 Supporting Material is available for this work. For more information, follow the link from the Table of Contents to "Accessing Supporting Material".

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

Richard G. Dudley ©

Consultant

PMB#239

14845 SW Murray Scholls Dr.

Suite 110

Beaverton Oregon 97007 USA

Phone: 62-0251-318226 (Indonesia)

[rgd6@cornell.edu](mailto:rgd6@cornell.edu)

Revision of 26 August 2004

A paper prepared for presentation at the  
22nd International Conference of the System Dynamics Society  
July 25 – 29 2004

## Abstract

*Social capital is built via a 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 conceptualize and 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).

Definitions of social capital vary but usually emphasize relations among people in a community:

“[Social capital] 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 the last 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 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.<sup>1</sup> (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 have specialized knowledge. 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).

Third, **norms and effective sanctions** within a community place pressure on community members to behave in a certain, hopefully responsible, way. That is, community operating rules expect certain types of ‘responsible’ behavior and the community 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 such pressure to conform is not always good. Acceptable behavior within a group may, for example, include racist attitudes and actions toward another group. 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, or believed to have, authority. The fact that norms and sanctions can have opposite effects indicates that this mechanism is

---

<sup>1</sup> Many authors 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.

more complicated than what is indicated above. Under some circumstances norms and sanctions create community benefits, but in other situations they may stifle diversity and lock the community into a fixed behavior pattern which may be hard to change.

We might explain this latter effect with the idea that excessive rules and regulations limit creativity, initiative, and innovation (Figure 3, orange arrows). However this is only a partial explanation/description.

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.

The mechanisms discussed above are considered further, as sub-models, starting on page 15.

## ***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). Pretty

(2003) summarizes the role that social capital plays in sustainable community management of natural resources.

### **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. Bonding 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. 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 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 and the Need for Agents**

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, 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.

Krishna (2002) found that agents can play a crucial role in activating social capital networks. That is, both existing social capital networks, as well as agents to assist in activating these networks, were a necessary condition for community action. In Krishna's view social capital "may remain latent until agents activate this stock and use it to produce a flow of benefits."

## **Social Capital and International Development 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 modes 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, if a reasonable framework 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 questions listed by Debertin (1996).

The modeling effort described here is a preliminary exploration into the workings of social capital systems. It does not seek to solve a particular problem, but attempts to build a framework within which problems involving social capital might be examined and solved. Using such an approach one might be able to focus on problem oriented studies related to policy and the use of social capital.

## ***Background for Model Building***

### **Creation of Social Capital**

In a restricted sense there are two major issues which must be addressed 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. 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. An important point here is how we define “benefits”. If benefits are defined very broadly then the likelihood of a causal relationship is increased.

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, the strength or quality of these connections is also of interest. 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 a 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 norms of behavior. However it may be helpful to first construct a more consolidated general model 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 implies that there is some optimal number of connections above which there are diminishing returns. This also reinforces the idea that we may wish to measure this aspect of social capital 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.<sup>2</sup> But once the group gets large enough say, more than 10 individuals, then there is an additional dynamics of 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.

---

<sup>2</sup> 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.

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.

### ***A Generic Model of Social Capital***

The above ideas can be used to develop a basic but would 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).

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.

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).<sup>3</sup>

---

<sup>3</sup> It is conceivable however that the perceived the benefit of social capital may not include the costs of maintaining the connections. That is, people may not realize that these costs are incurred. Here I will ignore that possibility.

## Some Preliminary Results

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.

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.

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.<sup>4</sup>

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.<sup>5</sup> In both cases the number of social capital connections eventually returns to the pre-project level. More realistically one might 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.

### ***How Does Social Capital Produce Benefits -- Some Preliminary Sub-models***

The generic model presented above is sufficient to give us the general idea as to how social capital might work, but the details concerning the generation of benefits by social capital require additional model structure. Presented in this section are three tentative sub-models which parallel the structures presented in Figures 1 through 3.

It is important to model these ideas as specific sub-models the cause they are significantly different in their real world mode of operation. Also, there are very likely interactions among them. For example, social capital connections built up via cooperative activities can easily lead to beneficial information exchange unrelated to the cooperative activity at hand.<sup>6</sup>

### **Reciprocity -- Linking Trust and Cooperative Activities**

This sub-model considers the concept of trust within a community, and is based on the idea that cooperative activities enhance trust just as trust enhances the likelihood of cooperative activity. I have modeled the concept of reciprocity and mutually beneficial cooperative action with feedback loops involving the memory of beneficial activities. Memory is divided into two components, positive and negative memories, rather than a single component. This is because it is possible that memories of negative outcomes have very different effects than those resulting from positive outcomes, and I may want to examine such possibilities later. For example, significant negative experiences may linger longer than positive ones. By modeling these types of memories separately we can keep open the

---

<sup>4</sup> 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.

<sup>5</sup> 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.

<sup>6</sup> The integration of these sub-models into the overall model will have to wait for a later draft of this paper.



option for looking at this and similar issues. For example we may also want to investigate the idea of deliberately promoting activities that are likely to be successful even though they may not be particularly important (Figure 12).

Memories of successful cooperative activities not only enhance opportunities for continuing cooperative activities, but also build trust within the community which has other ramifications. Increasing trust makes it more likely that future mutual activities will be successful. That is not to say that all activities will always be successful but the probability that a given activity will be successful is enhanced by increased trust among community members. On the other hand memories of unsuccessful activities will tend to diminish trust and will also cause a more rapid dissipation of connections among community members.

Interestingly, if there are no mutual activities there can be no positive memories of such activities and no trust can be built. Mutual activities are also stimulated by external factors such as need. In situations of extreme need mutual activities are forced onto the community and can create mutual trust among community members which will linger after the emergency has passed. On the other hand, if actions during such an emergency are unhelpful then the lingering memories will be negative and the likelihood of trust diminished, leading to fewer connections among community members.

### **Information Obtained via Social Capital Networks**

This sub-model considers information derived from social capital connections. New information obtained is absorbed into a stock of potentially useful information, and this stock dissipates over time as information in it becomes outdated or is forgotten. During the time information is in the stock it has the potential to create benefits, and those benefits, also modeled as a stock, exists for some limited time. These benefits feed back to the perceived value of social capital and via that to the maintenance of social capital connections (Figure 13).

Also indicated (exogenously) are factors which might limit the ability to acquire information. Even though information is available via a network some of it may not be usable by the recipient. For example, written information is not available to those who can't read. Also indicated exogenously are those factors which may limit the ability to use information in an effective manner.

An important component of this sub-model is the concept of useful information per connection -- how much new information is available per contact on a regular basis. This is an important question which could be examined in a future models and via real world research. In a community with strong bonding social capital and few outside connections, useful information per contact may be rather low since everyone has the same information. It is also possible that new connections may play a more important role in bringing in additional knowledge than do existing connections. Thus, a turnover of connections may

be important. It is conceivable that useful information per existing connection as well as useful information per new connection might be needed in an expanded model.

### **Establishment of Community Norms and Sanctions**

The phrase “community norms and sanctions” refers to standards of behavior within a community to which community members are expected to conform. These rules of behavior are believed to stabilize a community by making community life reasonably predictable. People know what to expect under a variety of circumstances and can carry out their needed tasks without difficulty. If rules, and community standards of behavior, are weak there will be pressure to establish better rules and regulations to provide a stable operating environment. Thus as rules weaken there will be a tendency for social capital to grow because of this need.

If community norms and sanctions become overly strict people will tend to abandon their social capital connections in favor of operating as an individual or in favor of connections elsewhere. This is because overly strict rules and sanctions limit what an individual can do, and might confine activities to certain paths of endeavor. For example people may be expected to sell their produce to certain individuals within the community even though better prices are available elsewhere. As a consequence, as community rules become too strong there will be a tendency for social capital to weaken.<sup>7</sup>

The establishment and abandonment of social capital connections are affected by both influences on benefits provided: benefits resulting from sufficient community rules to allow a predictable and stable operating environment, as well as benefits resulting from sufficiently few regulations to allow creativity and innovation. These two types of benefits have the opposite effect on intra-community connections.

How do connections among individuals influence the formation of community norms and sanctions? Links among individuals within a community lead to effective rules and sanctions within that community. According to work carried out by Krishna (2002), communities with high social capital were characterized by less intra-communal violence. If people are closely connected they are more likely to know each other well. We might assume that if people knew each other well they will be more likely to settle differences in a cooperative manner. By this argument community norms and sanctions become more effective because people have a personal obligation to be respectful and cooperative. I have tentatively assumed this: increasing social capital creates increasing obligations among people and these networks of obligations are a substantial part of the rules, both formal and informal, governing behavior within a community.

---

<sup>7</sup> Under certain circumstances, such as within very tightly bound communities, the options for loosening those bonds may be very limited. That is, sometimes once strong community bonds are formed and strict community rules and regulations developed it may be very difficult for people to extract of themselves from those bonds. This may be the case in communities where people are very dependent on each other for their livelihood and there are no outside options.

One can easily imagine that in cases where social capital is very high, peoples' activity could become limited by such obligations. Norms and sanctions become oppressive. We might imagine that the effectiveness of norms and sanctions, increases as social capital increases but gradually levels off. Eventually, at least in some situations, excessive rules and regulations develop, and these may hamper the creation of overall benefits for the community. For example, it is possible that overly strong rules and regulations limit incentive and innovation.

Summarizing these preliminary ideas, moderately strong rules and regulations provide benefits to the community as a whole by creating a predictable situation in which to carry out desired activities, but excessively strict rules and regulations, whether formal or informal, can limit productivity. The effect of established community rules and procedures on success of activities consists of these two elements. A more detailed examination of the evolution of norms of behavior within a community would be very interesting, and might include an examination of how and why people come to view certain values as normal.

How does one measure the strength of community norms and sanctions? Some colleagues suggest "compliance" or "effectiveness" but I have chosen to use "firmness" which reflects both the strength of the rules and regulations as well as the extent to which they are just enforced.

A preliminary sub-model of the way in which community norms and sanctions are linked to social capital is shown in Figure 14.

### ***Many Questions for Further Investigation***

There is a lingering question as to whether feedback from the benefits provided by social capital connections are the primary causal reinforcements of those connections. If not what causes these connections to develop and persist? Can this apparent problem be largely solved if we consider "benefits" in a very generic way? For example, even just feeling good because you're hanging around with your friends could be considered a benefit. On the other hand we may want to examine different types of benefits -- how might we do that?

There is also the possibility that quality of the connections should be more explicitly described. How might that be done? What types of "connection quality" exist? Are a few high-quality connections of similar value to many normal connections? If not, how should connection quality be modeled?

Trust may be influenced directly by connections among individuals, so there may not be any need for mutually beneficial activities. The current model structure does not show that -- unless we consider mutually beneficial activities in an all-encompassing manner. What are the relationships between memories of good and bad activities and the building of trust.

Does the model accurately reflect these? Do recent memories overpower older ones? If so does this agree with the assumptions underlying the single stock structure of these memories? Should long and short term memories be modeled explicitly? Also, can excessive trust lead to unsuccessful activities under some circumstances?

Do the models accurately account for information limitation within closed communities? How important are new interpersonal connections as compared to existing connections which regularly provide new information? Do these have the same effects on the reinforcement of interpersonal connections?

Is it correct to assume that interpersonal connections create interpersonal obligations of friendship and respect, and that these are the primary way in which community norms and sanctions in the a community are reinforced? What other modes of action might allow connections among individuals to reinforce the firmness of norms and sanctions? How do the development of rules and sanctions within a community effect of the views of community members toward rules and sanctions of other communities? Under what circumstances might interpersonal respect within a community be carried over to inter community respect (bridging social capital)? How might one model such relationships? Most studies tell us that strong bonding social capital is a detriment to inter community social capital. Why does this happen and how can it be investigated?

## **Conclusions -- Can Models Improve Our Understanding of Social Capital?**

The purpose of this paper was to investigate how SD modeling might conceptualize and provide a framework for examining the phenomenon called social capital. This modeling effort indicates that social capital must be defined in terms of the model itself. That is, social capital is not something within the model, but the model itself is, or rather, the model as a whole represents, a definition and a description of the social capital system.

The question of policy interventions which make use of social capital is of particular interest. In spite of the many questions posed above, with the models presented it is easier to focus one's attention on specific elements which make up the overall concept of social capital. Emphasis might be placed on improving the ability to make use of information available via a social capital network, or alternatively on building social capital and trust by working to carry out cooperative activities that build trust. To make use of social capital it may be of more practical value to focus on some of the sub-elements which make up the overall concept.

The concept of social capital is sufficiently complex that it requires some framework to enhance its understanding. 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 sufficient model structure for a more rigorous quantified model. This quantified model 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?

## Literature Cited

- Bates R. 1999. *Ethnicity, capital formation, and conflict. Social Capital Initiative Working Paper No. 12*, World Bank, Washington, DC
- Castillo D, Saysel AK. 2003. *Dynamic simulation model of common pool resource cooperation experiments. WPSD 05/03*, The System Dynamics Group, Department of Information Science, University of Bergen, Norway, Bergen, Norway
- Coleman JS. 1988. Social capital in the creation of human capital. *American Journal of Sociology* **94**(supplement): S95-S120.
- , 1990. *Foundations of social theory*. The Belknap Press of Harvard University Press: Cambridge, MA
- Colfer CJP. 1983. On communication among 'unequals'. *International Journal of Intercultural Communication* **7**: 263-283.
- Collier P. 1998. *Social capital and poverty. Social Capital Initiative Working Paper No. 4.*, World Bank, Washington DC
- Daubon RE, Saunders HH. 2002. Operationalizing social capital: A strategy to enhance communities' "capacity to concert". *International Studies Perspectives* **3**(2): 176-191.
- Deadman PJ. 1999. Modelling individual behaviour and group performance in an intelligent agent-based simulation of the tragedy of the commons. *Journal of Environmental Management* **56**(159-172)

- Debertin DL. 1996. *A comparison of social capital in rural and urban settings*, Department of Agricultural Economics, University of Kentucky.  
<http://www.uky.edu/~deberti/socsaea.htm>.
- Falk I, Harrison L. 1998. Community learning and social capital: Just having a little chat. *Journal of Vocational and Educational Training* **50**(4)
- Falk I, Kilpatrick S. 2000. What is social capital? A study of interaction in a rural community. *Sociologia Ruralis* **40**(1): 87–110.
- Gladwell M. 2000. *The tipping point: How little things can make a big difference*. Little, Brown and Co.: Boston. 280 pp.
- Granovetter M. 1973. The strength of weak ties. *American Journal of Sociology* **78**(6): 1360-1380.
- Grootaert C. 1998. *Social capital: The missing link? Social Capital Initiative Working Paper No. 3*, World Bank, Washington, DC
- Grootaert C, Bastelaer Tv. 2001. *Understanding and measuring social capital: A synthesis of findings and recommendations from the social capital initiative. Social Capital Initiative Working Paper No. 24*, World Bank, Washington DC
- Hirschman AO. 1984. *Getting ahead collectively: Grassroots experiences in latin america*. Pergamon Press: New York
- Kameda T, Ohtsubo Y, Takezawa M. 1997. Centrality in sociocognitive networks and social influence: An illustration in a group decision-making context. *Journal of Personality and Social Psychology* **73**(2): 296-309.
- Kleinfeld JS. 2002. The small world problem. *Society* **39**(2): 61-66.
- Krishna A. 2002. *Active social capital, tracing the roots of development and democracy*. Columbia University Press: New York. 252 pp.
- Krishna A, Uphoff N. 1999. *Mapping and measuring social capital: A conceptual and empirical study of collective action for conserving and developing watersheds in rajasthan, india. Social Capital Initiative Working Paper No. 13*
- Milgram S. 1967. The small world problem. *Psychology Today* **1**: 60 -- 67.
- Narayan D, Prichett L. 1999. Cents and sociability: Household income and social capital in rural Tanzania. *Economic Development and Cultural Change* **47**(4): 871–897.
- Ostrom E. 1990. *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press: Cambridge. 280 pp.

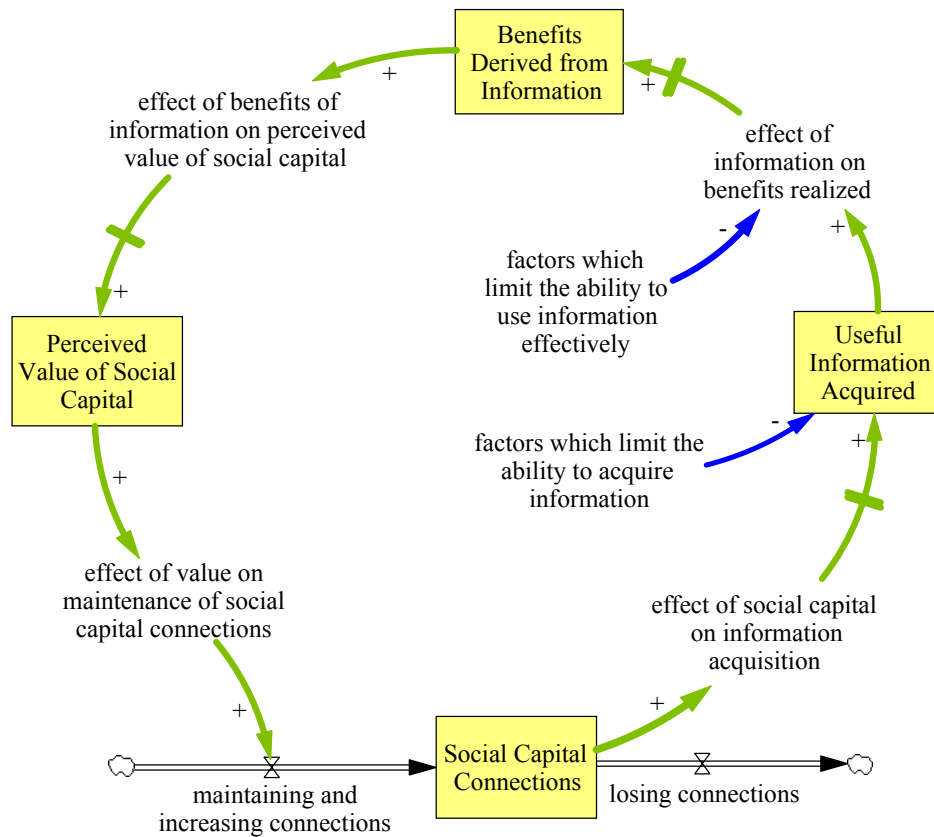
- , 1998. A behavioral approach to the rational choice theory of collective action. *American Political Science Review* **92**(1): 1-22.
- Paldam M, Svendsen GT. 1999. *Is social capital an effective smoke condenser? An essay on a concept linking the social sciences. Social Capital Initiative Working Paper No. 11*, World Bank, Washington, DC
- Pantoja E. 1999. *Exploring the concept of social capital and its relevance for community-based development: The case of coal mining areas in Orissa, India. Social Capital Initiative Working Paper No. 18*, World Bank, Washington, DC
- Pretty J. 2003. Social capital and the collective management of resources. *Science* **302**(5652): 1912-1914.
- Putnam RD. 1995. Bowling alone: America's declining social capital. *Journal of Democracy* **6**: 65-78.
- , 2000. *Bowling alone : The collapse and revival of American community*. Touchstone Books: New York, NY
- Putnam RD, Leonardi R, Nanetti RY. 1993. *Making democracy work: Civic traditions in modern Italy*. Princeton University Press
- Robalino DA. 2000. *Social capital, technology diffusion and sustainable growth in the developing world. RGSD-151*, RAND
- Rose R. 1998. *Getting things done in an anti-modern society: Social capital networks in Russia. Social Capital Initiative Working Paper No. 6*, World Bank, Washington, DC
- Torsvik G. 2000. Social capital and economic development: A plea for the mechanisms. *Rationality and Society* **12**(4): 451-476.
- Uphoff N. 2000. Understanding social capital: Learning from the analysis and experience of participation. In *Social capital: A multifaceted perspective*. Dasgupta P, Serageldin I (eds). World Bank
- Watts DJ, Strogatz SH. 1998. Collective dynamics of 'small-world' networks. *Nature* **393**: 440-442.
- Wegner DM, Raymond P, Erber R. 1991. Transactive memory in close relationships. *Journal of Personality and Social Psychology* **61**(6): 923-929.
- Woolcock M. 2001. The place of social capital in understanding social and economic outcomes. *Isuma: Canadian Journal of Policy Research* **2**(1): 11 - 17.

Woolcock M, Narayan D. 2000. Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer* **15**(2): 225-249.



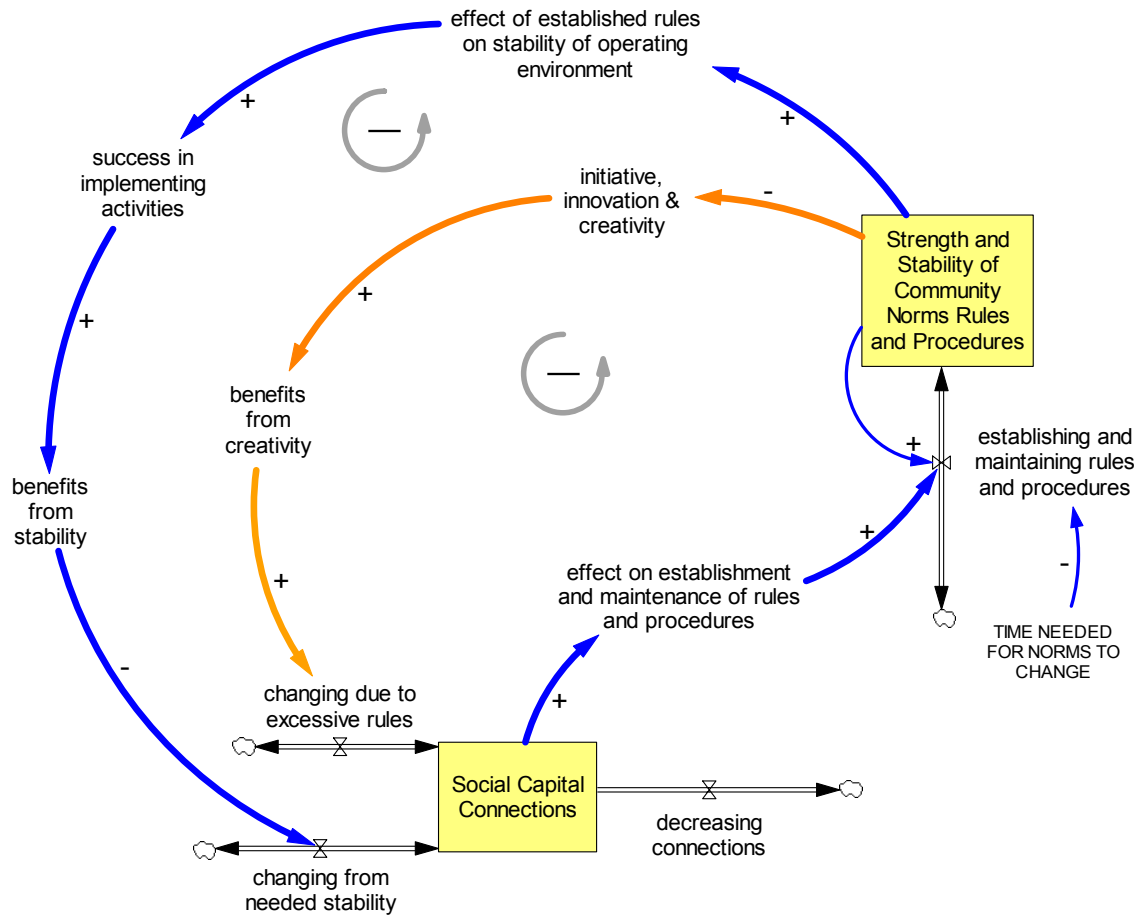


## Information Channels Provided Benefits

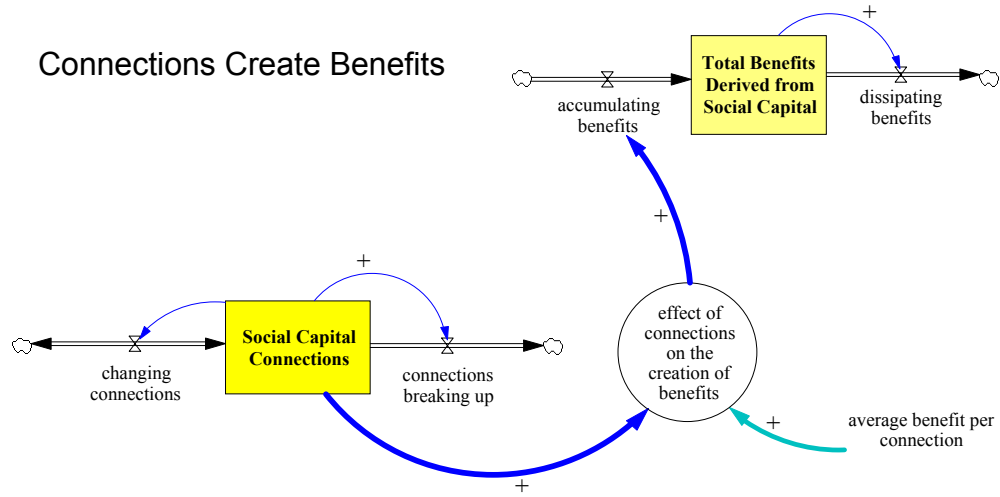


**Figure 2.** This simplified diagram illustrates how information channels within a community can generate benefits which reinforce social capital. Also illustrated here are possible model components which might limit the effectiveness of information channels. For example, low literacy within the community might be a factor that limits their ability to acquire, or use, information. Also see Figure 13.

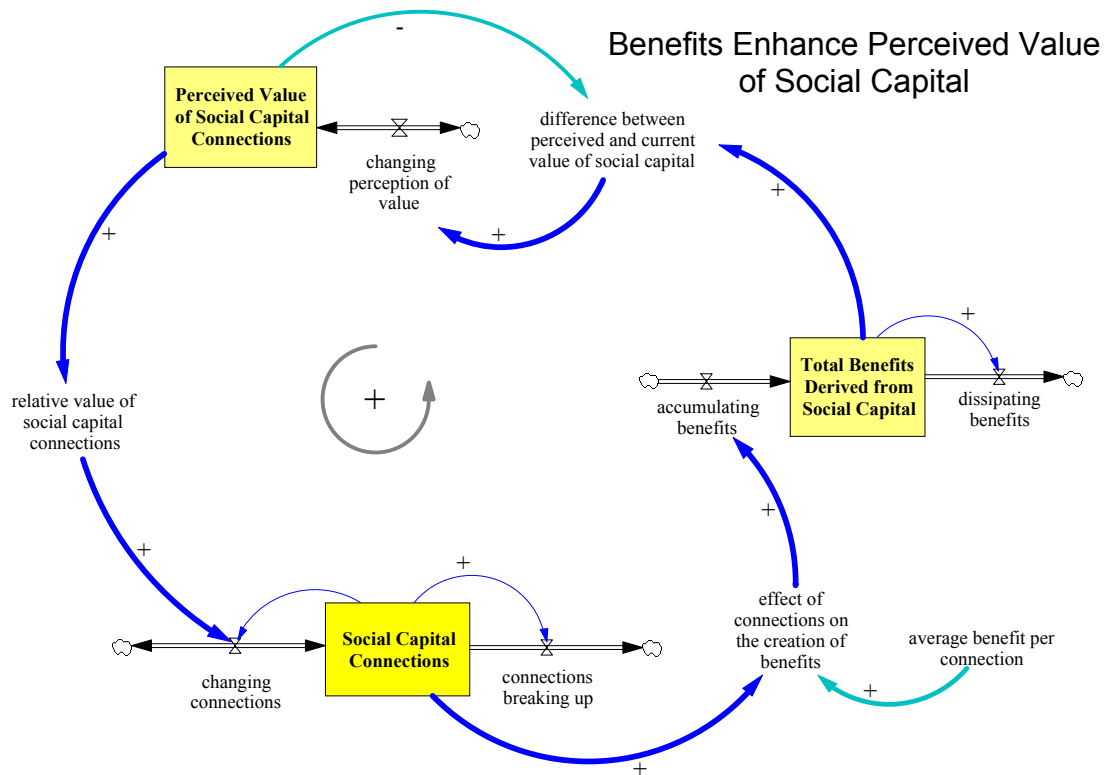
### Community Rules and Procedures Alter Benefits Resulting from Activities Attempted



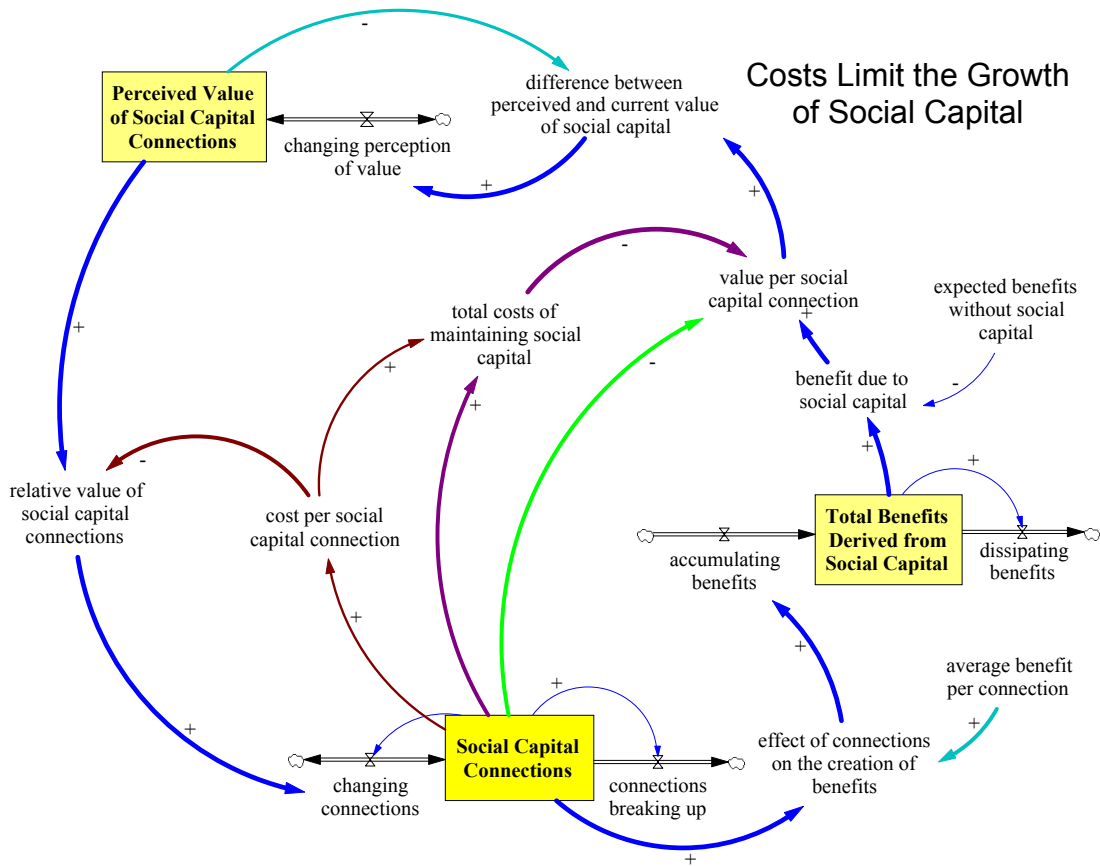
**Figure 3.** This diagram illustrates how community rules and procedures can lead to more successful activities which in turn can reinforce social capital. Obligations among community members cause a positive effect on establishment and maintenance of rules and procedures which reinforces community rules and procedures. Also illustrated (orange arrows) is how excessive rules and regulations may limit initiative and innovation and lead to a decrease in connections. Also see Figure 14.



**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.

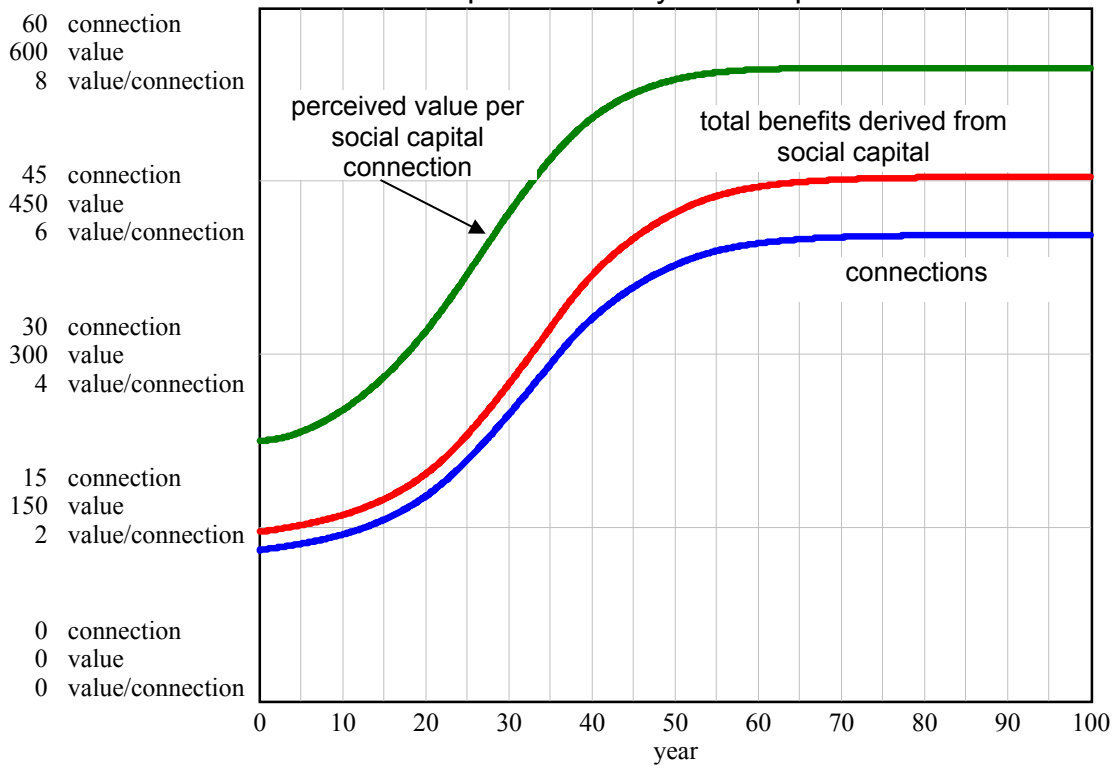


**Figure 5.** The benefits derived from social capital provide some value to the community and this value accumulates and persists over time. I hypothesize that this value is instrumental in increasing or maintaining social capital. However, as indicated in the text, it is conceivable that social capital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

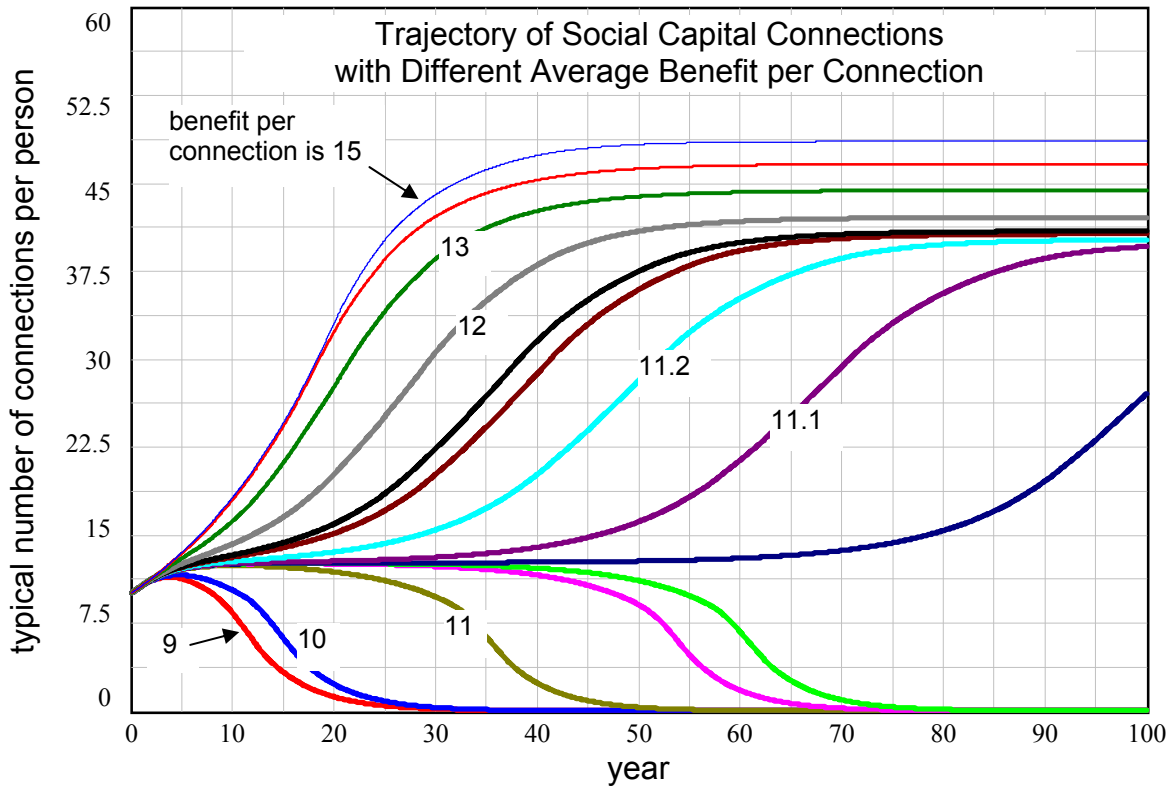


**Figure 6.** Since we don't expect social capital to grow forever there must be some factors limiting its growth. The most important of these is probably the costs of maintaining social capital connections.

### A Generic View of an Expected Outcome: Social Capital Gradually Builds up and Stabilizes

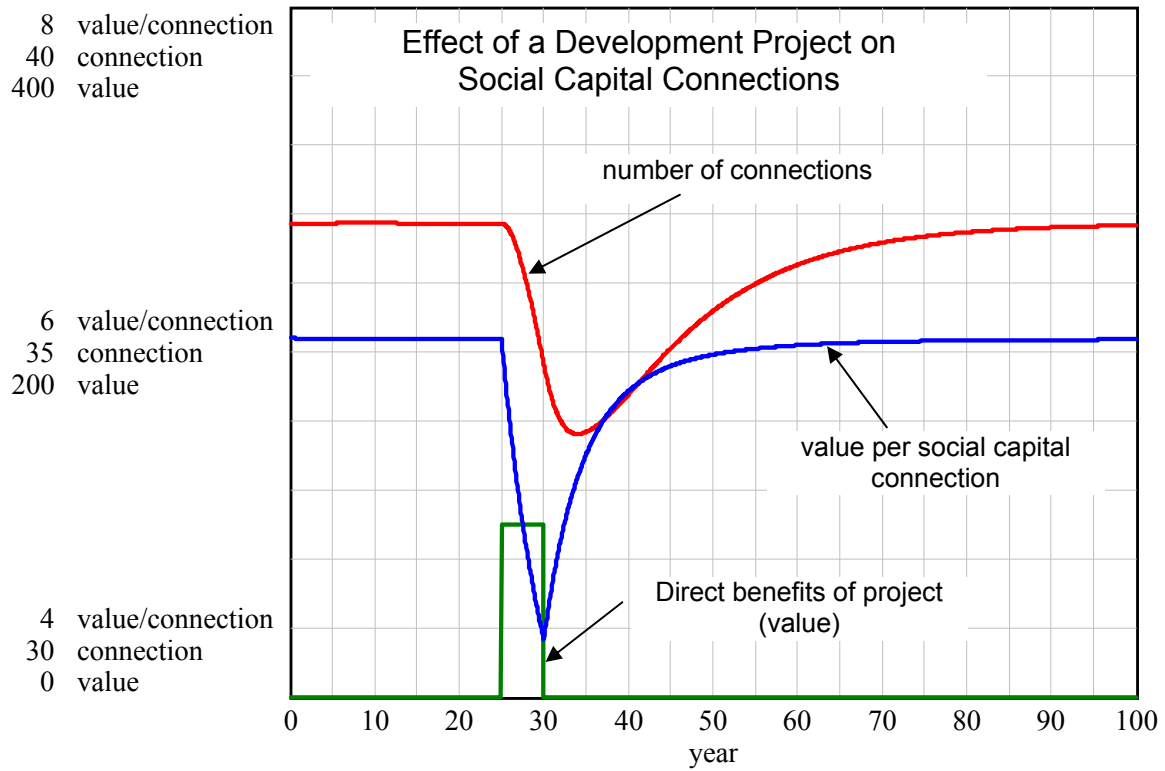


**Figure 7.** We might expect that in situations where social capital starts out at low levels the benefits provided will cause these levels to rise and stabilize. In some cases this is correct.

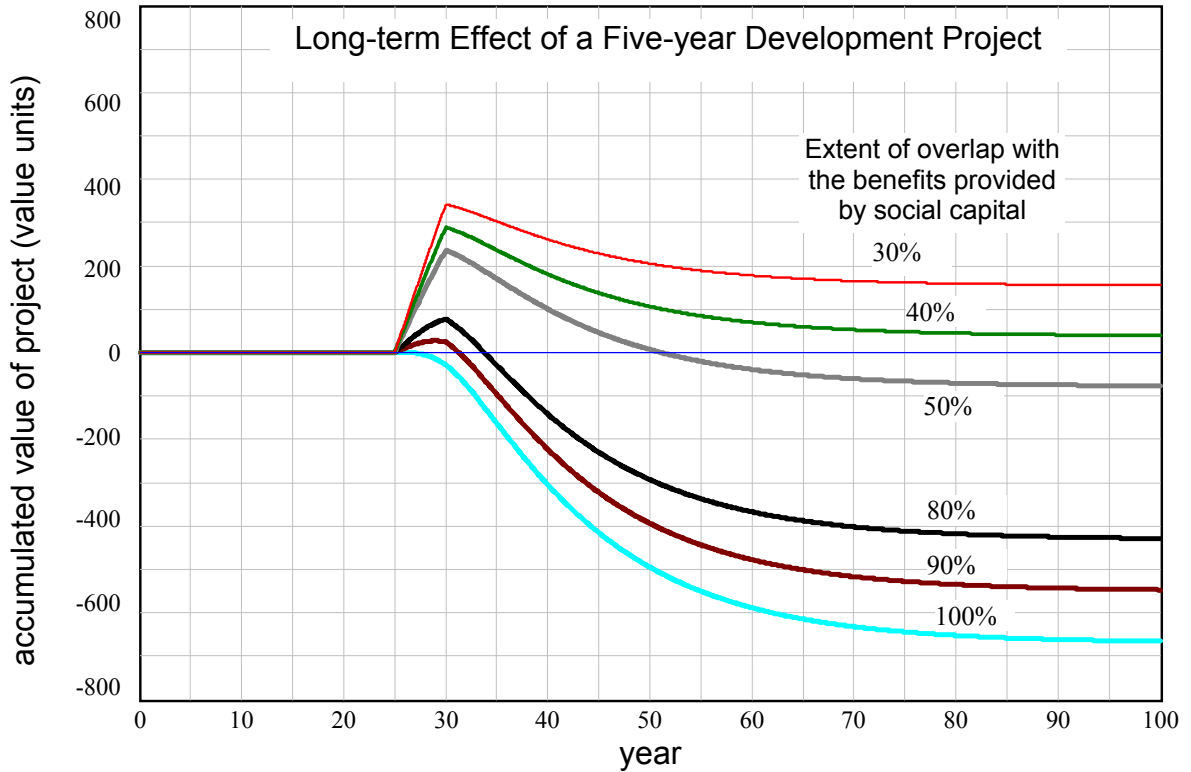


**Figure 8.** The importance of the value per connection on the formation of social capital is illustrated here. In cases with low value per connection social capital fails to maintain itself because the value of maintaining connections is less than the costs. In cases where the quality of the connections 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.



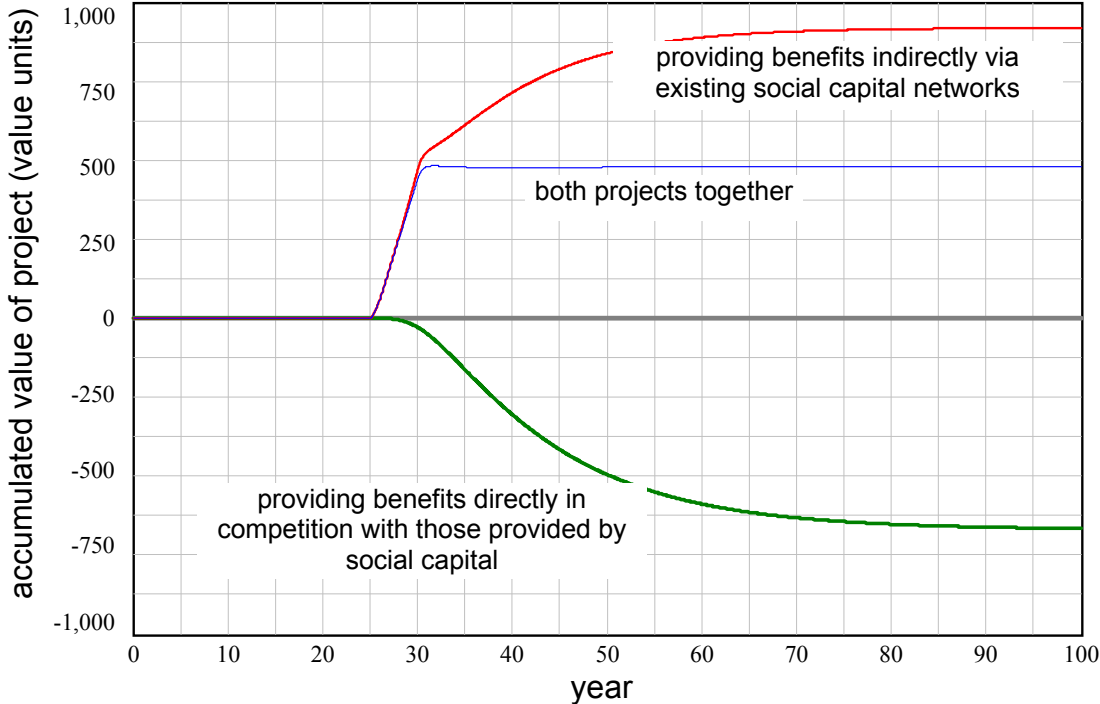


**Figure 9.** If benefits of a five year development project overlap with those benefits normally provided by social capital, then the value of social capital connections, and the number of connections, will drop in the period of the project. These connections will take a long time to rebuild after the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



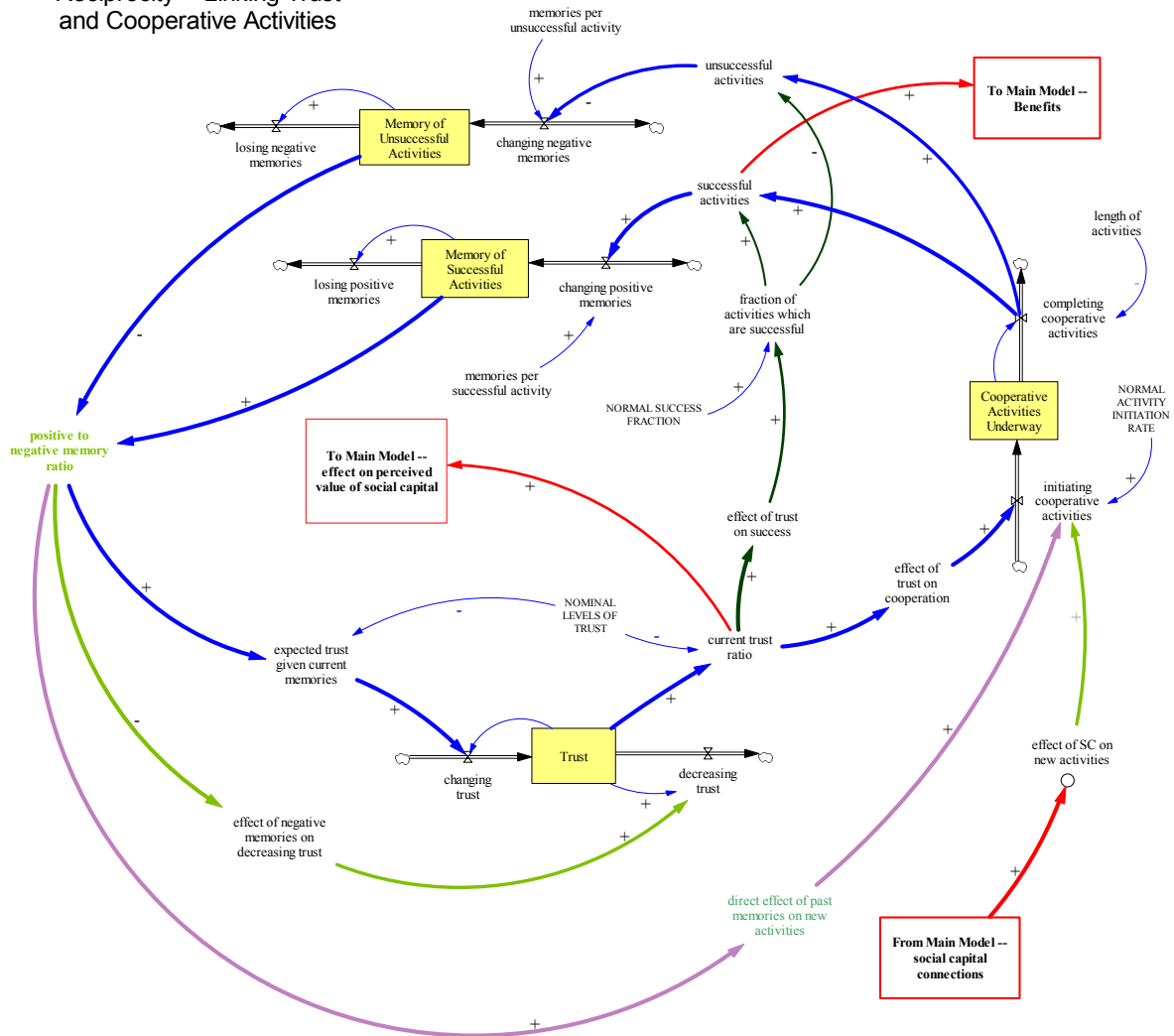
**Figure 10.** If benefits provided by a development project overlap significantly with benefits normally provided via social capital networks then the effect of such a project can be detrimental. Here six possible levels of overlap are displayed. Even if the overlap of benefits is only 50%, the accumulative 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.

A Comparison of the Long-term Benefits from Two Project Types



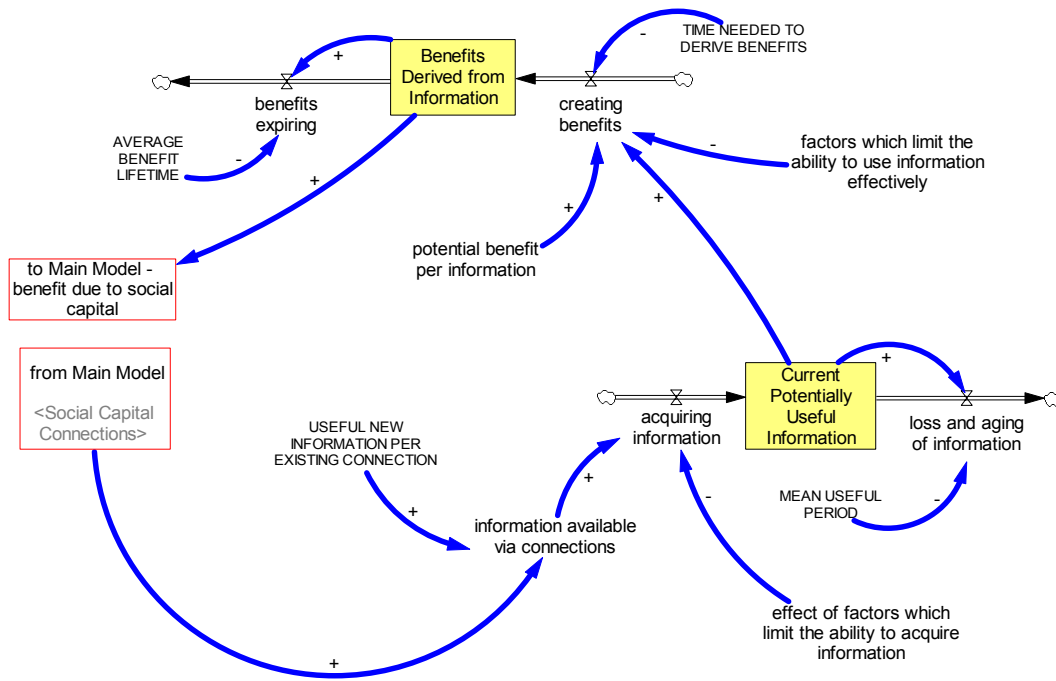
**Figure 11.** A project which provides benefits via existing social capital networks is clearly more effective than one which provides benefits directly in competition with those normally provided via social capital.

## Reciprocity -- Linking Trust and Cooperative Activities



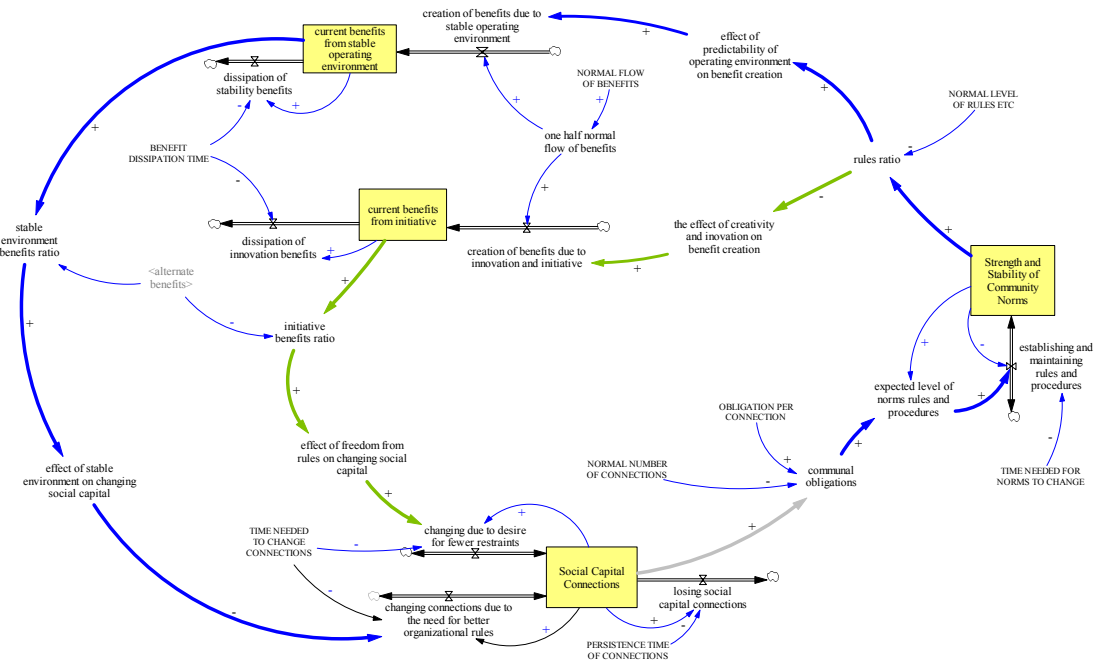
**Figure 12.** A preliminary sub-model which describes the relationship between trust and cooperative action and social capital connections. For clarity some model components are not shown. This is a follow-up to Figure 1.

### Information Obtained a Via Social Capital Networks



**Figure 13.** A preliminary sub model examining how information is provided via social capital networks. The boxes to the left indicate how this sub model connects to the main model. This is a follow-up to Figure 2.

### Community Norms, Benefits, and Social Capital Connections



**Figure 14.** The relationship between the strength and stability of community norms, rules and sanctions and the production of benefits for community members. Benefits are produced via two mechanisms. A stable community environment allows community members to carry out tasks without hindrance, but excessive rules can also limit productivity by limiting innovation, initiative, and creativity. This is a follow-up to Figure 3. Connections to main model would be via social capital connections and the two stocks of benefits.