

**LOUISIANA STATE UNIVERSITY AND THE NEW KNOWLEDGE  
ECONOMY: LEAPFROGGING LOUISIANA FROM THE 19<sup>TH</sup> CENTURY  
ECONOMY TO A 21<sup>ST</sup> CENTURY ECONOMY**

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Louisiana is well blessed with natural resources and has benefited greatly from its significant oil and mineral resources. These resources have subsequently provided the foundation for the development of one of the most significant concentrations of chemical and petrochemical industrial development in the country, as well as laid the foundation for Louisiana to be one of the leading centers on the planet for natural resource based economic development. From an economic development perspective, a natural resource based economic development center is similar to the foundation and basis of the U.S. economy from the 18<sup>th</sup> through the early 20<sup>th</sup> century and is largely the means or the basis for which the economy was built and maintained in the 19<sup>th</sup> century.

From this foundation, which many states are not blessed with, Louisiana has grown to have significant 20<sup>th</sup> century heavy industry development in areas such as aerospace and general manufacturing. These industries have drawn heavily from economic advantages, low cost labor and transportation, but they do not represent a significant foundation for the development of a knowledge-driven, knowledge-centered economy.

There are however signs of movement towards the direction of knowledge-driven economic development with the new centers of biotechnology innovation, agriculture innovation, biomedical research and various industrial and academic research programs and centers in pharmaceuticals, nanotechnology, microstructured devices and micromanufacturing. Each of these lay the very preliminary foundation for the beginnings of the expansion of a natural resource based economy in Louisiana to a natural resource and knowledge based economy.

Comparatively, it's important to note that states without natural resource based economies such as Connecticut, New Jersey or Georgia, do not have the distinct advantage that Louisiana presently holds, which is a strong natural resource based economy, a potentially very successful manufacturing economy, matched with the capacity to grow and intermix a knowledge based economy. Few states have evolved the linkage between the natural resource based economy and a knowledge based economy, those being California, Texas, Illinois and Michigan among a handful. Louisiana has this unusual opportunity of being a state that has the economic diversity potential of these leading state economies.

The key catalytic ingredients to the emergence of Louisiana as a broadly based economy of natural resources and knowledge based capacity are limited to just two factors. First, Louisiana must carry out the policies necessary to lay the foundation for a high quality educated workforce. This involves successful high school completion ratios

far above present levels, special community college for technology based training and significant undergraduate student production in areas of technology, business and science. This is a policy realm that I will not address in this paper, but it is one that is absolutely essential to the long-term development of a knowledge based economy in Louisiana.

The second critical variable, and it is one that is not intuitive, is the development of a single world class research enterprise in the state of Louisiana. A world class research enterprise is an institution with scientific and engineering research groups that are able to compete for national research funding in national and international research recognition on a scale equal to the leading 50 research universities in the United States. The development of such an entity is an essential ingredient necessary as a precursor to all other scientific and technological developments. This has been proven with the emergence of the University of North Carolina, and the Research Triangle Park region in North Carolina, the more recent emergence of the Georgia Institute of Technology in the Atlanta region, and the historic and well documented case of Stanford University in Santa Clara County, California. In these cases, as well as many others, it is ultimately the emergence of the research university and the knowledge community that surrounds the research university that lays the foundation for the building of a knowledge community sufficient to be self-generating and growing beyond the university sector itself. The point here being that the university sector is, and always has been, the first organizational form to take shape in laying the foundation for a knowledge-driven community and subsequently a knowledge-driven economy, and as a result, it is an a priori condition to the building of new economic opportunity in Louisiana.

At present, Louisiana as a state and Louisiana State as a university have a long way to go to meet the critical development stage. Statistics indicate that overall research and development funding coming into Louisiana is among the lowest in the country (in that competitive research funding at Louisiana State University remains moderate). Nonetheless, the seeds for the emergence of LSU as a national grade research university with the knowledge catalytic capacity is high.

### **The New Knowledge Driven Economy**

Given the fact that Louisiana State University sits as a potential seed for a knowledge community in Louisiana, why is it that such a development is critical to Louisiana's future? To understand this, we will have to run the clock forward and assume that knowledge driven enterprises will become increasingly important to the reshaping and remolding of the economy in the decades ahead. This reshaping and remolding of the economy will occur and be driven by increasingly more and more important scientific discoveries and technological breakthroughs. Those regions of the world not participating in these economic opportunities will be relegated to a status and position of trailing economies rather than leading economies. As stated earlier, Louisiana has an opportunity to be one of the unusual regions of the world where this is a strong natural resource based economy that can be matched with a knowledge based economy,

but if and only if the two conditions of a sound education base and a single knowledge-driven enterprise can be met.

In the new knowledge-driven economy, it is important to point out that several factors are becoming increasingly important. This is notwithstanding the fact that economists have known since at least Alfred Marshall in 1890, that knowledge is our most powerful engine production and that knowledge is, as a result of this, the main driver of economic change. Given this fact, as we move into the early decades of the 21<sup>st</sup> century, it is clear that knowledge will be more important than ever. This fact is illustrated by our present experience:

1. Extraordinary progress and information and communication technology is making the economy more global and enhancing production and efficiency levels to previously unheard of capability.
2. Increased speed of scientific and technological advance is providing mechanisms and means for the emergence of entire new industries in time frames of 20 years or less.
3. Increased global competition is increasingly knowledge-driven and knowledge enterprise centered and the rate of this increase is accelerating.
4. Changing demands for new technologies is driving the demand for knowledge economy inputs (new knowledge) at rates previously unheard of.

Several advantages are offering Louisiana and Louisiana State University a new and unique opportunity as the waves of change in the knowledge economy continue to have an impact on what some economists refer to as the forces of creative destruction. These forces create opportunities for the establishment of entire new industrial sectors or entire new technologies as a replacement to other technologies and thus offer to a knowledge centered economic region an opportunity to participate in the waves of development moving forward through scientific and technological advance. For instance, consider the following when considering the future of the Louisiana economy:

1. We have a movement away from the silicon based electronics economy with a completion of the economic and technological potential of silicon based microelectronics coming about somewhere between 2010 and 2015. This technological limit offers economic opportunity for the development of a new set of industrial opportunities derivative of the replacement technologies that will be brought to bear to replace microelectronics. A capable Louisiana State University will provide a mechanism for Louisiana to have some small, but significant, piece of the economic shift away from silicon based electronics.
2. Significant new revolutionary breakthroughs in molecular scale manipulation offer many opportunities for the potential development of new industries. Consider for instance what new industries will look like in nanoscale technology or in submolecular scale computing. Where these industries will be located and how they will evolve cannot be predicted with certainty, but is highly likely that these industries will have their genesis in and around knowledge centers such as Louisiana State University.

3. We are moving in the direction where our mapping of organisms from the fly, to corn, to rice, to humans will provide the basis for genetically modified everything. Genetically modified for a new economy means that there will be industries developing plants to solve environmental problems and foods that deliver pharmaceuticals, as well as nutrition to humans and/or animals. Without going through the whole litany of the kinds of opportunities that these technological breakthroughs and scientific activities will offer, it is unequivocally the case that the places in the United States and elsewhere that are knowledge creating and active in this arena will participate in this economy and economic development opportunities and that others will not.

In moving forward, a region such as Louisiana has to look at either investing its time, energy and resources in maintaining the status quo of a natural resource based economy, or in focusing its energy on laying the foundation for building a knowledge based economy, while at the same time protecting and defending its economic status quo. In doing this, there are a range of important reasons. The principle being to sustain economic growth opportunity through the development of knowledge producing communities, starting with a world class research university and growing and expanding from that point to help move the region beyond being what in 2030 or 2040 will be labeled a knowledge importing region versus a knowledge producing region. Toward this end, it is essential that the region move to position its economy to be a net producer of knowledge which should produce a positive set of economic alternatives which can then be mixed into the existing economic base. The specific advantage of this and the role of Louisiana State University can best be articulated as follows:

1. Knowledge communities provide advantages in speed and diversification of economic change.

Research grade universities provide the cadre of scientific and technological personnel and students to have the capacity to keep up with the increasing rate of change in scientific and technological oriented enterprises. Such capacity is essential to the ultimate diversification of the economy. One of the reasons that more than 40% of American biotechnology is located within an hour's drive of the Stanford University campus is not because the campus has the capacity to produce all of the technological seeds that have led to the development of these companies and industries, but rather that it is a center for scientific discussion, debate, breakthroughs and excitement. Such centers serve as both catalysts and community building force for the knowledge based economy organizations. These organizations being high tech start-ups, R&D laboratories, computer software firms specific to other areas of technology, and so forth.

2. Multiple large and small-scale fundamental science enterprises are needed ultimately to sustain a knowledge-driven economy on a regional basis.

Louisiana State University must evolve to the point where it is a sufficient scientific and technological catalyst to both permit the growth and development of new scientific and technological enterprises, either companies or research organizations that spin out of the

university, or are attracted to the university by the sheer capacity for intellectual discourse that the university provides. It is not by accident that technology based companies cluster around university centered knowledge communities. These enterprises which are essential to the ultimate growth of a regionally based knowledge economy are dependent on interactions with scientific and technological groups within the university, as well as strong dependence on new energized scientifically and technically capable students. To reach this objective, Louisiana State University must find mechanisms to attract not just adequate graduate students, but absolutely top graduate students into scientific and technologically oriented programs that are nationally competitive. This means positioning Louisiana State to recruit graduate students the way that it recruits athletes. Such recruitment requires resources, but more than anything, it requires outstanding facilities, programs, faculty and funding.

3. Regional knowledge based economies require the capacity to incubate knowledge enterprises.

Thousands of new technology based enterprises are established in the United States and thousands more in Europe, Japan, Korea and elsewhere. These knowledge enterprises must be incubated if they are new, and incubation is best done in the environment which is most open to the free flow of new ideas. Starting up a new software enterprise presence and proximity to a university with an outstanding computer science department and computer science students and graduates is essential. In the case of the Canadian corporation Research In Motion (designer and developer of the very successful Blackberry technology), the firm co-located next to a significant computer science department in a regional university in Southern Ontario because of the fact that the emerging company needed students and ideas that were best acquired in the working environment of the university computer science department. The point here being that one does not invest into a computer science department so that it can purposely become a technology development enterprise, but Louisiana State University, as an example, could serve as a catalytic force in the emergence of a yet to be fully thought through technological option in the new knowledge economy by simply having a world class computer science department. The presence of the computer science department, in and of itself, becomes the critical factor. This has been proven at the University of Illinois, Penn State, Stanford, MIT, Columbia and a range of other universities.

4. Regional knowledge based economies require a setting conducive to establishing knowledge networks.

The development of new knowledge based enterprises is not something that can be done in isolation. Three or four, or even 10 or 15, knowledge based enterprises in the Baton Rouge area would be insufficient to sustain, over the long haul, a regional knowledge based economy. Networks between firms, university laboratories, other universities, and international scientific and technological institutions is required for the establishment of Louisiana State University as a node on the international knowledge economy network. In this particular case, it is essential that the institution act and behave as globally as it possibly can. Faculty should be heavily engaged in collaborative research with

institutions around the planet, as well as heavily engaged in the national and international scientific and technological development process. This requires heavy investment in global recruiting, matching funds for linkages with international centers, and competition on an international scale. The Massachusetts Institute of Technology provides an excellent example in its joint technology development efforts with Cambridge University (\$80 million start-up fund from the British Government), as well as its efforts to establish new media lab facilities in Ireland and elsewhere. The point being that technology and science are global enterprises. Linkages between Louisiana State University and developing software centers in India, Bulgaria, or Indonesia could be fruitful in terms of new technological breakthroughs and new technological developments, as well providing regional homes for new pieces of these transnational knowledge driven enterprises.

4. Regional knowledge based economies require ready providers and brokers of financial and knowledge venture capital.

To build a regional knowledge based economy requires many things, the first of which is a successful research based university. Beyond this, it is essential to move that university into the mode of being able to act and behave on a highly entrepreneurial basis. In moving forward, two types of venture capital inputs will be needed for success. The first is the traditional form of financial venture capital and the second is knowledge venture capital. In this sense, the university offers the opportunity to provide the basis for the development of knowledge venture capital and ultimately to be successful, knowledge venture capital must be married on a local basis with financial venture capital. To move in this direction, Louisiana State University must find ways and mechanisms to become engaged in breakthrough technology and science. Such breakthroughs will require the university to take substantial risks in the development of scientific and technological capacity which is not just trailing the work of others, but leading in some small way or niche. Thus to be successful in the ultimate attraction of financial venture capital, Louisiana State University must find ways to define and advance niche based or niche focused scientific and technological ventures that are highly risky. For LSU to be successful in helping to catalyze the development of local financial venture capital investment, it must be willing to suffer moderate to heavy losses in its niche based scientific and technological foci. The result will be success, but initially only on a initially limited basis. These limited successes, however, if carefully nurtured and capitalized on, will provide the basis for the transformation in short order of Louisiana State University to the level of a Georgia Tech or University of Florida (10-15 years).

### **LSU In a 21<sup>st</sup> Century Economy**

In moving forward, Louisiana State University, as the one and only alternative seed for the development of a Louisiana regional knowledge based economy, should consider the following in both its strategic and tactical planning:

1. Only look forward and attempt to consider scientific and technological areas which are beyond the present concentrations of the leading academic research centers. This inherently difficult task must be done as a mechanism of

- “leapfrogging” to the scientific and technological capacity of competing institutions. This “leapfrogging” is essential if LSU hopes to have a clear opportunity of building separate scientific and technological prowess. For instance, consider those technology areas which in 2020 to 2030 are likely to be significant drivers of economic opportunity including nanotechnology, biomimicry, biomaterials, bioelectronics, biocomputing, artificial intelligence, knowledge management, planetary management, and new power technologies (sustainable technologies). There are a number of niches in each of these that have the capacity to provide the means for LSU to grow competitive research capacity. This means putting together the means to attract the scientists and engineers who have the capacity to compete in laying the fundamental science and technology for fields that are 15-20 years off from economic potential.
2. It is essential that universities both in the central catalytic role of a knowledge driven economy and the desire for being in such a role, focus on the building of not five or ten, but scores of industry university relationships. These relationships can be the result of technology transfer opportunities, research collaboration opportunities, or joint programs and joint centers, but in any case, it is essential the Louisiana State University develop the staff and capability for establishing numerous simultaneous industrial interactive relationships.
  3. In developing and expanding LSU’s research potential, it should steer away from becoming overly focused on purely applied or problem oriented research and focus more exclusively on fundamental research. Fundamental research can be both the type of research which is focused on nothing in particular, as well as the kind of research that is fundamental in nature but focused on solving particular problems. Many universities in an effort to become economically viable to a regional economy divert their energy to solving the problems of the industry physically present at the moment. LSU needs to focus its energy on building the intellectual community with the capacity to operate at the level of laying the foundation of an economic community which is 20-30 years in the future as a means of catalyzing ultimately the development of real time, present day, technology development activity. This is a difficult concept to really fully understand, but it is essential that the university have state of the art, leading edge, scientific and technological capabilities in a range of areas for which no economic potential is presently seen. It is only through this kind of research that the university can serve as the catalyst for the building of the knowledge community which is the essential step necessary to the ultimate development of a knowledge based economy, even on a regional basis.
  4. Given the rate of interest in scientific knowledge and the increasing significance of academic based scientific knowledge to industrial development, it is essential that Louisiana State University focus maximum energy, resources and effort on providing its scientists and engineers state of the art access to the wealth of scientific knowledge (enhanced digital library systems), as well as the capacity to host scientific meetings around the world in those niche areas that the university has determined are most critical to its potential success.
  5. To be successful as a catalyst for a knowledge community, Louisiana State University needs to undertake investments in science and technology, as well as

investments in professional staffing, and the development of a wide range of strategic research partnerships. Such partnerships require bringing together academic, science and technology groups and the professional staff to help partnerships around these groups succeed. The types of partnerships most essential to LSU's future include research joint ventures with both industry and other universities.

- a. LSU should focus dramatically on piggybacking with a range of other institutions in proposals and programs.
- b. Strategic alliances with further evolved universities in areas related to scientific and technological development is essential.
- c. Industrial consortia should be pursued at an institutional level in areas identified as the niches that LSU will occupy.
- d. Cooperative research and development agreements (CRADAS) should be pursued with the federal government linking areas of science and technology need in industry with scientific and technological capacity in the university.
- e. Federally funded research and development centers should be pursued in as many forms as possible to be closely allied with Louisiana State University. Rather than earmarking academic centers which only results in limited gains over the long-run, all political resources available to the university should be focused on the building of federally financed research and development centers around the Louisiana State University campus, as a means of expanding the relationships between the university and a range of other scientific alliances.
- f. LSU needs to establish under its own flag at least three world class research centers which are recognized as one of the top five centers in the world in the subject by all external sources. These would serve catalytically as a mechanism to help spur the development of the university itself.

### **Summary**

The 21<sup>st</sup> century economy is one that will be broad and diverse and have as one component, not the dominant component, a science driven knowledge enterprise development foundation. The building of such an element in the Louisiana State and regional economy requires two ingredients. These ingredients are significant educational enhancement in areas underpinning and underlying emerging areas of technology and the development of a single world class knowledge enterprise, Louisiana State University. Louisiana State University is the only public sector institution within 40 years of having the capacity to develop the catalytic properties sufficient to provide the initialization ingredient for the emergence of a knowledge based economy in the Louisiana region. Such a development of the University will take focused investment in niche areas of science and technology that are likely to be high risk. Such investments, however, will lead to the positioning of Louisiana State University as a major center for scientific and

technological creativity and such developments will permit the beginnings of the process of building a knowledge community in the Louisiana community.

Investments in Louisiana State University should be highly focused, highly academic, and measured largely by academic success and scientific prowess, as opposed to specific economic development success. Economic development success follows academic success in the knowledge driven economy.

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