

SCIENCE and TECHNOLOGY INSIGHTS in SMEs

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Abstract: Access to and applications of new technological information from worldwide sources is fast becoming critical for SMEs. Nevertheless, SMEs have distinctive challenges to overcome in order to generate business and S&T insights that would result in tangible actions. Assistance to SMEs by governments appears to be very much in fashion but their understanding of the specificities of SMEs and their capacity to act, both from a technological and market points of view are usually limited. In this paper, I shall examine the issue of S&T insights for technology based SMEs in order to stimulate further discussion and empirical research.

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INTRODUCTION

Greater availability of statistical information, has allowed academic researchers to investigate business strategies in a dynamic environment. In periods of information scarcity, generals who had good maps and scouts had a distinct advantage over their adversaries. However, strategies were static and the ability to anticipate the countermoves of adversaries and reaction of the population was limited. Aristotle Onassis suggested that one needs to know something that one's competitor does not know. In today's knowledge society and information overload, it is almost impossible to follow this advice. What is now required is a slow and methodical gathering, screening, organizing and analysis of information for the generation of insights. Insights, sometimes called Intelligence, is generated from information from competitors, customers and suppliers and is aimed at strategy formulation by the Executive team with its clear trade-offs and choices.

INTERNATIONAL MARKETPLACE OF SMEs

Since the end of the Second World War, world trade has expanded, and by the early 90s was comparable to its level at the beginning of the first world war (1). The impact of this globalization brought about in part by the reduction in tariffs will not only be felt acutely by Multi National Corporations (MNCs) but also by Small and Medium sized Enterprises (SMEs) (2). As the merger of MNCs (3) continues unabated we can expect that supplier SMEs will see MNCs either set up their own suppliers, establish alliances, acquire SMEs or simply demand that SMEs assume responsibility for technical development and increase productivity. The reductions in custom tariffs and the easier movement of capital, will force SMEs to internationalize their strategies. Although there are many examples of SMEs which have a lucrative export business, until recently, most have been excluded from foreign markets because they lacked the required expertise and/or human and financial resources. Nevertheless, when exports reach a certain level, SMEs usually encounter non-tariff barriers enacted at the instigation of local firms (4). As every threat is also an opportunity, SMEs will also face more competition in their own unprotected home markets.

There is presently a World-wide ideological and political consensus on the benefits of free trade. However, that consensus may, or may not, continue over the coming decades. The increasingly protectionist industrialized countries are seeking to raise labour standards, eradicate sweatshops and stop child labour in developing countries even though low wages in developing countries arises from their low productivity (1). Indication of a backlash is already noticeable in Latin American Countries (5) and one could legitimately question whether the population of developing countries will accept ever increasing liberalization of world trade.

But, professor Kobrin (6) at the Wharton school believes that the scale of modern technology makes the trend irreversible. Furthermore, specialization results in interdependence as organizations specialize in developing core competencies and deepening their strategic positions rather than broadening it. Thus for the foreseeable future, the road-map of the business world appears to be moving away from independence to interdependence and it is those who will be learn the skills required to manage this interdependence (7) who will prosper. It follows that the complexity of decision-making in SMEs should and will reflect the complexity of the competitive environment (8).

TECHNOLOGY BASED SMEs

The received common sense is that SMEs have the ability to respond with speed and flexibility while larger companies are much slower. This common sense neglects to address the fact that SMEs do not, in general, have massive resources at their disposal and that they may not recover from a wrong strategic thrust. The US National Bureau of Economic Research (9-a) has demonstrated that small firms are less likely to use advanced technologies such as computer controlled tools and account for a disproportionate share of job losses and job gains. More recently, Baldwin (9-b) found that SMEs have not only been paying increasingly lower wages but are also less productive. This would indicate that decision making in SMEs is not, in general, as good as the received common sense would suggest. This may entice researchers to seriously look at the specificities of SMEs and governments at better targeting their SMEs assistance programs.

It is unfortunate that SMEs have been lumped into one amorphous category and although the use of technology would be a determining factor of competitiveness for most SMEs, a distinction should be made between agricultural SMEs, service SMEs and manufacturing SMEs. SMEs (except for agricultural SMEs) are either suppliers of products to MNCs, incubators for new products and processes that would be bought by MNCs, or producers of customized products and services (10). Companies with no sales (start-ups) have a different set of requirements for insights. This distinction is important because globalization has proceeded at different rates not only for companies who are in different industrial classifications but also for those within each classification. I will confine (11) myself to manufacturing SMEs (Technology Based SMEs) who utilize technology as a source of proprietary product or process innovations. In this case, the purpose of Science and Technology insights (STi) is the identification of threats and opportunities.

Technology based entrepreneurs, like any entrepreneur, attempt to sell, in a given market, a superior product or service. Products must be priced correctly, with commensurate specifications to compete in the market place, and be effectively marketed to potential customers. The Executive Team in SMEs is required to anticipate market needs over the planning horizon and the potential technological developments that will displace their products, present and future. Thus, technology based SMEs require insights for the preparation of business plans, the raising of capital and the pricing, marketing and distribution of products, etc. The process of integrating managerial, financial and marketing with technological skills is no mean feat, as traditionally these have been two solitudes. In general, successful technology based SMEs are those where the executive team has learned how to bridge these solitudes and is demonstrated by the emergence of new behaviour (12).

S & T INSIGHTS

Technology is now recognized as one of the basic determinants of competitiveness. Scientific and Technical insights (STi) is therefore crucial for all SMEs which rely on technology for their survival and must include the ability to monitor technological developments of competitors, clients and customers World-wide. STi has been defined as S&T information on external opportunities, threats and developments who affect the company's future position in the international marketplace (13). Another definition is knowledge and foreknowledge of the environment as a prelude to management action (14). Thus, STi is both a defensive and offensive tool since it not only reduces the risk of investment decisions but is also a source of opportunities. STi focuses specifically on insightful technical information in the context of the international marketplace. This information is often obtained through various networking activities (15). Also, the executive team must be fully cognizant of both technology push and technology pull forces World-wide. Indeed, the recognition of technical opportunities, coupled with the identification of market needs, are recognized as the two most important ingredients for successful innovations. Most SMEs realize the need for early recognition of technological opportunities, but have usually neglected to conduct thorough S&T monitoring or scouting. This neglect can only be explained by beliefs of the Executive team either that one has no ability to control the outside environment, or one knows it all.

STi strength comes from the slow accumulation and analysis of S&T information, its analysis in the context of the international marketplace and its use for strategy formulation. If one follows Mintzberg's (16) analogy, STi is the result of steady and continuous analysis of S&T information (left brain), with synthesis or insights (right brain). The 4th century Greek philosopher, Aristotle postulated that wisdom was not achievable by logic alone, but was by disciplined intuition. Thus, one should not develop a STi program based exclusively on analysis since the exclusion of synthesis would considerably diminish the usefulness of STi in business decisions.

BACKGROUND ON S&T INSIGHTS AND SMEs

There is a paucity of papers and case studies on the phenomenon of S&T Insights (STi) in SMEs. This may be because most politicians and researchers, consciously or not, look at SMEs as having an overriding objective of expansion into large firms. Yet only a minority of SMEs will ever expand into larger firms and it is unwise to base programs and policies on such premises. The general assumption is that a SME would require the same quality of STi as its larger counterparts, but somehow more targeted and cheaper to generate.

The challenge for the executive team is to allocate its investments in the right direction to move from the present design to future designs at the lowest development cost per unit of customer satisfaction. To do this, the team needs to understand the requirements of its customers, employees and shareholders, in that order. This hierarchy is based on a study that indicates customer demands far outstrip other factors as the main engine of innovation.

Yet there appears to be a paradox between the increasing unpredictability of the business world and our "faith" in technological foresight and forecasting. Drucker (17) suggested that "it is not so very difficult to predict the future, it is only pointless". The competitive advantage of being able to know today where are the future technologies, based on what has been discovered today.

Although there are multiple intelligence models (18) and nodes in SMEs, The steps in the STi cycle (loosely based on Kroll (20) and Mintzberg (16) taxonomy) are as follows:

- . Technological needs as defined by overall company strategy
- . Collecting data from publicly available sources
- . Organizing and processing information
- . Analysis of information and generation of S&T insights
- . Synthesis of STi with various business insights
- . Strategy formulation by Executive team
- . Technological needs as defined by overall company strategy

Technological needs must be clearly defined in order to generate useful STi. The issue is that the analyst can drown in too much data thus, the search must be focussed on the technological requirements which are deduced from the firm strategy. If one believes Porter, strategy formulation should be to deepen the strategic competitive position rather than broadening it (19).

- **Gathering the data**

In collecting one must ask oneself how much structure to establish? The amount of staff networking to encourage as the involvement of staff has other benefits besides sharing the workload. If information is widely dispersed, one would have to enlist other sources of information and gatekeepers such as local libraries, industrial associations, universities and colleges or government resources and specialized (21) information retrieval firms (Is closer contacts with fewer universities better?). Soliciting the views of customers, non-customers and suppliers would increase their satisfaction with the firm. Also the use of stock analysts is often neglected.

Other considerations in designing a gathering system are:

Maturity of the technology (In rapidly evolving industries, STi should be generated from an international viewpoint. Coe and Helpman have demonstrated that foreign R&D stock is at least as important as the national stock in countries with small economies;

Capital intensity (Larger investments would require extensive STi, as once an investment is made, it is usually difficult to undo);

Who and where are the other players (competitors, suppliers, clients; the size and background of present and future players often indicate their decision making processes);

What are their technological plans (If they are allocating funds to R&D then one can expect changes);

Where is the marketplace (If the marketplace is small and local and the technology mature then one would not expect competitors unless...);

Stability and predictability of the marketplace (competitors, clients, suppliers);

How are the competitors responding to globalization? (Are they going in or out of certain markets, are MNCs bankrolling competitors?);
Quality of investors (angels, venture funds, bankers, shareholders);

- **Organizing and processing the data**

Once the data gathered, then organizing and processing of the data can be done. Examples of processing data would be various citation, patent and content analysis. This should be done with the involvement of senior staff in the company who have extensive experience in the marketplace.

- **Analysis of information and generation of S&T insights**

The analysis of information and generation of insights on both the technology and competitors is weak even among MNCs (22). The generation of STi in a MNC is usually centralized and assigned to a dedicated group close to the executive team. The result would be an objective assessment of current technologies compared with present competition and an assessment of new competitors based on emerging technologies or change in strategy. In the case of an SME insights could be generated by divisions heads, with the occasional involvement of outsiders with specific skills or expertise. Recently several service companies provide customized analysis of published information. These companies have assembled substantial knowledge and expertise in specific technical sectors and have substantial archiving capabilities. Their publications are sold to whomever pays the subscription price. Most companies will perform analysis on a custom basis, but obviously it is rather expensive and out of reach of most technology based SMEs (\$100K). Nevertheless in fast moving sectors it would be a false economy not to undertake thorough scouting of S&T information.

- **Synthesis of STi with other insights**

STi must be combined with other business insights in order to make decisions and take actions. STi is only one piece of the puzzle in strategy formulation and one generally technical insights on its own does not lead to corporate decisions. Therefore, the convergence of both streams must be completed at this stage. This is not easy even in large companies (22).

- **Strategy formulation by Executive team**

The style of decision making of the Executive team is an important factor in designing any program. Insights must be presented in a form that allow the owner and his team to develop and formulate their strategies (16). An astute Executive team would also want to monitor the effect of its technological strategy by further collection of data and analysis.

GOVERNMENT RESEARCH AGENCIES and UNIVERSITIES

There is a perception that government and university researchers have vast deciphering powers that can nurture technology based SMEs. Also, most Technology based companies depend on such international governmental activities as standards and regulations. It is therefore not a surprise that SMEs have requested that governments share with them their insights on

international markets and technologies. These STi activities are often viewed as a natural extension of technology transfer from government laboratories. These demands neglect to take into account that public research institutions, including universities, have as prime motivator the stability of their research programs and a certain aversion to risk(23).

Albagli et al. (15) developed the concept of exploiting the participation of National Research Council of Canada researchers in collaborations and networking activities to generate STi. A trial copy of an STi bulletin was prepared and selectively disseminated to technology based SMEs in the high technology sector. The evaluation of the trial demonstrated that the concept was unique and the information provided useful and needed. As specific SMEs needs were unknown, the government researchers had to have the skills to analyze information (left brain) and synthesize insights into the international marketplace (right brain). It was abundantly clear that the training of researchers was crucial, but government researchers have rarely the skills to perform both functions and they seldom can differentiate between what are an exciting technical discovery and a commercial opportunity. It is now the opinion of this author that government research organizations can provide on a continuous basis screened technical information, which remains a very useful contribution to SMEs.

Conclusion

I have defined the need for S&T insights by technology based SMEs and scoped various factors affecting the generation of STi. It is evident that further empirical research on this topic is required. Specially, the service sector has been neglected and is worthy of more thorough investigation as by all accounts, greater productivity increases would occur in this sector.

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