Growth of Construction Activity in Thailand:
Views of the System from Three Vantage Points

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Abstract

This paper views three feedback maps of the construction activity in Thailand, developed by three experienced modelers as three views of the same problem seen from three vantage points that consider different time frames. The three maps possibly appeared since reference mode for the modeling problem was not explicitly stated, while a wide spectrum of historical data was provided to the modelers. System Dynamics attempts to model processes rather than systems and as such a clear statement of the problem is necessary before a model with a unique structure that corresponds to the stated problem can be formulated.

Introduction

This papers discusses three maps that emerged from the analysis of a wide spectrum of historical data by three experienced modelers. The time frames these maps embodied are different. Thus, they represent three views of the construction activity seen from three different vantage points, possibly, slicing the construction system three ways (Saeed 1992). The methodological issue here is that historical data, per se is indeed different from reference mode as suggested in Saeed (1995), and that a wide spectrum of historical data can lead to multiple reference modes if the time frame of the policy issue is unclear. The moral of the story is that pays to invest time and effort to delineate the reference mode pertinent to the problem being addressed before beginning to map the related feedback system.

The puzzle

Uniqueness is an important requirement of science for models to be valid, besides existence, verifiability, and refutability (Casti 1981). In system dynamics modeling, however, the property of uniqueness is closely tied to how clearly a reference mode is conceived and represented. In a research project attempting to model the construction activity in Thailand, three different feedback maps were conceived by three experienced modelers asked to identify the system. While a copious record of qualitative information, and time series data was supplied to the modelers, no clear problem statement or policy agenda was given to them (Purrington Foundation 1994). The three modelers, evidently extracted three different patterns of behavior embodied in the historical data, taking vantage points that addressed different time frames.

While information relationships and feedback loops resulting from them are the building blocks of systems, for addressing specific problems, the related vantage points rather than a pre-conceived anatomy define a system. The process of growth of construction in Thailand is conceived in the accompanying information maps from three vantage points that differ in their respective foci and time frames.

The first map developed by Peter Genta considers long term processes of change and describes

information relationships that have created a structural transformation in Thailand from predominantly agricultural to a substantially industrial economy. The second map developed by James Hines considers the medium growth of income and demand within the industrial sub-economy and how it has affected urban land use patterns, and building technology. The third map developed by Khalid Saeed takes construction demand as largely given and describes how the construction sector has been transformed in efforts to cope with the inputs, labor and skills markets and the regulatory processes of the government.

The maps and their related policy threads
The three maps constitute important threads in the understanding of the various stages of growth experienced as well as the development of the limitations currently being experienced. They represents three slices of the growth system, each combining the pertinent symbiotic processes relevant to the time frame and issue focus in perspective. The processes each map embodies are discussed below:

a) Peter Genta's Map:
Structural Transformation and the Making of an Industrial Economy
This map, shown in Figure 1, describes the growth of surplus farm labor, which is fueled by population growth and farmland conversions. The farmland conversions are, in turn, driven by land prices which rise as the demand for building sites, which is fueled by traffic congestion, building density and industrial construction.

Industrial construction is a key process in the map which is driven by several factors. These are surplus farm labor, the indigenous demand for goods and services, export earnings, infrastructure access and foreign capital, the infrastructure need also drawing foreign capital. Tourism, driven by exotic cultural and physical environment as well as infrastructure also draws in foreign capital. The growth processes in both urban and rural sectors are represented by the self-reinforcing feedback loops increasing crop output in the rural sector and industrial and infrastructure growth in the urban sector. A faster relative growth of the industrial sector would progressively replace agricultural activity with industrial activity creating structural transformation as postulated in traditional economic development literature. The rapid growth of the industrial sector, however, also gives rise to several insidious growth processes, such as traffic congestion and land prices escalating each other impose limits on further growth. Farmland conversion lead to political unrest while industrial growth deteriorates environment, both discouraging tourism.

The time horizon of this map is 40-50 years and the map user could either be a planning organization or businesses interested in assessing the environment for planning their future operations. Also interested would be development economists and students interested in the dynamics of structural transformation from agriculture to industry and its functional and dysfunctional impacts.

b) James Hines's Map:
Growth of a formal industrial economy and its impact on urban land use and construction technology
The central growth mechanisms in this map, shown in Figure 2, constitute the multiplier effects created by interdependent growth of production and disposable income. The filling up of an "empty" consumer goods inventory, the activation of "deferred consumption" due to a rise in living standard and "wealth" and the creation of better financial markets due to increase in the "bankability" of wages and wealth – all creating positive feedback loops that intensify multiplier effects – precipitate a strong take off.

An interesting impact of the increase in wealth, in the absence of an adequate variety of low-risk investment opportunities is a rush on buying land, which escalates land prices, which are further augmented by a growing demand for housing, factories and businesses. High land costs, in turn raise building density, which in turn also fuels traffic density since more trips must now be

accommodated by the available road infrastructure. Since traffic density makes it difficult for people to commute, the need for living close to the central business district intensifies, which further augments construction density.

A rising construction demand, in the face of a limited construction capacity creates labor and material shortages, which are relieved through importation of foreign workers substitution of technology for inputs and to some degree through learning from experience. The limit to growth in this model come mainly from the zoning laws, a timely introduction of which might have avoided the current traffic chaos, although they have never been seriously considered. A temporary limit also arises from the risk for the builders operating with labor and input shortages, but these are alleviated through substitution by technology.

This model captures the demand side real growth processes arising out of indigenous multiplier effects, and to some degree also the speculation in land. These drive the volume and the technology of construction and land use. Construction in this model is an aggregation of business and housing structures and infrastructure built to serve real as well as speculative demand.

The model captures the various stages of growth in indigenous urban demand over an economic life cycle and could serve as useful instrument for designing policies for demand management and to some degree for intervention into the supply side. The time horizon covering the various stages of the demand is possibly 20-30 years.

c) Khalid Saeed's map:
The development of risk and inefficiencies in the construction sector responding to a given demand pattern and regulatory environment
This feedback map, shown in Figure 3, focuses on how the construction sector might cope with a given demand pattern in exogenously determined government policy. The government policy in thailand has traditionally strongly regulated input prices, labor wages, work permits and training capacity but has weakly dealt with zoning and building codes.

The construction rate delivered by the industry depends on construction demand, capacity of the sector to handle the desired volume as well as technical requirements of construction projects and the possibility of market entry for the new firms which creates competitiveness and agility on the part of the builders. While the existing firms attempt to adjust their workforce and materials and equipment inventories according to the volume of construction they handle, any shortages in the supply of materials and inputs create uncertainty and risk in the operations for which an extra capacity slack must be provided. The need for this slack calls for investment into excess capacity both for handling construction volume as well as technical and managerial skills for handling difficult project situations.

Regulation of input prices and labor wage rates in the face of a growing demand leads to the creation of risk that fuels the creation of slack in capacity. The absence of zoning and building codes limits choice of sites creating difficult construction situations that require further upgrading the technical capacity. Growth of risk limits market entry into the builder sector thus creating an oligopoly structure with its inherent inefficiencies and sluggishness.

The banking sector, in the presence of adequate lending capacity responds to construction demand by accommodating much of the existing risk that eventually leads to contractual disputes that further discourage market entry. The construction sector, thus, has the potential for developing into an inefficient turning dysfunctional, which might create a serious bottleneck for the smooth functioning of the economic growth processes.

The model has a time horizon of 5-10 years. Its user might be the government formulating its regulatory policies for the smooth functioning of the economy or the contractors attempting to cope with a given demand and regulatory environment in the implementation of the projects they might undertake.

Conclusion
Since we attempt in system dynamics to model problems rather than systems per se, the model boundary is defined by the the problem pattern being addressed and the policy space being

considered. All three feedback maps rely on the information collected by the Purrington Foundation and formalize selected parts of it into models. The policy focus of each model seems to be determined the three modelers rather than being clearly defined before undertaking the modelling task. Perhaps, a final model should be developed after the problem at hand is clearly discerned. A problem focus should help to assemble the pertinent processes included in each map into a system appropriate for addressing the defined problem.

References

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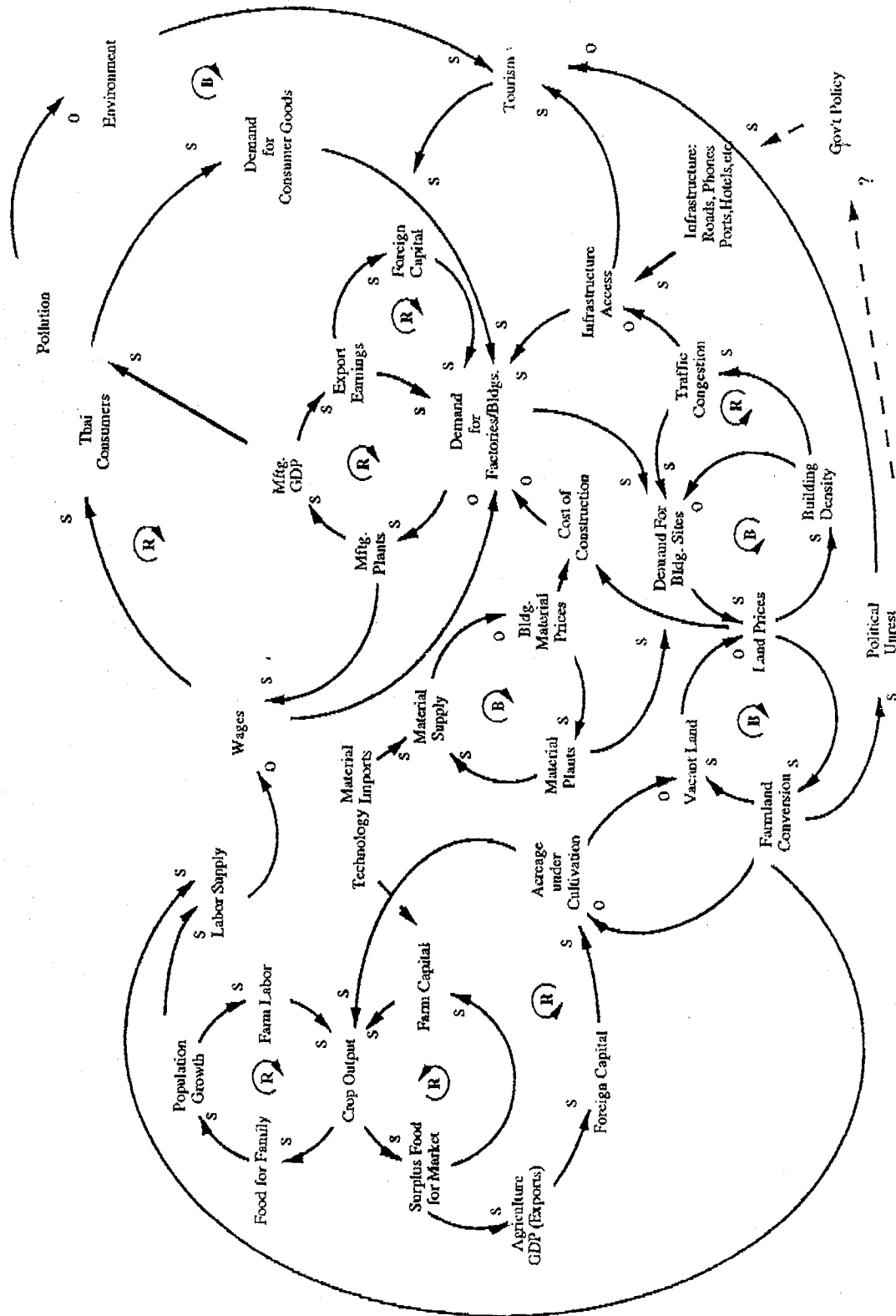
Figure 1   Peter Genta's Map: Structural Transformation and the Making of an Industrial Economy
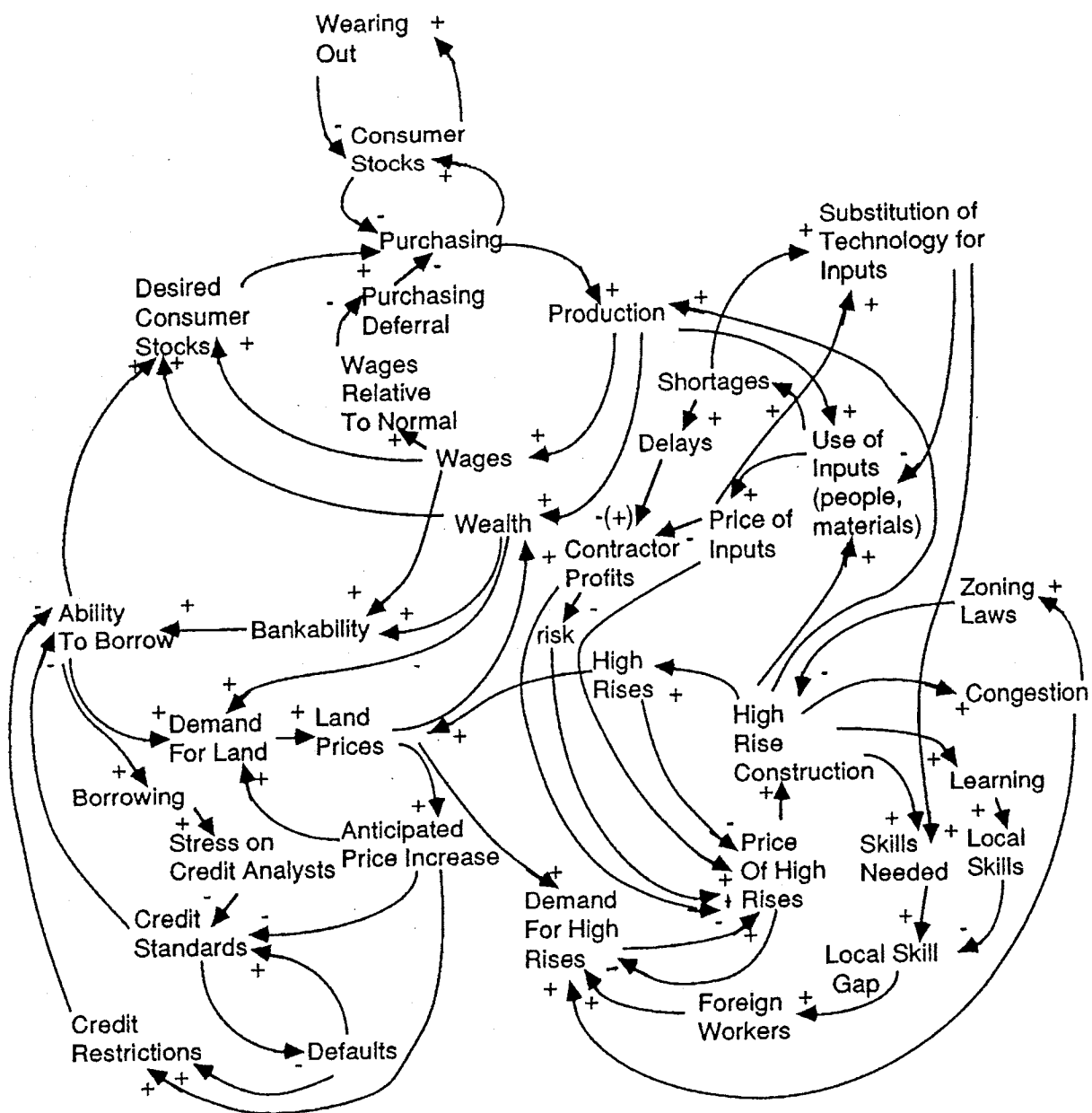
Figure 2   James Hines's Map: Growth of a formal industrial economy and its impact on urban
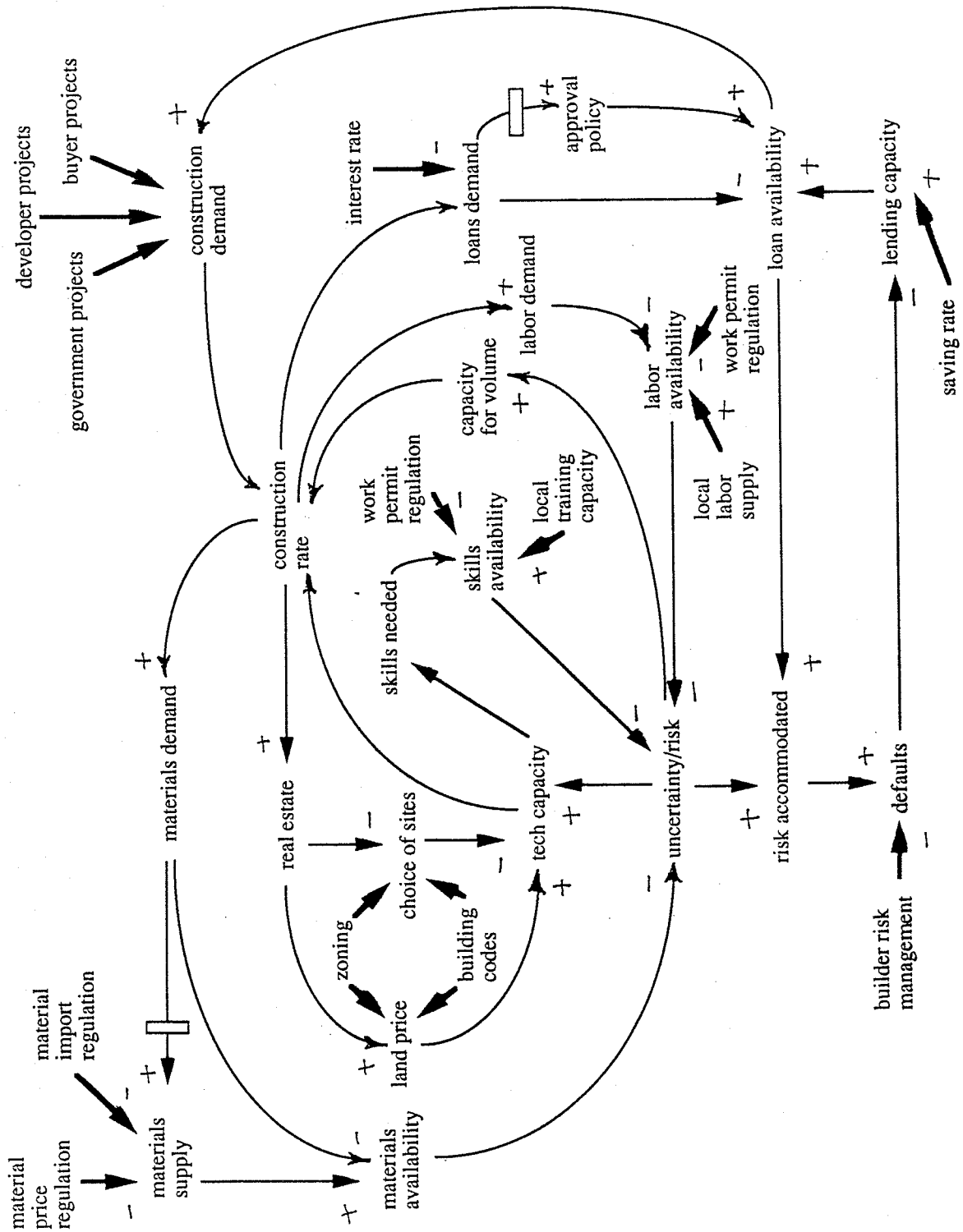land use and construction technology

Figure 3   Khalid Saeed's map: The development of risk and inefficiencies in the construction
sector responding to a given demand pattern and regulatory environment