

Laredo Town Center: Boon or Bane? A Systems Thinking Perspective

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1 Introduction:

“Seeds of Change: LEC area due for an extreme makeover” reported Mike Hall in Laredo Morning Times well before the year 2006. References were made to the proposed “88 acre Laredo Town Center across from the Laredo International Airport Passenger Terminal on Bob Bullock Loop”(Laredo Morning Times, 2005).

Lake Casa Blanca Wetland Preservation (2006- exact date not known): Petition is uploaded to the internet where citizens are able to sign if they’re concerned about the development and future of the wetland, given the following points to consider.

Value of Lake Casa Blanca as recreational site for Laredoans and visitors: The Texas Parks and Wildlife Service recorded more than a half million visits to the park in 2006.

Lake Casa Blanca is a valuable wildlife resource, increasing the quality of life for Laredo citizens—men, women, and children—whose neighborhoods have been made devoid of green space by development.

Furthermore, Lake Casa Blanca is Laredo’s best source of water for supplementing the Rio Grande and for providing water to meet the city’s basic requirements during emergencies.

Although, the probability of a disastrous spill into Lake Casa Blanca is unlikely, the cumulative effects of non-point source pollution can produce long-term devastation on its water quality. To our knowledge, studies of chemical degradation in Lake Casa Blanca have not been done, but we strongly suspect that fertilizers and pesticides are entering the lake from the residential and commercial development that is growing around its perimeter. If development is not brought under control and careful attention given to preventing contamination, the value of the lake for drinking, recreation, and business will be greatly diminished (Lake Casa Blanca Wetland Petition, 2006)

Ashley Richards of the Laredo Morning Times reports that "**LTC formed a new environmental mitigation proposal to preserve a portion of the wetland property near Lake Casa Blanca.**" The developer is also acquiring 45 additional acres northeast of the 88-acre development for its wetland mitigation, as opposed to the original proposal to preserve 18 acres off-site on Chacon Creek. To accommodate the new preservation plans Merchants Holding is redesigning much of its original development plans. (Laredo Morning Times, 2007a)

"6,000 oppose filling wetland near lake" Ashley Richards of the Laredo Morning Times informs that protesters have gathered more than 6,000 signatures in opposition to the LTC's 404 permit application with the US Army Corps of Engineers with fewer than 10 days remaining in the 30-day public comment period. (Laredo Morning Times, 2007b)

The Board of Directors of the Laredo Chamber of Commerce published online a resolution entitled, **"Resolution in support of Laredo Town Center Development"** approved on 9th day

of May of 2008. which resolution seeks to logically explain why the Chamber of commerce considers the Laredo Town Center project to be beneficial to the local economy and urges the City and County leaders to recognize the benefits of the project and potential losses should the project be abandoned (Laredo Chamber of Commerce, 2008).

“Restraining order pool: City is unable to deliver clear title by June 4,” a temporary restraining order was served to the City of Laredo on Monday to “preserve and maintain the status quo” on closing the sale of land to Merchants Holding for 88 acres near Lake Casa Blanca on which the Laredo Town Center development is proposed. City Manager Carlos Villarreal announced at the City Council meeting Monday that the developer filed the restraining order and no action could be taken on the issue. (Laredo Morning Times, 2007c)

“Laredo town center takes the offensive for the development” was a news report by Ashley Richards in LMT on 8/9/07. The report continued, “Laredo Town Center officials took the offensive Wednesday after months of defending the \$120 million, 88-acre retail and hotel development.” (Laredo Morning Times, 2007d)

“TCEQ boosts mall: Town Center has state OK; now it’s up to the feds” Progress on the Laredo Town Center project made a major stride forward this week when the developers received clearance from the Texas Commission on Environmental Quality for a water quality certification. The go-ahead from TCEQ granted Monday could be the final approval necessary before the U.S. Army Corps of Engineers issues a section 404 permit, which would allow mall developers to fill in part of a stream and a detention pond with emergent wetland qualities. (Laredo Morning Times, 2008a)

Candlelight for the Environment 35 environmentalists show up to protest Laredo Town

Center About 35 local environmentalists held a candlelight vigil Sunday night in opposition to the current plans for the Laredo Town Center, a \$100 million mall project that developers will build on Lake Casa Blanca, across from the Laredo International Airport. Fabiola Flores, member of the Rio Grande International Study Center, called the vigil a return to the environmentalists' roots, such as in 2007 when they collected 13,000 signatures for a petition that protested the filling of a part of the detention pond, stream and forested wetland (Laredo Morning Times, 2008b).

1.1 The Research problem: Clearly, Laredo Town Center plans have run into considerable rough weather and have generated heated debates between the parties advocating and opposing the plans. Those who are predominantly business minded and pro-development in a typical capitalistic sense, argue that Laredo Town Center is a “boon” to the city economy and must be proceeded with in the economic interests of the local community. However, environmentalists, advocates of sustainable development are opposing the plans citing concerns about the degradation of environment and contamination of the Lake Casa Blanca since the proposed site of the Town center, a.k.a. “wet land” has been acting as a filter for the storm water runoff before it reached the lake Casa Blanca.

All though the builders and developers are aware of the concerns of the environmentalists and have accordingly revised the Town Center plans, environmentalists maintain that those changes are not sufficient and moving the location of the Town Center away from the vicinity of the Lake Casa Blanca is the best option to preserve the wetlands and is in the best interests of local community.

1.2 Rest of this report is organized as follows; section 2 deals with analysis of the Town Center plans and the arguments in favor of and opposing the Town Center plans. Section 3 deals with describing the Systems Thinking and System Dynamics methodology to deal with complex systems fraught with interacting variables leading to delays and feedback loops with behavioral and dynamic rather than detail complexity. Section 4 describes how a causal loop diagram for the Town Center issue could be developed. Section 5 concludes with recounting the current status of the project and how the planners and policy makers could reconcile their views by using a System Dynamics model and methodology to gain deeper and better understanding of the situation and resolve the issue in an amicable manner.

2. Need for clarity: Importance of the research problem/question.

Clearly there are two sides to the issue and the Town Center project has emerged as a serious contentious issue. Arguments on either side sound reasonable and logical when viewed independent of each other.

Consider the dilemma facing the City Council: Laredo needs to develop keeping pace with the development else where in other parts of the country/economy. In a city like Laredo it's difficult to attract external investment in trade and industry without offering some concessions to the investors. In case of Laredo Town Center project the developers chose to utilize the 89 acres of land abutting the Lake Casa Blanca across the Laredo Airport on East Loop 20. City of Laredo can not pass up such an opportunity to expand it tax base and possible growth in employment coming from these plans.

However, the chosen location overlaps the only piece of wetland acting as the storm water filter before the rain water run off from the airport area makes it into the Lake Casa Blanca. Environmentalists and ecology conservationists are opposed to the Laredo Town Center plans. City of Laredo is duty bound to honor public opinion in its decisions. For obvious reasons it's very hard to reconcile these two opposing view points as they stand.

If a compromise is to be reached, both parties will have to give in a little bit on their part and be willing to see the logic and reason of the other party. If only both sides can agree on some objective function and a suitable simulation model developed to capture the reality, alternate policy scenarios can be simulated to ascertain a mutually acceptable policy option. Here is where system dynamics model which is a “continuous deterministic simulation model” can help capture the behavior over time of the involved variables and provide a suitable solution for the behavioral dynamics problem. The objective here is to suggest the use of Systems Thinking and System Dynamics modeling as a means to gain a deeper and better understanding of the system we are dealing with so that the attendant conditions may be better appreciated by all stakeholders.

According to the Laredo Development Foundation the Merchant Holding the developers of Laredo Town Center expect to have up to 75 retailers and 10 restaurants. This in turn would create about 1,000 new jobs and house high-end retailers 9Laredo Development Foundation, 2008a).

The LDF also says that they plan to invest about \$120 million for its open-air mall. It will have about 75 luxury retailers along with 10 restaurants and probably a high-end hotel. (Laredo development Foundation, 2008b)

The Laredo Town Center, which would be made up of retail stores, restaurants and a hotel, is expected to add \$100 million to the city's tax base and create 1,000 to 1,300 full-time equivalent jobs, Garza said. (Laredo Morning Times, 2007b)

However, there are counter arguments to the ones put forward in favor of the plans. For example, Dana Meadows had quite some time ago quite clearly counter argued the benefits of "urban growth" in her biweekly column Global Citizen while summarizing from Eben Foder's (1999) book "Better not Bigger : How to take control of urban growth and improve your community." Donella Meadows was the director of Sustainability Institute and an adjunct professor of Environmental Studies at Dartmouth College and used to write a bi-weekly column titled "Global Citizen" In her column she wrote (Meadows, 1999). In this summary published on 2/25/1999 the following twelve myths are debunked with suitable examples.

Myth 1: Growth provides needed tax revenues.

Myth 2: We have to grow to provide jobs.

Myth 3: We must stimulate and subsidize business growth to have good jobs.

Myth 4: If we try to limit growth, housing prices will shoot up.

Myth 5: Environmental protection hurts the economy.

Myth 6: Growth is inevitable.

Myth 7: If you don't like growth, you're a NIMBY (Not In My Backyard) or an ANTI (against everything) or a gangplank-puller (right after you get aboard).

Myth 8: Most people don't support environmental protection.

Myth 9: We have to grow or die.

Myth 10: Vacant land is just going to waste.

Myth 11: Beauty is no basis for policy.

Myth 12: Environmentalists are just another special interest.

(Meadows, 1999 quoting from Foder, 1999)

Obviously, views of the above type favor the environmentalists' cause and run counter to the Laredo Town Center advocates' views.

However, John Kasadra, a professor at the University of North Carolina recommends building cities around airports because the "airports are now effectively a part of global production systems," Kasarda says, "and without that connectivity, you're out of the game" (Lindsey, 2006). Even though these statements were made in a totally different context, we have some useful pointers here for consideration. Professor Kasadra maintains that accessibility is the mantra for development of new cities. Just as three main factors for consideration in real estate business are "Location, Location, and Location" the three main factors for success in the new global business environment are 'accessibility, accessibility, and accessibility.'" So viewed from that perspective the location of the Laredo Town Center close to Laredo International airport and off the Bob Bullock loop in a city like Laredo which is within driving distance from an international border with Mexico could prove to be a major success factor (for imports purposes) for the Town Center and it could prove to be the competitive edge the Town Center would have against other similar retail shopping malls not only in Laredo but also in other cities like San Antonio and San Marcos

as well. So when it comes to comparing the city of Laredo with other cities, its important to recognize the fact that maintaining a competitive level of growth rate is important for the city economy to retain its workforce and investors' interest.

On one hand is the opportunity to the city to capture substantial economic growth in terms of a 750,000 square-foot retail center with millions of dollars in tax revenue for the city in near future not to speak of job opportunities and growth opportunities in support services. On the other hand is the need for preserving the one of its kind piece of wetlands and a beautiful clear water lake that helps maintain balance in nature by supporting flora and fauna in an otherwise fast developing city which many fear may turn into a dry and dirty city, if development is not properly managed.

This is a typical systemic issue that needs to be studied adopting a holistic perspective rather than studying the system parts in isolation of each other. So systematic analysis is necessary to grasp what is at stake in terms of opportunities and costs so that a balanced, considered decision may be taken.

3. Research methodology and analysis.

The research methodology will involve both quantitative and qualitative analysis. All past and current news reports on the subject will be gathered and studied. Arguments from both sides will be taken into consideration.

Quantitative data will also be gathered about the volume of business/likely revenue generation/employment potential and other spin off benefits. Qualitative analysis will include, understanding the ecological issues and the likely impact on the quality of life issues and other consequential issues. Causal loop diagram will be developed to understand the interaction between the variables and the effect of the plans on the Laredo Economy as a whole in a systemic perspective.

3.1 The Concept of a System

To appreciate the need for use of systems thinking we must start with understanding the concept of a system. It's well known that for many centuries humans were aware of the notion of the system which is 'a collection of parts interacting with each other to form a complex whole.' This is evidenced from the fact that physicians knew and treated human body as a complex system made up of interacting parts besides other examples from astronomy and other disciplines.

3.2 What is a System?

A definition that has had popular acceptance given by Kauffman is, "A system is a collection of parts which interact with each other to function as a whole" (Kauffman, 1980).

Kauffman went on further to classify systems into the following types, Mechanical, Human, Biological, Ecological and Social systems and identified the characteristics of 'complex systems' as being, self stabilizing, goal seeking, program following, self reprogramming, environment modifying, self-replicating, self maintaining and repairing, self reorganizing, self-programming (Kauffman, 1980).

3.3 Systems Thinking and System Dynamics

Ancient thinkers and scientists believed that the best way to learn about some unknown object or entity is to reduce it down to its smallest parts and study them. This approach obviously gave good results with most of the objects and entities that came under study and in particular, this approach yielded enormous new knowledge in pure sciences such as Physics, Chemistry, and Biology. Encouraged by the success of the approach the scientific community reached the point of concluding that an entity is ‘nothing but the sum of its parts’ (Kauffman, 1980). However, this approach did not work quite as well in the study of ‘systems’ for the simple but significant difference that systems have ‘organizations’ (Kauffman, 1980; Senge, 1990, pp185)

In the early 20th century, scientific community came to recognize the fact that regardless of the differences in the constituent parts, all systems were put together by same general rules of organization. This realization gave way to systems theory and systems thinking arose thereof (Musa, 2000).

‘Systems Thinking’ is the approach of reflecting on organizational process (or behavior over time) rather than snapshot states of the systems, which is pervasive in western culture (Senge, 1990, pp185). This understanding is in line with the popular definition of ‘systems thinking’ as given by the practitioners (Senge, 1990, pp7).

3.4 Systems Thinking

The indispensability of system thinking lies in the fact that we live in a world that is characterized by many interacting systems. And being a part of the system (Senge, 1990, pp 7) ourselves, we humans have a hard time to see the whole pattern and instead we tend to focus on

isolated parts of the system, whereas “systems thinking” provides us with the ability to overcome this limitation.

Peter Senge’s book “Fifth Discipline, The Art & Practice of The Learning Organization” published in 1990 firmly established system thinking as a discipline (Senge, 1990). The Fifth Discipline helped popularize the systems thinking philosophy and practices among the intellectuals and top managers of the late 20th century.

The five disciplines that Senge discusses in his book are,

- Personal Mastery,
- Mental Models
- Shared Vision,
- Team Learning
- Systems Thinking, the Fifth Discipline.

Stated in simple words, the core of each of the five disciplines is,

- Personal Mastery: is a continual clarification of who we are, what we want to be, and where we are going and a commitment for lifelong learning by the individual member of the organization.
- Mental Models: are the deeply ingrained assumptions, generalizations, or even pictures or images that influence how individuals understand the world and how one takes action. Simply put they form the basis of one’s decision-making.
- Shared Vision: is the single most significant leadership quality that can truly galvanize the whole organization into action. So, a true leader should be able to translate the organization’s objectives into shared visions.
- Team Learning: because, teams and not individuals are the learning unit in modern organizations. Unless the teams learn, the organization can not learn

- Systems Thinking: the only tool for coping with complexity of systems and the binding force that combines the first four disciplines to facilitate deriving the most out of all, a discipline that by enhancing each of the other disciplines continually reminds us that the “whole can exceed the sum of its parts.”

3.6 Laws of Fifth Discipline (System Thinking)

A discussion of Senge’s fifth discipline viz. systems thinking remains incomplete without, at the least, a brief mention of the laws of fifth discipline. One can say that these laws deliver the very essence of the systems thinking philosophy.

The laws of fifth discipline, according to Senge are (Senge, 1990, Ch 4),

1. Today’s Problems come from yesterday’s “solutions” : a time solution to a problem merely shifts the problem from one part of the system to another part
2. The harder you push, the harder the system pushes back: In situations involving ‘compensating feedback loop,’ well-intentioned interventions result in system response that offsets the benefit of intervention.
3. Behavior grows better before it grows worse: Typically treating the symptoms without understanding the totality of problem appears to cure the symptom but aggravates the problem in long run.
4. The easy way out usually leads back in: Applying known and easy solutions to the problem without a proper appreciation of systemic nature of problem.
5. The cure can be worse than the disease: Sometimes the easy and familiar solution is not only ineffective: sometimes its addictive and dangerous like use of alcoholism to cure work related stress- the technical name for this phenomena among systems thinkers is, “shifting the burden to the intervenor.”

6. Faster is slower: All natural systems have intrinsically optimal growth rates and all attempts to grow faster than such optimal rates not only slow down the system growth but also, many times, leads to the very extinction of the system (The rise and fall of People's Express airline -- Senge, 1990 ,Ch 8).
7. Cause and effect are not closely related in time and space: This law emphasizes the need for understanding the underlying systemic interactions causing a problem, to introduce changes in order to effect a lasting improvement.
8. Small changes can produce big results- but the areas of highest leverage are often the least obvious. High leverage changes are usually highly nonobvious to most participants in the system-like the 'trim tab', a tiny part sitting on the rudder of a ship that facilitates easy movement of rudder that in turn causes a mighty ship on move to turn in desired direction.
9. You can have your cake and eat it too- but not at once: What appears as an either-or choice at the current point of time may actually be a case of having both over a period of time by a careful choice. Like, 'low cost or high quality' dilemma may be resolved by opting for high quality in the first instance that leads to lowering costs as well over a period of time.
10. Dividing an elephant in half does not produce two small elephants: Living systems have integrity and so do organizations. Emphasis here is on adopting a holistic view of the system rather than looking at parts.
11. There is no blame: people tend to blame outside circumstances for their problems instead of realizing that they are part of a system and that the cure lies in understanding their relationship with the problem.

3.7 Tools of Systems Thinking

System thinking has a set of very powerful tools that are useful for gaining a clear understanding of the complex feedback problems as well as to solve such problems.

As per Goodman, systems thinking tools include (Goodman M.R. 2005),

- Causal loop diagrams (CLDs)
- Behavior-over-time graphs (BOT plots/charts)
- System archetypes (a.k.a. Nature's Templates) and
- Structural Diagrams or Stock and Flow Diagrams(SFDs)

CLDs are used for capturing and visually representing the dynamic interrelationships among variables making up the system. "Causal loop diagrams capture how variables in a system are interrelated. A CLD takes the form of a closed loop that depicts cause-and-effect linkages," (Goodman, M.R., 2005).

Behavior Over time (BOT) graphs capture the history or trend of one or more variables over time. By sketching several variables on one graph, you can gain an explicit understanding of how they interact over time (Goodman, M.R., 2005).

3.8 System Archetypes

System Archetypes or Nature's Templates refer to certain patterns of structure that appear to be common among, and recur repeatedly in most types of organizational structures no matter how different and diverse they are. Typically, these system archetypes are comprised of various combinations of 'reinforcing' and 'balancing loops'. The most often encountered systems archetypes are, (Senge, 1990; Goodman M.R., 2005)

- Balancing the process with delay,

- Limits to growth,
- Shifting the burden
- Shifting the burden to intervenor
- Eroding goals
- Escalation
- Success to the successful
- Tragedy of the commons
- Fixes that fail, and
- Growth and underinvestment

Each of these archetypes is represented visually in system dynamics CLD notation in Appendix 2 of Fifth Discipline (Senge, 1990; pp378-390).

3.9 Origin of System Dynamics Modeling

Jay W Forrester invented system dynamics at the Massachusetts Institute of Technology (MIT) in the 1950s. Essentially, system dynamics is a methodology for studying complex systems using system thinking and computer-simulated models.

Due largely to the efforts of Jay W Forrester and the System Dynamics Society, system dynamics and systems thinking have gained great interest as popular disciplines for research, particularly in social and economic systems.

3.10 Modeling software used

There are a variety of software applications available for use in developing causal loop diagrams and the System Dynamics models. In this paper Ventana Simulations Inc's Vensim(c) software is used for developing the causal loop diagrams in section 4.

4. Causal Loop Diagramming:

Ventana Simulations Inc.'s Vensim software provides all the necessary functionality for the kind of Causal Loop Diagram (CLD) we intend to develop for this report. Causal Loop Diagrams are helpful to capture the causality associations between the variables. Some examples of causality relationships of the current scenario on hand follow.

Growth provides needed revenues: Most of us very easily believe that this statement is true. Perhaps, it is but only in the short run. Because, in the long run growth attracts more people to the region which in turn increases the need for urban facilities like water, maintenance, sewage, road maintenance, police, protection and hospitals and public services. This will increase the need for additional taxes to fund all these activities which results in increases in taxes rather than reduction in the taxes. This need for additional revenues forces the local economy to consider further growth options to keep up with the increase in cost of operations.

The above causality can be captured in a causal loop diagram as follows in Figure 1. As may be observed, economic growth leads to more jobs, more trade and business and thereby more revenues in the short run. But economic growth and increased jobs will cause, albeit with a small delay, influx of immigrants from other regions thereby increase the workforce and increase the demand for public services which leads to increase in budgets and thereby deficit in budgets.

Extending the causal loop diagram in Figure 1 to include the effect of growth on environment we can obtain a diagram as depicted in Figure 2. As may be seen, growth leads to deterioration in environment, but luckily growth provides for funding to implement environment protection programs which are not otherwise possible.

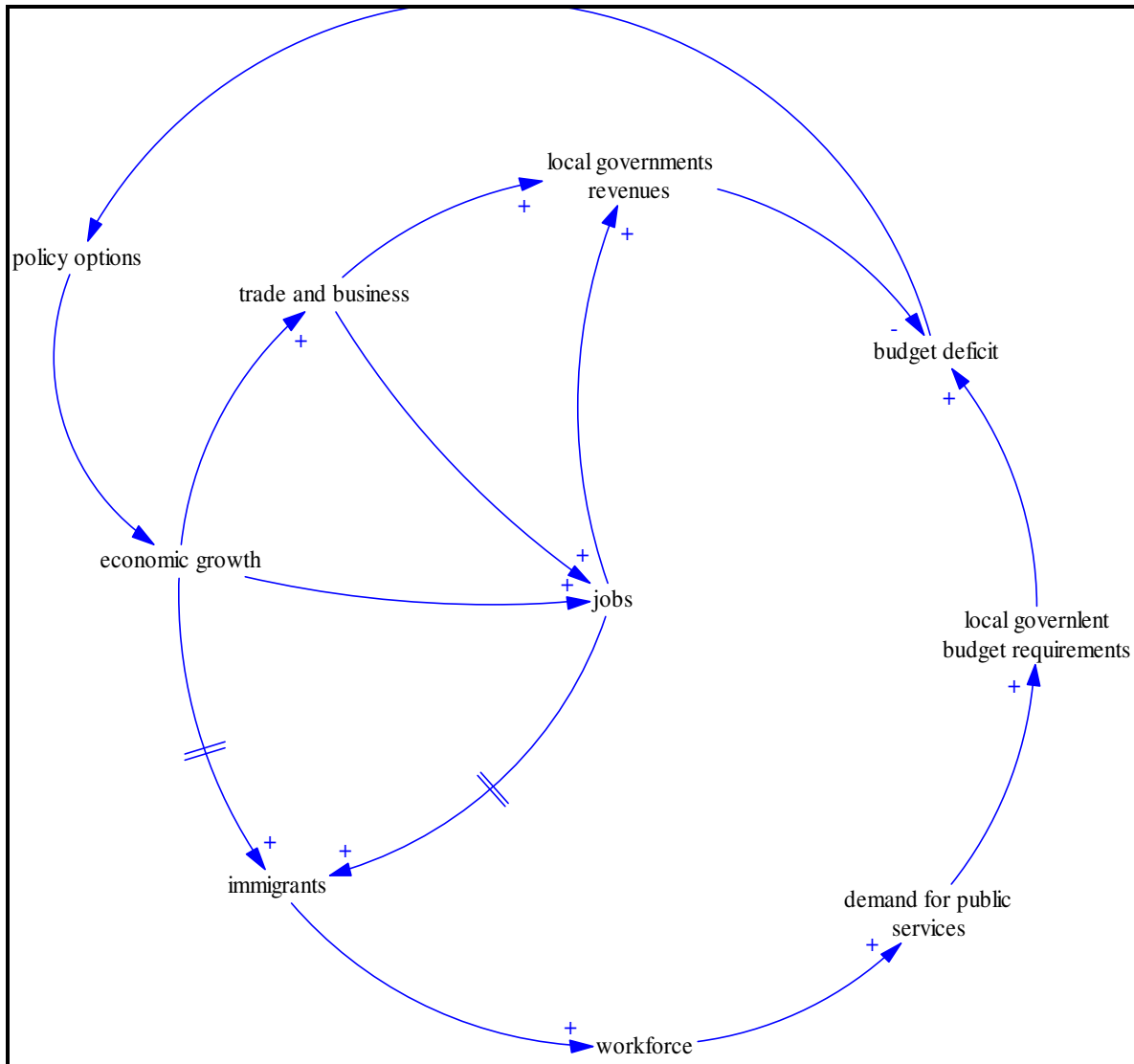


Figure1. Causal Loop Diagram of Growth Provides needed revenues in the short run but causes need for more revenues in the long run.

An important question to address while developing Causal loop Diagrams is to determine the boundary of the system and what variables to include and what not to include. All significant variables must be included and yet any unnecessary variables need to be kept away to avoid too much of detail complexity at the cost of capturing the dynamic behavioral complexity. These causal Loop diagrams are required to be presented to experts and stakeholders to receive their feedback before converting them to the structural diagrams or what are known as “Stock and

Flow Diagrams” a.k.a. System Dynamics models. By that stage the modeler will have to input quantitative values for the causality and relationships between variables and initial values for certain stocks for example: jobs, workforce etc.

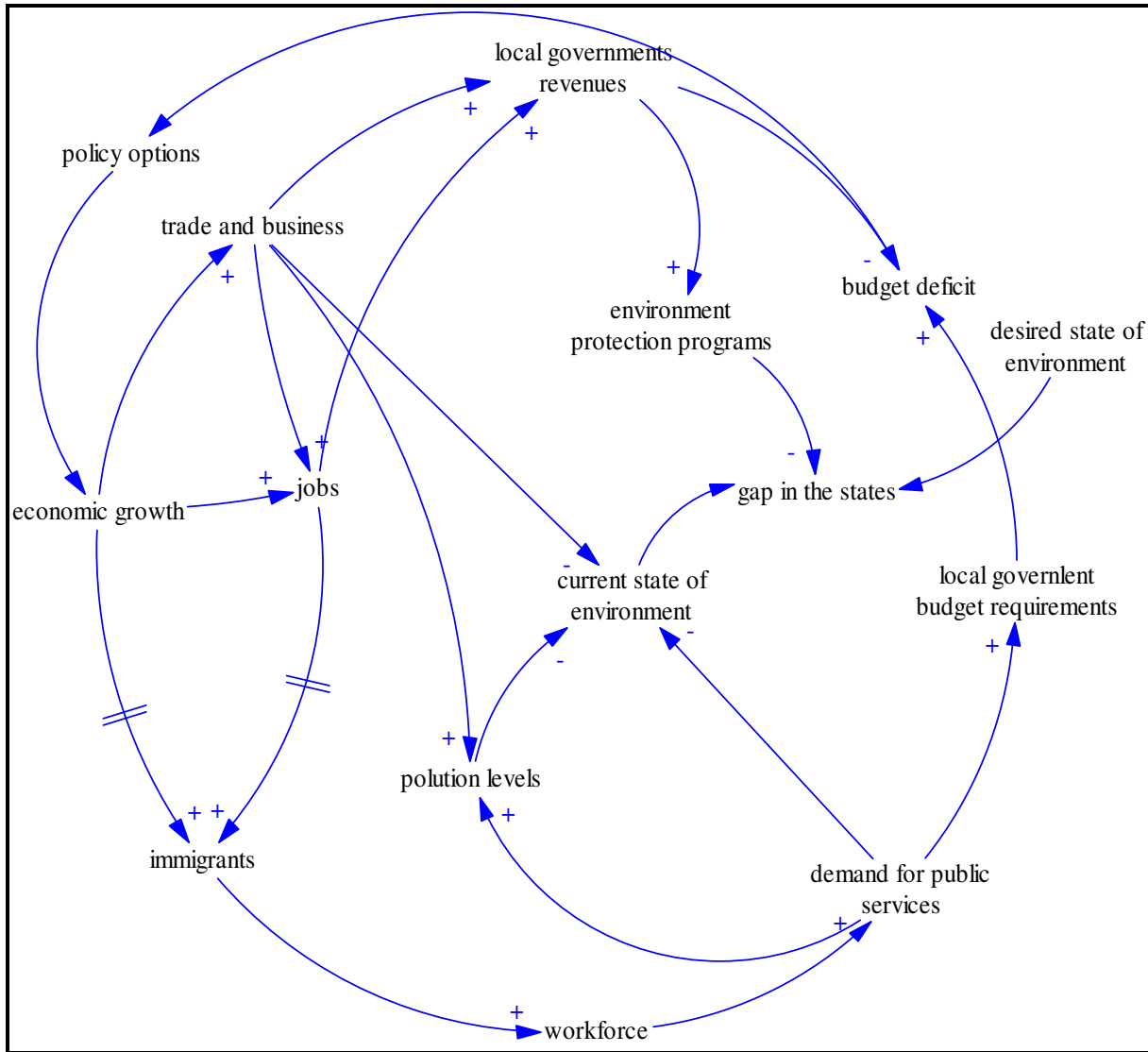


Figure 2: Causal loop Diagram of Growth and Revenues and Growth Environment

Once a system dynamic model is built that captures the reality and mimics it, the modeler is able to experiment with alternate policy options. Given an objective function defined with reference to the model variables, modeler can optimize the parametric settings of the model which then helps in formulating the policies to adopt.

5. Conclusions, Contributions and Future research:

As has been discussed in the introduction section, for now the Laredo Town Center construction is on hold and the matter is under judicial review. The final outcome of the Laredo Town Center is unknown at this point in time. However, if the policy makers were to formulate a policy that would be acceptable to both groups of people advocating and opposing the LTC plans, it would be advisable to develop a simulation model that can capture the interacting variables involved in the scenario and their behavior over time. That would enable the policy makers to simulate alternate policy options to choose the best option that meets approval of all stakeholders and accomplishes optimization of a mutually agreed objective function.

It is shown in this study that the Laredo Town Center issue has emerged as a most debated issue in local Laredo Community. That the issue is a systemic issue and as such it warrants a holistic perspective to address it systematically rather than symptomatically. It's further shown how the arguments on either side of the issue could lead to interactions between the variables of the system involved leading to counterintuitive end results. Then systems thinking and system dynamics methodology is described as a suitable methodology to deal with the issue. Causal Loop diagrams of partial scenarios of the issue are developed to demonstrate the feasibility of use of the proposed methodology for policy experimentation and formulation.

So, a logically possible future research is to develop a continuous deterministic simulation System Dynamics model to understand the effect of policies on the economy as a whole following the techniques developed by Jay Forrester in his book "Urban Dynamics." (Forrester, 1969) and MIT literature collection for validating the SD models (Forrester and Senge 1979). Such simulation model would require accurate data in terms of the various variables involved in the issue and their parametric values and the likely interaction between them. For

obvious reasons all stakeholders need to contribute to the development of such a model in order to ensure their buy-in from the beginning so that the final results may be acceptable to all the stakeholders and the policy options chosen will have prior endorsement of all stakeholders. Such a project needs the sponsorship of major stakeholders involved in the issue to ensure access to complete data and continual clarifications during the model development stage. However, it is important to recall Sterman's quote that, "All models are wrong, so no models are valid or verifiable in the sense of establishing their truth," (Sterman, 2000). Further, Sterman argues that, the question facing the user and modelers is never whether a model is true but whether it is useful. The true usefulness of the model lies in providing a better understanding of the dynamics and guidance in the place of the mental models that would be used otherwise (Sterman, 2000).

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