

The Proto-Sustainable Chinese Village as Generator of the Future Chinese City

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INTRODUCTION

China is currently undergoing a massive unprecedented urbanization and industrialization program. Within the next five to ten years a minimum of 200 million Chinese farmers will leave their villages to become factory workers in hundreds of new towns and cities. There are strong indicators that from an economic, social, cultural and environmental point of view, China's cities will be massively unsustainable with dire consequences for both China as well as the rest of the planet. It is vital that a sustainable alternative to this unwise development be pursued.

The European Commission has sponsored a research program in China called "SUCCESS", whose goal has been to forge a sustainable future for the Chinese village. It has worked with seven villages in six Chinese provinces, initiating Civil Society processes having the potential of increasing the life quality and economic potential of the villages through sustainability oriented means. Teams of villagers have been working with forty researchers from China, Europe and the US on the one hand asking the question "what to maintain and what to change?" and on the other hand, creating alternative scenarios of possible futures for the villages.

The scenario-building process takes its structure from the architectural design process, and at the same time employs both scientific analytical methods and systems modeling feedback tools. The current metabolism of the villages is studied and modeled and unsustainable practices (i.e. the use of fossil fuels, agricultural chemicals, unsound agricultural practices, etc.) are replaced in the model with sustainability oriented equivalents. Future alternatives are developed as systems models of present and future scenarios. "What-if" questions are then posed and the different scenarios are modeled to assess both their balance as well as their performance in the village-as-a-system. Scenarios are each balanced within their natural budget or what we call their Sustainable Area Budget, assuring that any scenario that is eventually pursued satisfies the criteria of sustainability.

With the experience of modeling the Chinese village and projecting it into the future on a sustainable basis having been established, the Chinese sustainable village is used as the starting

point for larger towns and cities whose growth and development proceeds through this same sustainable scenario building model to develop diverse, vibrant new towns for China's future. This prospect is presented both as a systems model as well as an architectural/urbanistic model.

VILLAGE AS A GENERATOR

The traditional Chinese village has slowly evolved over thousands of years and represents a natural point upon an evolutionary path of sustainable human settlements. Over the course of time, different cultural and architectural typologies sprung up and crystallized in these villages, each unique to its geographic location. The villages were pulled into the 20th century at an alarming rate when compared to the slow and natural traditional evolutionary process that had brought them up to this point. As a result, their local culture, architecture, and most importantly, sustainability, is being threatened by this rapid and uncontrolled modernization. For example, the advent of electricity with its unfamiliarly rapid introduction has not had time to be embraced by and incorporated into the traditional village architecture, so the elegant hand-crafted wooden beams which are a part of a naturally evolved construction system presently have wires crudely nailed to them, marring the generations-old traditions that have created an internally balanced system. This is exemplary of what is happening on a larger scale with the metropolises of China not having enough time to adjust to their rapid industrial expansion. These economically booming cities are uncontrollably overflowing onto the traditional Chinese landscape damaging its sustainable lineage.

However, the Chinese village, unlike the Chinese metropolis, in spite of the few foreign bodies that have crept their way into the system, for the most part, still produces its own food, manages its own waste, and feels the effects of its own problems. For this reason, the "SUCCESS" project has identified the traditional village as an appropriate place to begin to implement sustainability processes for the future Chinese sustainable town. That is to say, the villages can provide a model for future Chinese sustainable development. First, the few unsustainable traits of the village-as-a-system at present must be eliminated and replaced by sustainable counterparts. Then it will be possible to evolve future, much larger towns from these nodes that are already working within sustainability processes.

SUSTAINABILITY AS A SYSTEMIC BALANCING PROCESS

If the future Chinese village, evolved as a modern town, were to incorporate many of the widely published sustainability principles and, as a result, create scattered individual “green” projects, this in itself would be no demonstration of sustainability. In fact, it is important to note that it is not possible on a case-by-case basis to establish particular standards that in the aggregate would constitute sustainability. This is because sustainability is an ongoing re-balancing urban design process that functions only when developed as a whole system. For example, it is not useful in a sustainability regime to establish the criteria for maximum CO₂ emissions for a given factory. Rather, a whole sustainable town-region would have to balance out the CO₂ emissions within its region. If it chose to allocate a particular factory with a large part of that budget due to its great importance in the town-system, this would be perfectly acceptable as long as the budget of the town-system were not exceeded. That is to say, as long as, on a net basis, excess CO₂ was not exported beyond the town-region. It would be most unfortunate if the industrialization of the proto-sustainable villages proceeded based upon the “best environmental practices” of the present. This is because, as should be clear, even many of the best practices of the present will become unacceptable practices in the future. On the other hand, a town-region that has negotiated its urban processes within its ecological budget (Sustainable Area Budget or SAB) cannot become obsolete in the future.

The sustainable Chinese town of the future is certain to become a highly desirable location for industry, tourism, investment, and residence. What needs to be kept very much under control are the terms and circumstances by which development can occur. The traditional Chinese village is an excellent candidate for the application of such a sustainability process as we have developed.

THE SUSTAINABLE TOWN-REGION

METROPOLIS VS VILLAGE

The Sustainable Town-Region (STR) is the sort of new urban model that is particularly well suited for Chinese development conditions. This model is of a very dense urban design for a small town that incorporates all of the economic activities, occupations, services, and industries that would be both necessary and desirable in the small sustainable town of the future. It is small enough to be of a walkable pedestrian scale, and thus requires few vehicles. It would be

surrounded by a large agricultural area corresponding to its population-based Sustainable Area Budget. This area would be large enough to supply all of the land-based resources (energy, food, water, etc.) to sustain its industry and way of life. The town would be small enough to be affordable to build, and be buildable in a short period of time. With its success, it would provide the momentum and enthusiasm for the building of more and more sustainable town-regions, each with somewhat different activities and industries. A network of such STR's would be linked by public transportation. The projects would be an example of both sustainability principles and processes, as well as a demonstration of a desirable way to live. This process of development would be much more amenable to mirroring traditional Chinese urban and residential patterns than are the many foreign-influenced unsustainable urban patterns that are now emerging all over China. The new urban model that we have developed for China is small enough to be walkable yet large enough to have the full range of urban services and opportunities and dense enough to maximize urban qualities and amenities, all surrounded by its Sustainable Area Budget determined land area to provide all of the land based resources (food, energy, etc.) to sustain the resulting human-scaled town. Because of the limited size of each Sustainable Town-Region, there is little need for vehicular transportation within the town (only delivery and emergency vehicles) and many different STR's would eventually be linked by an efficient system of public transportation.

The sustainable town is conceived as a learning ecology. In other words, it learns from its successes as well as its mistakes. It avoids the American urban illness of urban sprawl. It also avoids the Western reliance on the automobile, which is a force that exacerbates every other urban problem. Our analysis clearly demonstrates that a rapid increase of private ownership of automobiles in China will quickly clog existing cities and make the development of new sustainable cities impossible. The Sustainable Town-Region is the smallest significant piece that can stand on its own as the minimum unit of sustainable development.

IMPLEMENTING THE SUSTAINABLE TOWN PROCESS

After having selected the proto-sustainable traditional Chinese village, for the sustainable town project to be carried out, it is vitally important to get the process right. The process is carried out in conjunction with the operational definition of sustainability as we have developed as principal authors of the European Charter of Cities and Towns Toward Sustainability and as developed

further by our Center for Sustainable Cities in our different projects. In China, sustainable development will take on a very different form than it will in Europe under the Charter. This is because Europe is a continent of mature towns and cities, and development must inherently mean gradual change within these existing towns and cities. In China, studies have projected an incipient migration unparalleled in human history. A minimum of 200,000,000 rural farmers are to become industrial workers in large new towns within the next 5-10 years. This will necessitate numerous new towns and major expansions of existing towns. Thus, there is the possibility, and arguably a necessity, for new kinds of urban structures that have not been seen before, as well as new kinds of urban governance and management. A vast array of new choices will be opened up that are not possible in either Europe or the United States.

The sustainability process in Europe relies on the presence of participatory, bottom-up citizen-stakeholder activity. The kinds of processes for gradual change that are being institutionalized in Europe according to the principles of the Charter have a great deal of such citizen participation. With major new developments such as the hundreds of new towns, cropping up within the space of just a few years in China, processes with a strong citizen participation, bottom-up character are not likely or feasible. This carries some inherent disadvantages, but also some significant advantages if the people and institutions that will shape the towns are chosen in an appropriate manner.

In shaping a new or greatly transformed village or town to operate according to sustainability principles, a team of experts, technicians, and potential stakeholders and citizens would be assembled to play the "sustainable town game." Initially, the sustainable town game is set up by researchers and consultants as a systems modeling process at the town-region scale. The information database is filled with documents and embedded with all of the relevant local characteristics relating to economy, environment, social and cultural conditions.

The team of participant-stakeholders will include experts from many different disciplines, but experts who at the same time have a strong background in sustainability principles as well as in collaborative efforts and participatory processes. It will also include systems model builders and technicians as well as architects and urban designers skilled in working with sustainability oriented concepts. From this point, the participants will work with a variety of town-region scenarios. Some of these may have been prepared beforehand by any of the stakeholder-participants or by the experts and technicians, but the scenarios can also arise out of interaction and collaboration

between the different participants during the “game” process itself. After three or more of these scenarios have been designed or negotiated, they are then subject to testing and evaluation through a systems analysis using the Sustainability Engine™. The feedback obtained in this process will give a solid indication of the ways in which the different aspects of the town-region scenario are working well, and also reveal the aspects that are far from being in balance within the system. In the early iterations of this process, it is to be expected that many aspects of these scenarios will be far from their balance points. Since the main criterion for sustainability is that a sustainable town-region be operating near the balance points of the system or approaching its balance points, it becomes clear what issues must be addressed in the next iteration of this scenario-building sustainability game. After feedback from the Engine has been obtained, the participants take stock in contemplating subsequent moves and modifying the scenarios. New ideas and suggestions can come from any quarter. When a number of different scenarios are in play, it also becomes clear to the participants that each of these scenarios has strengths as well as weaknesses. The playing of the “sustainable town game” becomes a process of working with the strengths of the competing scenarios while at the same time trying to eliminate their weaknesses.

After a number of iterations of this process, each of the surviving scenarios becomes more complex, more comprehensive, and more robust. At the same time, there is a strong tendency for each of these scenarios to have taken into account and responded to all of the diverse stakeholder interests. Through this process, each of the participants gains a sense of ownership, of both the process as well as each of the emergent scenarios. The sustainable town, first as a game, and later as an actual town to be constructed and managed through a continuation of this stakeholder process, gains the confidence, support, and emotional ownership of all of the participants.

SYSTEMS MODELING WITH THE SUSTAINABILITY ENGINE™

The feedback tool in this alternative scenario building process is a systems modeling tool we call the Sustainability Engine™. The Sustainability Engine™ is a software system that is still under development and in its early form is based on the STELLA software. At present, it is just a mathematical model into which data from the alternative scenarios is plotted on a systems diagram of each scenario. The system is run under a variety of “what if” scenarios in efforts to both balance as well as maximize the performance of the town system. In subsequent versions of the engine, it

is anticipated that actual Computer-Aided Design and Geographic Information Systems models of the different scenarios will be used, and a much more user-friendly interface will be developed. In the advanced version, which is now under development, there are diagrams of the village system associated with plans and images of the alternative town scenarios being developed. Thus, ordinary townspeople will find it easier to enter their ideas and preferences into the "what-if" scenario modeling process and will be able to view images of the urban consequences as well as get feedback as to any quantitative performance data.

In the "SUCCESS" project, which is just being completed, such a systems modeling process was developed for Chinese villages. The Chinese village is of course smaller and simpler than a town, but its system characteristics can be modeled in much the same way. For demonstration purposes, we have developed some very simple systems models of a village named Dujia, in South-Western Yunnan province. The modeling process is demonstrated in several sections below. The first sections explain how to make a systems model and how a systems model works. At the heart of these models are systems diagrams that use "Intelligent" icons to typify the relationships between the different parts of the village system. Because these mathematically based systems icons represent the actual metabolism -- that is the energy, time and material flows in a village -- it is a simple matter to add or subtract functions from the village or to change their relative quantities. By doing so, "what if" questions can be asked of the village system. As a demonstration of this, the last section takes a small part of the agricultural economy of Dujia (The growing of certain commodity crops for export income), and experiments with changing the amount of agricultural allotment devoted to the different crops. It is of interest to note that, in conducting this simple "what if" experiment, an unexpected discovery was made. Sugar cane, although it brought in a substantial percentage of the yearly income of the village, was discovered to have an associated negative net cash-flow. The villagers would actually be able to eliminate almost half of their annual labor and still have more cash on hand if no sugar cane was planted at all. This fact is not known to the villagers. This is because, although the sugar cane harvest generates a large amount of income at the two yearly harvest times, the expenses associated with its production accumulate gradually throughout the year and were lumped together with all the other agricultural expenses. Of course, this example is a very simple one. Much more complex determinations are made through the numerous "what if" questions that can be asked through this process.

A key component in the building of any systems model is that the boundaries of the system be very carefully defined. The sustainability modeling process has two kinds of boundaries. One type of boundary is the boundary constrained by the conditions of the actual town: the physical, geographical, economic, climactic, soil and water limits, as well as cultural, social, and administrative limits that may exist. The second type of boundary is what we have designated as the Sustainable Area Budget (SAB), which is similar to what in Europe and the United States has been called the Ecological Footprint, or the Appropriated Environmental Space. The Sustainable Area Budget concept makes it possible to use the footprint concept in a design process. It does so by establishing the land and resource budget that can be assigned to a given town-region. The concept develops what others have called the "Fair Earth Share." In principle this means that each individual is entitled to 1 six-billionth of the earth's bounty on a regenerative basis. A town would thus be entitled to the aggregated Fair Earth Share of each of its inhabitants, interpreted as land area. While this principle is simple enough, there is a lot to be decided in terms of what the exact area is to which each individual is entitled. There are many variables, including: fertility, water, climate, and so on, because not all land is of equal quality. Though there are possible variations in methodology, the amount of land accruing to each individual by any of the different schemes of calculation, with their different underlying assumptions, does not vary a great deal. This means that, for China's purposes, we can establish a fairly consistent land budget by dividing China's land area, which is 9,326,410sq km, by its population of 1.3 billion people. This gives a Sustainable Area Budget per person of approximately 7.2 mu of which 15.4% or 1.1 mu would be arable land. Although, for a variety of reasons, we may wish to modify the determination of this number in the future, for now it should be a satisfactory basis for the determination of the SAB for any prospective sustainable Chinese town.

It should be noted that the sustainable town, particularly in the early stages of its emergence, will be a town that maintains the traditional Chinese strong agricultural base. Thus, it will be designed and calculated to provide, among other things, all of its own food and energy requirements. In most cases, a town with a strong agricultural base is likely to produce a large surplus of agricultural products, which can in turn be used to supply larger cities, and as a source of some of its export income. This export activity will actually increase its SAB allotment because it will be provisioning the larger cities which are unable to provide for all of their own needs.

Therefore the sustainable cities will effectively appropriate some of the larger cities SAB. This will add to the smaller Chinese cities economic and sustainability potential and value.

CONCLUSION

In recent years the trajectory of Chinese urban, industrial and economic development has been nothing short of phenomenal. As this trajectory continues there are strong signs that although it remains extremely robust, it will not be possible for such a path to continue indefinitely. Its path will increasingly run up against environmental limits, social and cultural limits and even economic limits. It will be necessary to modify the path such that it adjusts to the limits as well as the strengths of the Chinese context and the carrying capacity of the land and resources of China. Although this situation can be represented as a problem, and a growing problem at that, especially if little is done about it, in actuality it represents an enormous opportunity for China. It represents an opportunity because China is in the position of developing a new kind of urban-industrial development based on traditional Chinese patterns as well as on China's natural budget. Only in towns based on such a balanced approach can a durable future be assured. The alternative that occurs in any period of rapid expansion is the creation of an economic "bubble" which has no other possibility but to eventually burst. Fortunately the resources and the technology now exist to develop sustainable towns in China. China desperately needs a major, visible demonstration of sustainability and any of the seven villages studied in the "SUCCESS" project would be ideal sites for such a demonstration using principles, processes and new urban models that will demonstrate sustainability for the rest of China and the rest of the world (just in time for the major expo in Shanghai in 2010) These new Sustainable Town-Regions, as part of the ongoing Chinese urban experimentation, will demonstrate a better way and ultimately the only way that the Chinese economy can expand to create Zhao Kang in the years ahead.