

# THE REAL TIME SYSTEMS GROUP - A UNIVERSITY/ INDUSTRY PARADIGM PIONEER

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## INTRODUCTION

This paper discusses the vision of the Real Time Systems Group (RTSG), a development and research group based in the Faculty of Engineering at The University of the West Indies. Its self-declared mission is to make meaningful and permanent contributions which would lead to an increase in regional productivity through the formulation of appropriate innovation mechanisms, with particular reference to regional development and research strategies. Because of the broad scope of technological processes involved, the RTSG has focused its activities on the design and analysis of computer hardware and software systems for industrial and commercial applications; its name is derived from the fact that most reliable computer-based solutions require real time operating systems for handling critical requests for computer resources. The note expands upon this issue of the need for "innovation formulas" for regional industries.

## BACKGROUND

The RTSG works in close association with the Department of Electrical and Computer Engineering. It came into existence around 1988 seeking to forge a template for a University/industry interface using resources drawn from diverse quarters: local and extra-regional funding, University infrastructure support and expertise primarily from the Department of Electrical and Computer Engineering. The RTSG has invested considerable effort in developing the various facets of this interface; accounting systems, component procurement systems, staff composition, management structure, project management procedures, and even computer and electronic system design philosophies.

The creation of such an interface was necessary because of the perception that the Faculty of Engineering, and by extension the University, had never really developed a level of involvement with the industrial sector befitting of a higher institute of learning. For sure, there were those lecturers who

consulted with industries; however, for the most part, these consultations focused on highly specific technical issues. By and large, the University had little influence on the policies of the industrial sector as they pertained to the role of technology and technological development and research in increasing their profitability. No attempt was ever made to directly address the aversion of the regional manufacturing sector to the involvement of "UWI academics" in their productive processes.

The group actually evolved from efforts in the Department to challenge the technological sector to harness the power of microprocessors. After all, these new devices were heralded by international experts as crucial vehicles for the advancement of Third World nations [1]. Their virtue lay in the fact that systems design now depended less on expensive hardware capabilities and more on the imagination and creativity of designers. Moreover, with the predicted upsurge of informatics and telematics as key factors in the world economy, microprocessors were seen as vital components of an enabling technology for maintaining global competitiveness.

Given the importance of the technology, relevant programmes were introduced by the Department at the postgraduate level; later on seminars and workshops were organized for practicing engineers. However, it was soon noticed that these programmes seemed to have very little impact on the companies in which these engineers were employed. The fact that participants simply returned to "business as usual" upon completion of the workshop indicated that something was wrong and that a different strategy had to be adopted.

In Trinidad and Tobago, this situation was exacerbated by the oil boom in which the non-oil sector saw zero, even negative growth and in which the manufacturing paradigm was to import all components necessary for production; equipment as well as expertise. Manufacturers simply imported equipment and supplies, trained their staff in the rudiments of maintenance and operation and set about their

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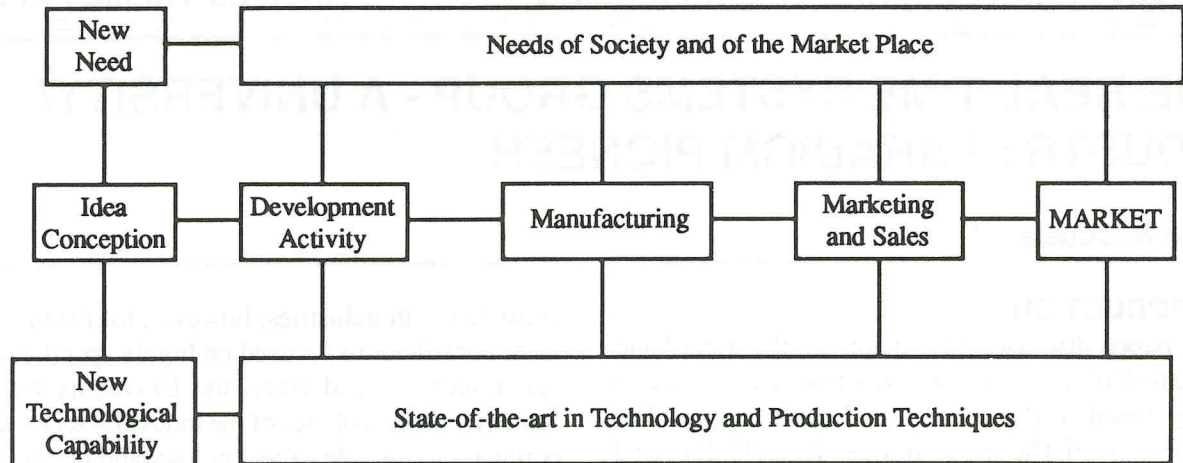


Figure 1: Rothwell's Innovative Process Model

production activities. Although the Governments of the time saw the need for the development of the non-oil sector, their policies emphasized import substitution and protectionism and eventually proved to be ineffective. Some regional economists claim that our present paradigm for industrial activity is inherited from the colonial past; in fact ours has been called a "plantation economy" by these economic experts. We all know that in the days when sugar was the main export, all major production components were obtained extra-regionally with the raw material being supplied locally. Originally, the competitive advantage was the uniqueness of the product and the cheap (slave) labour supply. When European scientists discovered how to manufacture sugar from other sources, this advantage was seriously degraded; it was completely lost with the later increase in the cost of local labour.

Paradigms, by their very nature are difficult to identify and, more importantly, difficult to change. Thus, when the industrial base shifted to oil, there was no corresponding shift in the industrial paradigm. In the past, survival within this framework of operation necessitated protectionist policies. Today, our governments have been coaxed into removing these barriers, thus forcing our manufacturers into open competition on the global market. The RTSG is of the view that our manufacturers are, for the most part, not ready for this level of competition. This view has been recently substantiated by the manufacturers themselves, who are asking for time to adjust to proposed trade liberalization policies.

The RTSG is also of the view that we, as a region, are in this predicament because innovation and invention, two key factors of competitiveness of major world industries, have never really been part of

our psyche. We have never really had to depend on our wits to survive.

At this juncture, it should be emphasized that there is a distinction between the invention and innovation. Invention is "an idea, a sketch or model for a new or improved device, product, process or system" [2]. By contrast, innovation "is accomplished only with the first commercial transaction involving the new product, process, system or device..." [2] In other words, innovation has to do with finding all the right components for creating a financially successful product; it includes invention. The innovation process is multi-dimensional incorporating several disciplines including engineering, marketing and management. The RTSG has found that innovation often includes social and cultural factors as well. This is substantiated by experts such as Rockwell [3] whose innovative process model is shown in Fig. 1.

The innovative process varies from one country to another. Japan's formula is clearly different from that of the United States, Germany, or even that of the other newly emerged countries of the Pacific Rim. Where we have failed, therefore, is in realizing the importance of the innovative process and in determining a regional formula for this process.

There are many who would reject the concept of failure projected here. Consider, however, the case of the Trinidadian oil industry. Trinidad has just about the oldest oil industry in the world; indeed, the very first oil well was drilled in the south of the island some 127 years ago. Yet she still imports much of the extraction equipment, processes and some of the expertise required for this industry. Another measure is our patent activity. Of the 1,430 patents registered locally from 1974 to 1989 [4], only 10% were

registered to Trinidadians; all others were granted to foreign concerns seeking to protect their local investments. This level of patent activity indicates a poor potential for growth through exploitation of technology.

### **PIONEERING THE PARADIGM SHIFT**

What the RTSG is proposing is essentially a new paradigm based on a well thought out innovation formula. We have not as yet determined all the facets of this formula but have realized that it must take account of the following:

(1) Our industries are small by the global scale: even Trinidad and Tobago, well known for its history in oil, accounts for less than 0.5% of the world supply. This small size indicates an inability to control market prices; it therefore follows that profits can only be increased through a reduction of production costs. Three important factors in production costs are extra-regionally supplied goods and services, regionally supplied goods and services and labour. The traditional means of improving profitability include exchange rate adjustments and reduction of the labour force: both have severe social repercussions. However, significant improvements can be made by procuring much of the goods and services we now import extra-regionally from local or regional sources. To be sure, we will always be dependent on our competitors for some technology, but unless we strive to work on that part of the innovation formula which allows for a more profitable compromise between local and foreign sourcing of the components of production, our countries will never reap significant benefits from our natural resources.

(2) Innovation relies heavily on technology. All the nations which we have judged as successful have openly admitted their reliance on technology as a prime factor in maintaining their competitive advantage. Research and development is seen as playing a major role since it is a key mechanism in a competitive environment, allowing one manufacturer to differentiate his product from another. It is the RTSG's view that regional industries can increase their profitability only if they are willing to invest a percentage of returns on local/in-house development and research projects. Moreover, it is felt that the emphasis should be more on DEVELOPMENT than RESEARCH. This represents a major shift in the University paradigm.

The traditional emphasis of UWI on primary

research, destined for foreign publication, can only be of marginal benefit to the region. Research is associated with the cutting edge of scientific knowledge and therefore impacts more directly on new and emerging technologies. However, in most cases, the region is not equipped to take full advantage of UWI academic research, particularly in science and technology. Development, or applied research, on the other hand, deals with the application of known techniques and procedures (or slight modifications of these) to solving existing problems. Given the current economic circumstance with inflation over 10% and unemployment in excess of 20%, the UWI should redirect more of its resources to development work which would more immediately and directly impact on the productive capabilities of the region.

(3) As indicated earlier, the non-technological components of innovation are just as important as, often even more important than, the technological component. Non-technological components include such factors as marketing and management. There are also sociological and cultural factors to be dealt with on the factory floor, in the manager's office, in the conference room and in the market place. This holistic view of innovation is extremely important since it is the tendency of regional academics to focus only upon the components which relate directly to their field of knowledge; this is a traditional weakness of those in the science and engineering disciplines. Recently, for example, the RTSG was involved in the design of a new product for one of its clients. For all the efforts placed on the technological components, this product almost never made it to the marketplace because of inadequate marketing and advertising expertise in the product development process. Fortunately, the omission was realized in time and the product now occupies a competitive niche in the regional telecommunications market.

(4) True innovation requires the identification of areas of technological competence. Given the economies of scale, it is felt that much attention should be paid on the targeting of strategic technologies which would lead to the development of the innovative process. Moreover, new technologies should not generally be acquired for their own sake. For example, Trinidad experts once toyed with the idea of developing local expertise in the electronics and micro-electronics area. The RTSG philosophy on this issue is that our regional competence in electronics should be enhanced primarily to support development

activities in our existing industries, particularly those "flagships" of the economy (oil, natural gas, urea, bauxite etc.). Experiences gained with the technology and the relevant market forces would then eventually determine the viability of broadening the scope of activity. The same applies to other support technologies such as computer engineering and communications.

The considerations given here are by no means exhaustive. The RTSG, for example, is fully aware of the fact that it cannot determine this innovative formula on its own. Indeed, the formula, although bearing some national/regional characteristics, must also vary from one company to another. For this reason, the group emphasizes joint approaches to problem-solving when dealing with its clients. This ensures a two-way transfer of knowledge; on the one hand, the group acquires some knowledge of the client's productive operation while the client is encouraged to discover and enhance their innovative process. It is this joint approach which differentiates the group from the traditional consulting firm.

### **CONCLUSION**

This paper has discussed the Real Time Systems Group and its vision for new economic growth driven by a new paradigm for the productive sectors of the region. The paradigm centres around the notion of a regional innovation formula. Given its multifaceted nature, this formula is larger than the RTSG: it requires no less than a concerted national/regional effort to successfully determine its composition. Because change is never easy, the RTSG sees itself as a change agent (paradigm pioneer [5]) for forging this new Caribbean approach to industry.

The discussion above has not detailed the significant contribution to be made by all sectors (Govern-

ment, banking, industrial and academic). The role of the University is particularly significant since it is the one institution which brings together experts on the various innovation formula components. In this new world of trade liberalization and global trade policies, only those nations who have refined the process of fine-tuning their innovation formulas will be truly successful. It is the Group's hope that our region will one day achieve the level of success attained by countries such as Singapore, Korea and, more recently, Malaysia through the determination of that formula. We remain convinced that the University is the major vehicle through which the required paradigm shift can be effected.

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