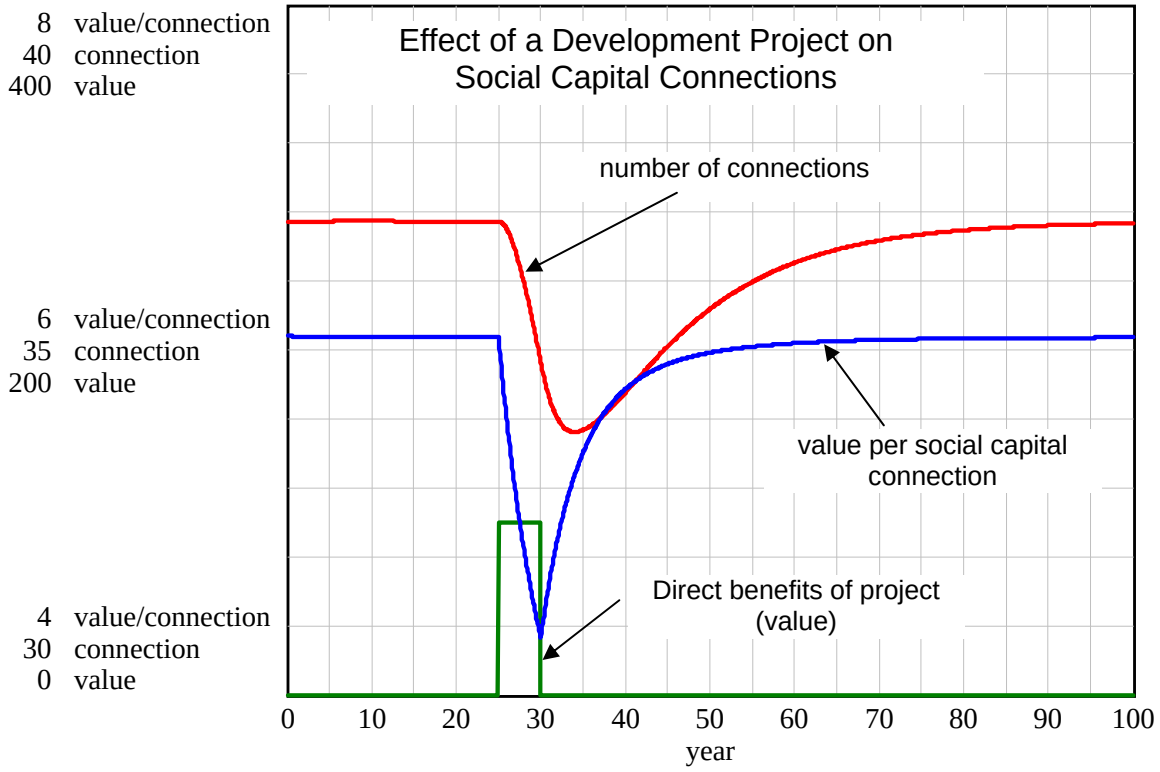

Figure 9. If benefits of a five year development project overlap with those benefits normally provided by social capital, then the value of social capital connections, and the number of connections, will drop in the period of the project. These connections will take a long time to rebuild after the project is completed. In this figure 100% overlap is assumed. Here the model has started in equilibrium.

The long-term effects of a project with different levels of overlap are examined in Fig 10. Here the benefits normally occurring without a project are subtracted from those occurring with the project. (A value of zero in this figure indicates no change). If overlap is high, then the long-term effect of the project is clearly negative. But even in cases where the overlap is lower (e.g., 50%) the overall, long-term, effect is still negative.

Clearly there are many other aspects of this model that can be examined. In particular the model helps us realize that a development project might be more effective, in cases where there is existing social capital, if we were to improve value per connection rather than directly providing benefits. For example, a project might provide access to better sources

of fish price and catch information via traditional channels. This would enhance the value of these existing channels and would improve the overall conditions for fishermen and also for the maintenance and formation of social capital.[3]

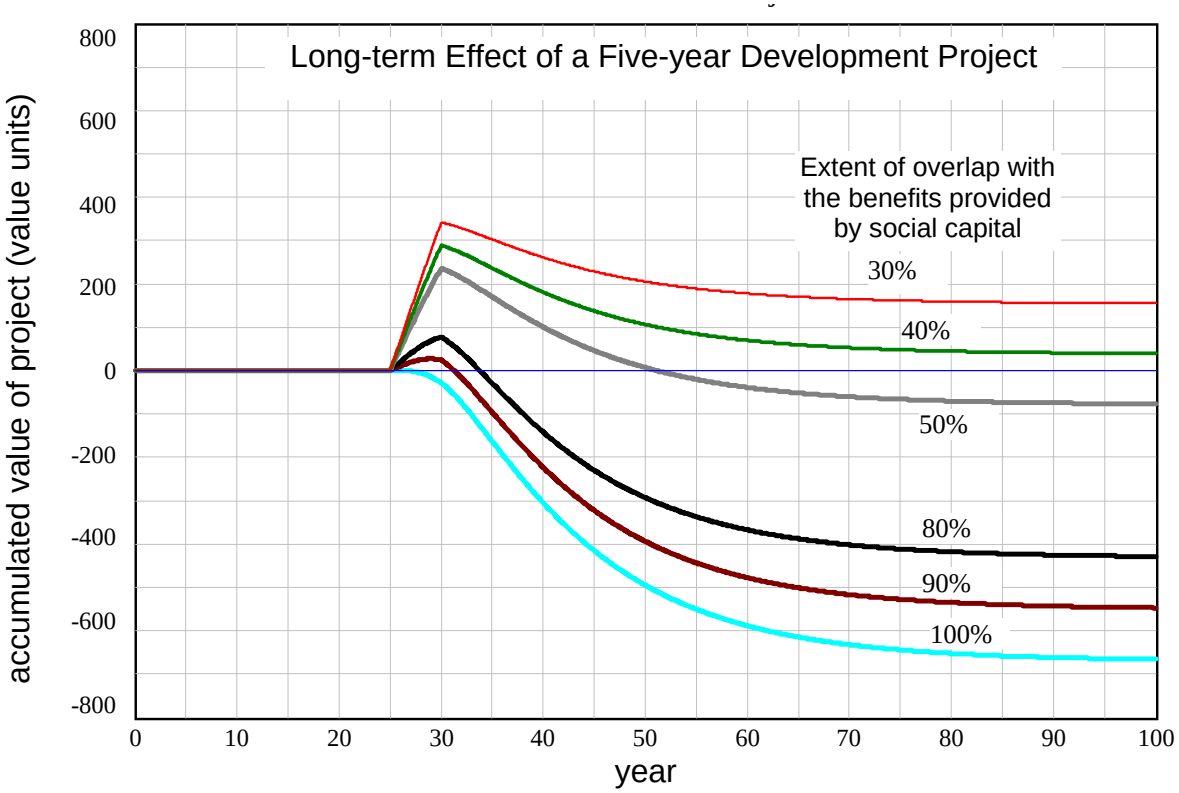

Figure 10. If benefits provided by a development project overlap significantly with benefits normally provided via social capital networks then the effect of such a project can be detrimental. Here six possible levels of overlap are displayed. Even if the overlap of benefits is only 50%, the accumulative long-term effect of the project will be negative. Importantly, benefits will appear to be positive both during the project (year 25 to 30), and for several years after it ends. If benefits overlap significantly then detrimental effects of such a project are more obvious. The rightmost end of each line indicates the overall cumulative effect of the development project.

Comparison of these two project types is presented in Fig 11. Here project benefits are scaled so that both attempt to increase benefits by about 27%. Direct benefits provided by the first project are more than offset by decreases in social capital and the benefits it provides (also see Fig 10). The second project, by enhancing value per connection, creates benefits and also helps in the creation of social capital.[4] In both cases the number of social capital connections eventually returns to the pre-project level. More realistically one might

[3] I have not discussed negative possibilities of such an approach. For example, there are some situations where small scale fishermen are at the mercy of traditional fish buyers. In such a case strengthening traditional channels may merely reinforce inequities in the system.

[4] This comparison could also be applied in reverse in cases where social capital is believed to be detrimental. That is, in some cases we may wish to weaken certain types of social capital.

suppose, depending on project design, that an improvement in benefits provided per connection could last beyond the project lifetime. In that case increases in benefits and social capital connections would be more permanent.

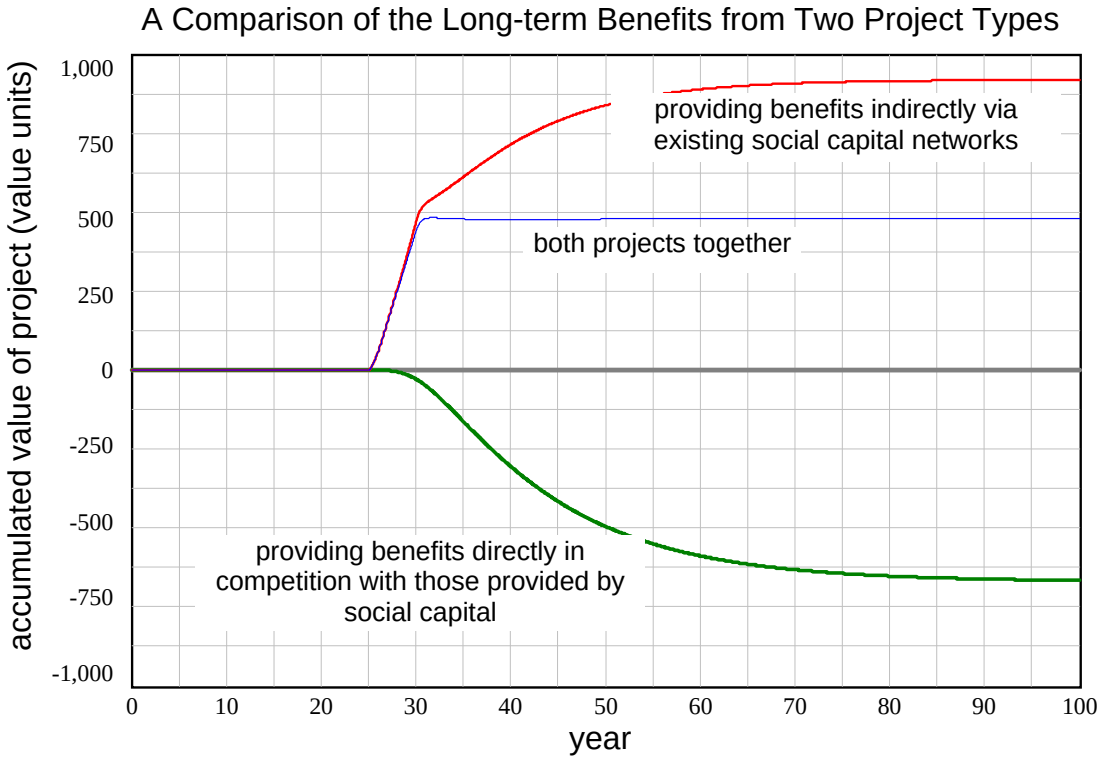

Figure 11. A project which provides benefits via existing social capital networks is clearly more effective than one which provides benefits directly in competition with those normally provided via social capital.

Can Models Improve Our Understanding of Social Capital?

The concept of social capital is sufficiently complex that it requires some framework to enhance its understanding. In fact we can define social capital by the model structures presented here. This is not to say that the structure provided is necessarily correct. But rather, it is the first step toward providing a comprehensive framework for looking at issues connected with social capital, so that the concept can be more readily understood, and measures to use that understanding more readily implemented.

The next step in developing a comprehensive model of social capital is to provide enough detail so that a more rigorous quantified models can be developed. These quantified models could then be used as a starting point to re-examine and improve the basic model structure. Ultimately a sufficiently detailed model could be used to examine issues like those discussed above: What is the interplay between bonding social capital and bridging social capital? How can the positive aspects of social capital be encouraged while avoiding

the destruction of existing social capital? What is the relationship between institutional social capital (e.g., government institutions) that might be strengthened through various development projects, and existing bonding social capital which people depend on for their day-to-day livelihood. Can these both play a positive role?

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