The Potential of Quality Information Systems for Eastern European Economic, Technologic, and Managerial Leverage

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Abstract
This study examines the role of quality management information systems in Lithuania for global competitiveness. It identifies two strong relationships – first between the increase in exporting and the increase in the importance of quality, and the second between the sophistication of the information system being used by the organization to manage quality and that organization’s level of global success through acceptance of their goods.

Through these two relationships four-levels of quality management systems and their implementation in business surface: 1) quality through compliance paper system; 2) quality through compliance automation (basic); 3) quality through strategic information technology (intermediate), and 4) quality through TQM/expert systems (advanced). To explore these four levels case studies of four businesses were investigated (one corresponding to each level) for a progressive look at these advantages each produces through information systems for global competitiveness. The first two cases are of Eastern Europe businesses (conducted through primary research on-site) and the last two are from US business (taken from secondary research and published materials).

The conclusion of this research is that in order for Lithuania to accomplish its goal of attaining membership in the European Union and access to the global marketplace it must upgrade the quality of its exported goods and services to meet established standards. This can only be accomplished with the implementation and use of quality management information systems. This use has to be endorsed as a national imperative and the cultural aspects of Lithuanian businesses’ adoption of technology must be worked in as one of the key factors to the systems success.

The contribution of this research is the laying of a foundation for the need of quality information systems in Lithuanian and other CEE countries now in transition. It can be used as a starting point and guide to help the national governments in their ongoing progress towards acceptance into the global marketplace of the 21st century.

1. Background

The most successful Management Information Systems are implemented as a tool with the purpose of helping to achieve a business goal rather then just for the sake of technology. In our current world of transition economies, there is no greater goal than of becoming a valuable and profitable participant in the world market. This is the situation of the Eastern European countries, recently independent from Russia. But the desire to play in the game is not the same as playing competently. You must prepare by acquiring the equipment, putting on the uniform, learning the rules, and practicing. Then you must gain permission by the other players to become part of their game that has already begun. Can MIS help? Yes. What kind of MIS? Quality Management Systems. How? Through technology transfer and exporting.
1.1 Lithuania and Exports

In September 1997 the Ministry of European Affairs founded the Lithuanian Development Agency (LDA) to promote and attract foreign direct investment. The importance of this was that LDA later merged with the Lithuanian Agency and the Lithuanian Export Promotion Agency. Their job is to promote Lithuania, and an important job it is. According to a study in 1997, the country-of-brand origin and the country-of-manufacture are both important cues in consumer evaluations of product quality, product value and willingness to-buy (Iyer & Kalita, 1997).

Lithuanian exports approximately $3.4 million to the global market, mainly to other Eastern and Central European countries. Its major export industries include agriculture, mineral products, textiles, chemicals, wood, and now milk. In an October 1998 interview, Lithuanian borrowing official Rumanas Lygis stated “our economy is now geared to trade with the EU, not the former Soviet Union, and we have a successful privatization record which has supported economic growth. Psychological not economic factors have determined our trading spreads.”

1.2 Lithuania and Technology

On November 12, 1991 the Supreme Council and Government of the Republic of Lithuania announced the official launch of the Program Lithuania 2000.” Phase I was to prepare a strategic plan for the development of a Lithuanian Information Infrastructure (LII). This infrastructure would be an integrated whole of information technologies, standards, regulatory frameworks, and organizational structures and procedures that would provide the electronic means to handle and exploit major national information resources. This plan was developed in collaboration with a project team consisting of over 82 specialists from various public, scientific, and academic institutions, including an IT specialist from the United States. The strategic plan was presented on November 3, 1994.

Among the benefits touted by the plan are the advantages to be accorded business: 1) for small to medium business it would offer more business opportunities and more effective management; 2) for large-scale businesses, the LII would provide information services and help foster international relationships; and 3) for financial credit institutions and banks the LII would help with the speed up and control of clearings.

Despite the government’s good intentions the reality of computerization and information systems is still in the same state as when the project was first proposed. The objectives, benefits, and preliminary outline of the plan are completed but continuously revised. On July 8, 1999 Dr. Valdas Undzenas, head of the section of Information Systems, of Lithuania’s Department of Information and Informatics, released an update report in Bucharest on the development of IS in Lithuania. In it he states that a 1998 draft of the plan was prepared and submitted to the Government for consideration. The government decided to have the plan refined. A new reading of the program was to be presented by the autumn of 1999.

1.2.1 Technology Transfer

This is the official government stance. The industry picture is quite different. Lithuanian business is not waiting complacently for government to approve a final plan. Taking advantage of a new accessibility to western ideas, expertise and technology, they have started to rely on “technology transfer” to “catch-up” with global competitors.

Josh Duberman of Perken Elmer, Inc. Applied Biosystems Division defines technology transfer (TT) as “a process in which technology originated in one place for one purpose is used elsewhere, for either the same or different purpose.” Technology transfer has many players in the global arena-
national agencies and laboratories, national government technology programs, the university licensing community (CEE Institutes), industry, academia, and various intermediaries of economic development. Some of the mechanisms that make TT possible include: joint research, cooperative agreements, cooperative research and development agreements (CRADAs), licensing, technical meetings, trade shows, information dissemination, industry strategic partnerships, and subsidiaries.

Usually provided by foreign partners (trading or investing), this transfer most commonly takes the form of hardware and software in the CEE countries. This appeals to Eastern European managers because they view it as a “silver bullet”—a big idea that will rescue their company during this transitional period, after all if their western partners succeeded with these tools why won’t they? What they fail to realize is that these “tools: are only parts of the solution. Recipient enterprises lack the rudimentary strategic management skills to adjust these tools’ maximum benefits for their particular situations. Technology transfer should be seen as an intermediate step to promote innovation until the enterprises can understand and implement IT systems on their own.

There are several barriers to overcome in transferring technology to the CEE countries cultural norms, laws, tax polices, political and economic conditions. The key factor to the current failure of technology transfer is truly a cultural one. In the words of Michael Ishman “under the Soviet economic and management model the free flow, or sharing of information, existed when it served the purpose to shape society and even then it was a subject to distortions and fabrication. Individual initiatives, risk-taking, and the embracing of technology change were not encouraged.” Managers must be trained in order for customers to be served by efficient companies able to deliver the promised benefits of free markets and democracy. In the words of Martin Bell “transferred technologies might be just as likely to subside into the low productivity levels prevalent in their new contexts…what you get depends on what you’ve got.” What is stronger—new technology or old ways?

In addition, technology transfer is a 2-way process. Technology flows in one direction are matched by the counter-flows of commercial returns sought by owners of the technology. (Bell, 1997, pg. 64). In other words “there is no free lunch.” The developing countries that receive this technology must pay a fee—whether in lower prices for their goods or outright licensing fees for the use of the technology. The nature and magnitude of these costs rest on the imbalance of powers between the two parties involved—a developed country and a developing country. This not only concerns the costs, but also the “quality” of the technology transferred (including the modernity of the technology) and the scope and depth of the information, know-how and expertise that is transferred with the equipment. (Bell, 1997, pg., 68). A key question of all Baltic companies involved in technology transfer is quality of the technology they are getting versus their cost of the technology in the agreements they are currently party to or about to become?

But the concerns with the technology transfer do not end here. What if the Baltic States have no one to transfer with? Underdeveloped cooperative relationships between individuals and between organizations stood out as obstacles to technological innovation and improvement of industrial performance in industry studies conducted by Dyker and Peririn in 1997. International exchanges in higher education and related basic research was restrict by Eastern countries mainly for political reasons (Pavitt, 1997, pg. 49). Now they are being expanded for political reasons.
Table 1. Opportunities to Close Gaps with TT, Adapted from Salvo Radosvoc, 1997

<table>
<thead>
<tr>
<th>Product Development Gap</th>
<th>Market Development Gap</th>
<th>Management Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Direct Investment</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Joint Ventures</td>
<td>High/medium</td>
<td>High/medium</td>
</tr>
<tr>
<td>Subcontracting</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Exporting</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Alliances</td>
<td>Medium/Low</td>
<td>Low</td>
</tr>
<tr>
<td>Licenses</td>
<td>Medium/Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Furthermore, the process of technology can not help but affect, and in some instances begin, restructuring of the science and technology already in existence leading to reformation. If technology transfer is to do more than just hand over equipment and software, but also to encourage innovation (Chataway, 1999), the recipients will have no choice but to reexamine and modify their current technological practices and strategies.

For technology transfer requires strategic management to be able to select and choose a suitable solution (for the specific company) from those being offered. This strategic mindset, of looking at long-term costs and benefits from any kind of partnership, is not one that Eastern European countries are accustomed to. But that is changing. For with the equipment, etc., technology transfer is also transferring market concepts and new strategic paradigms.

We must keep in mind Mayr [1986] who said:
Technology as a fundamental human activity is intimately related to other human activities and thus is an integral, indispensable, part of a human culture, and is not, as one often hears, an alien, inhuman force unleashed upon mankind by some external agent.

TT consists of five major activities: technology scouting, technology marketing, technology assessment, transfer related activities, and finding experts to help with the above. “Experts” for the CEE countries are few. Most European international TT resources are concerned with European Union (EU) member states only. The European Innovation Monitoring Systems (EIMS) has six main areas of focus; the most relevant to us is innovation and technology transfer and supporting infrastructures (see http://www.cordis.lu/eims/src/about.htm). In this role EIMS provides information via conferences and publications on important TT issues such as:

- Establishing technology needs of users
- Recognizing opportunities for TT
- The role of intermediates
- Identifying technology sources
- Project management
- Intellectual property rights
- Monitoring and evaluation

Access to these resources enable member states to complete in the global marketplace with crucial advantages over those without a foundation of contacts and partnerships. Considering the Baltic’s handicap in its transitional status, these resources provide a high incentive to become a member of the EU.

To give EU its due, it did create the COPERNICUS program which supports cooperation and information exchange among Research and Development (RTD) communities in Central and Eastern Europe and the EU. In order to participate however, an efficient information infrastructure must be available or under development in CEE. Two COPERNICUS projects focused on this infrastructure is the European Science and Technology Transfer Network (ESATT) and the Information Dissemination in European RTD (IDIS). One of the general objectives of these projects is technology and know-how transfer to and inside CEE. These two projects offer services through RICE centers (Regional Information Center) located in various CEE countries.

Lithuania met the prerequisite with its LITNET network Infrastructure. It uses the Baltic backbone network BALTBONE and was first sponsored by an UNESCO project in 1992/1993. The Institute of Mathematics and Informatics of the Lithuanian Academy of Sciences mainly operate it. It also has a network-operating center (NOC) in the Computer Center at Kaunas University of Technology (http://www.litnet.lt). The Lithuanian government supports LITNET covering the costs of all-internal traffic and a leased line to Riga, Latvia. As of 1995, there was no direct connection to the Internet. This was accomplished by using TELNET to get a connection to Oslo, Norway. Speed is very slow and only the most basic Internet services can be used.

The EU COPERNICUS program also has a specialized project BENEFIT- Concerted Action for Stimulation and Support of East-West Collaborations in the Area of Microelectronics and Signal Processing (http://www.iiel.de/exports/html/benefit/Welcome.html). As per its elongated title, this project specializes in a specific type of technology transfer- microelectronics and signal processing, only.

There is also CEENet (Central and Eastern European Network Association). The purpose of CEENet is to co-ordinate international aspects of academic and research networking in the CEE region and to provide international connectivity to its members. It held its first meeting in Vienna on February
25-26, 1994 with representatives from 13 countries: Austria, Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Russia, Slovakia, Slovenia, and Ukraine. Lithuania’s LITNET applied for membership in 1995.

No discussion of TT would be complete without the legal complexities of this process. In the United States (US) various acts of legislation have been passed to protect the interests of parties involved in TT. For examples, the Technology Transfer Act of 1986 (PL 99502) and the National Technology Transfer and Advancement Act of 1995. In addition various export control and intellectual property rights have been made regulation. The global marketplace recognizes the importance of these protective measures through its own collection of treaties and agreements (WTO, GATT, etc.). CEE countries must offer a minimal of protection as well, and the more offered the more appetizing they appear as TT recipients. Lithuania is hard at work reforming her legal structure and commercial laws to meet this challenge, and is among the most advanced in the Baltic’s thanks to its view that harmonization of its laws with European law is a major priority. In August of 1995, Lithuania passed the Law on Investment of Foreign Capital granting investors the same rights as Lithuanians. It also ratified the New York Convention on recognition and enforcement of foreign arbitrage, supporting it with a new law on commercial arbitrage in April 1996.

Before ending this conversation on technology transfer I would like to offer the following graph which depicts TT as a solution for Lithuanian’s competitive identity:

![Figure 2. Technology Transfer: A Solution for CEE’s Competitive Identity](image)

1.2.2 Privatization

Another method of “catching-up” is a partnership between government and industry-privatization. Privatization can make up for managerial and institutional deficiencies leading to improved performance and productivity. It can also serve as a catalyst for the introduction of new technology and innovations in once stalemate industries because of lack of necessary funds. But it must be done recognizing again the cultural inhibitors. Privatization has worked best in those countries, such as the Baltic’s, who have an understanding that capitalism and free markets require more than just
private property, they also require fundamental rules and safeguards that make the outcomes of exchange secure, predictable, and widely beneficial (Nellis, 1999). Lithuania is undergoing a mass reformation of its commercial laws to support the privatization effort encouraged by its government. However, U.S. legal consultants (lawyers) who work pro-bono in this area state that once they leave their recommendations are not implemented. They return to their previous cultural norms. This characteristic prevails throughout the country.

1.2.3 Assimilation of External Technology

Whether through foreign investment, joint ventures, or privatization, the next question is how much of the “new” technology is assimilated and at what speed? Important factors such as proper focus, scope, completeness, and training affect this issue. Various classifications of degrees of assimilation have been proposed Dahlan et al. (1987), Lall (1987 and 1992) and Stewart (1990). I will be using Martin Bell’s 4 degrees model (1997) with one modification. Instead of looking for these 4 degrees as mutually exclusive, I believe them to describe a sequence of steps in process of assimilation. These steps progress from one to the other, but their progression is not guaranteed. Any company can become stuck in any step, and it may be that is the step it requires to be successful. The four degrees are:

1. **Operational assimilation** - the acquisition of technology in the form of designs, specifications, equipment and so forth, together with the skills and know-how needed to use and operate the technology at its design levels of performance. This is straightforward technology transfer. It is static and requires nothing more than the ability to read and follow instructions.

2. **Replicative assimilation** - acquiring or developing the knowledge and capabilities needed to reproduce (elements of) the technology. The original technology is repeated in similar facilities or in order to enhance the value chain of local suppliers of materials, components, sub-assemblies, etc. Here is the beginning of sharing, but with self-interest. Technology will go only as far as is required for the company's prosperity.

3. **Adaptive assimilation** - to acquire or develop the capabilities needed for incremental adaptation, improvement, and redesign of the initially acquired products, processes, and production organization. The receiving company can make a minor modification to fit their specific needs.

4. **Innovative assimilation** - developing or acquiring the knowledge and capabilities needed to make more substantial developments in the technology. At this level, “modifications” may go so far as to create a “new” technology.

The importance of the level of assimilation correlates with the cost of the technology that is transferred. At the beginning of this process the receiving company is in a state of technological dependence, which carries with it the danger of stunting the development of creative and dynamic technological capabilities within the receiving company itself. Without developing its own capabilities the receiving company is held under the sway of the transferring company. The cost for imported technology becomes its independence on the new marketplace.

To determine the assimilation level various factors are taken into consideration: 1) the companies involved in the transfer (including their social/cultural makeup, objectives and strategies for the transfer); 2) the industry of the companies involved; 3) the actual technology being transferred; 4) the channels and mechanisms through which the technology will be transferred; and 5) the economic, political, and legal environment at the time of the transfer. As in most aspects of successful business endeavors the key is relationships- who are these companies to one another and how well do their philosophies fit together.
2. Lithuania and Quality

2.1 What is Quality?

There are various definitions of quality depending on who you are in the value or supply chain including 1) a transcendent view; 2) product based view; 3) user-based view; 4) manufacturing based; 5) value based. A transcendent view of quality describes innate excellence, a mark of uncompromising standards and high achievement. The product-based view is more focused on the product itself and sees quality as a precise and measurable variable. The user-based view looks at how the consumer measures the product or service in comparison with other products and services (in other words, quality is in the eyes of the consumer). In particular it focuses on the following 5 factors:

- Tangibles (appearance of physical elements)
- Reliability (dependable, accurate performance)
- Responsiveness (promptness and helpfulness)
- Assurance (competence, courtesy, credibility and security)
- Empathy (easy access, good communications, and customer understanding).

The manufacturing view is focused on what happens on the manufacturing floor or in the service department as the product or service is being prepared for distribution to the consumer. The value-based views define quality in terms of value and price.

Quality assurance can therefore be measured within three dimensions: 1) people, 2) products, and 3) processes. Identifying which dimension(s) to measure and how is what makes the different quality movement philosophies unique. Regardless of the view or philosophy selected, quality comes down to conformance to requirements (Crosby). The question our transition enterprises need to answer is to whose requirement should they conform?

Table 2: Quality Philosophies Summary

<table>
<thead>
<tr>
<th>Guru</th>
<th>Known For</th>
<th>Book</th>
<th>Misc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walter A. Shewhart</td>
<td>Control Charts</td>
<td>Economic Control of Quality Manufactured Products (1931)</td>
<td>Adopted by the Japanese</td>
</tr>
<tr>
<td></td>
<td>Statistical Contributions</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>“Objective Reality”</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>“Subjective Quality”</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>The Chain Reaction</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>The Deming Cycle (PDAC – Plan, Do, Check, Act)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phillip B. Crosby</td>
<td>Quality Management Maturity Grid</td>
<td>Quality is Free (1979)</td>
<td></td>
</tr>
<tr>
<td>Armand V. Feigenbaum</td>
<td>Horizontal Scope of Total Quality Control</td>
<td>Total Quality Control, 3rd Ed. (1983)</td>
<td></td>
</tr>
<tr>
<td>Kaoru Ishikawa</td>
<td>Eastern Total Quality Control distinguished from Western practices</td>
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</tbody>
</table>
2.2 What is TQM?

Total quality management (TQM) views quality as an application holistic to the entire organization. It refers to an organization-wide effort to achieve quality in every aspect of the business. It is a more strategic approach to business improvement. TQM uses the user-based view for defining quality, but extends the user from supplier to customer. Successful TQM programs are built through the dedication and combined efforts of everyone in the organization and supported by the 5 “pillars:” product, process, leadership, organization, and commitment. Some other important elements include: 1) continual improvement; 2) competitive benchmarking; 3) employee empowerment; 4) team approach; and 5) knowledge of tools (Stevenson, 1995).

Table 3. Important Aspects of TQM, Adapted from Chase, Aquilano, and Jacobs (1998)

<table>
<thead>
<tr>
<th>Focus</th>
<th>Tools</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer-driven</td>
<td>Ishikawa Diagram</td>
<td>Benchmarking</td>
</tr>
<tr>
<td>Leadership</td>
<td>Stratification</td>
<td>Reengineering</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>Check Sheet</td>
<td>Cycle Time Reduction</td>
</tr>
<tr>
<td>Employee empowerment</td>
<td>Histogram</td>
<td>Just-in-Time Operations</td>
</tr>
<tr>
<td>Employee participation</td>
<td>Scatter Diagram</td>
<td></td>
</tr>
<tr>
<td>Quick response</td>
<td>Pareto Chart</td>
<td></td>
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<tr>
<td>Prevention</td>
<td>Process Flow Charts</td>
<td></td>
</tr>
<tr>
<td>Corporate responsibility</td>
<td></td>
<td>Brainstorming</td>
</tr>
</tbody>
</table>

2.3 The Changing Notion of Quality in Lithuania

Quality during Russia’s occupation of Lithuanian (often referred to as Soviet Times) was based in a central planning paradigm. Quotas for goods were set by a state agency and then given to manufacturers whose only responsibility was to make sure they met the numbers. There was never any reason to do a good or better job, or to monitor the quality of the goods or jobs when the same number of products would be shipped regardless. The result was poor quality goods (Hanson & Pavitt, 1987). This deficiency and others demonstrated the inability of centrally planned systems to generate and sustain technological learning and process improvement. Simply put, the outcomes of centrally
planned systems turned out to be obsolete when brought face to face with the standards of the rest of the world (Pavitt 1997, pg. 52).

With independence from Soviet rule, Lithuanian industry faced a paradigm shift from a planned economy to a market economy. With market forces now calling the shots, Lithuanian businesses must take into account the transformation of their customer from one state agency to many individual consumers located in various countries. The consumer’s idea of quality is one based on comparison between goods and their perceived values and benefits. As Lithuania moves forward to global competition, it is advised to export or produce only good-quality products that meet the standards for these consumers. It has been noted that the export flow can deter cheating on the quality of goods (Marin & Schnitzer, 1998). But there is still much to be done. Quality based on customer orientation is still very limited in the CEE. Quality is improving however, mainly because it is necessary to focus on exports in order to win hard currency (Sharp & Barz, 1997, pg. 114).

We must be careful not to narrowly limit our concept of “quality” only to goods. Quality problems in material, equipment supply, and administration are barriers to global success as well. “Material” also includes subcomponents. To be competitive on the market (any market) you must use subcomponents of world quality standard.

### 2.4 Importance of Quality for Lithuania

Quality is important to Lithuania for a variety of reasons. First, Lithuania is on track for a coveted membership into the European Union. *Integration into the European Union is one of the cornerstone’s of Lithuania’s domestic and foreign policy* (Paleckis, 1997). Applicant countries must meet various criteria in order to be admitted. One of these criteria focuses on “The Existence of a Functioning Market Economy and the Capacity to Cope with Competitive Pressure and Market forces.” In order to cope with competitive pressure Lithuanian goods and services must meet with Global Marketplace Acceptance so its goods can be exported. According to the Seventh Annual Grant Thorton Survey of American Manufacturers: improved product quality was second only to better distribution channels as a reason for growing exports.

One way of assuring improved product quality is the adherence to globally recognized standards. One of the most widely accepted is the ISO 9000 standard. ISO stands for International Standardization Organization, an organization based in Geneva, Switzerland. The ISO standards are voluntary, consensus-based standards. No one company is forced to adopt them. However, they have often become the de facto national standard for many European countries and in effect can affect the free flow of international trade (Morrissey, 1999). There is currently a great push for registration under ISO and it is coming from European Union regulations. The standards will foster consistency across the EU’s many borders and make trade among the members easier and less costly.

According to ISO 9000 Series Standards quality is “the totality of features and characteristics of a product or service that bear on its ability to satisfy a given need.” This definition relies on Juran’s definition of quality as “fitness for use.” ISO standards compliance is monitored through the process of registration and certification. This certification does not guarantee quality, but rather consistency of procedures. Certification is then used for recognition of a supplier’s legitimacy or a product’s quality (however erroneous).
Table 4. ISO Standards and Guidelines

<table>
<thead>
<tr>
<th>ISO Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>9000</td>
<td>Guidelines for Quality Management &amp; Quality Assurance Standards</td>
</tr>
<tr>
<td>9001</td>
<td>Model for Quality Assurance in Design, Product Installation, and Servicing</td>
</tr>
<tr>
<td>9002</td>
<td>Model for Quality Assurance in Production and Installation</td>
</tr>
<tr>
<td>9003</td>
<td>Model for Quality Assurance in Final Inspection Test</td>
</tr>
<tr>
<td>9004</td>
<td>Guidelines of Quality Management &amp; Quality System Elements</td>
</tr>
</tbody>
</table>

Second, improvement in quality has been proven to satisfy customers, employees and stockholders, and to increase market share. Third, quality usually leads to reduced costs because of less rework, fewer mistakes, fewer delays, and better use of time and materials. Deming’s Chain Reaction (1986) describes it this way: when you improve quality, costs decrease. This leads to improved productivity and increased market share because of better quality and lower price. With this increase market share the company stays in business and can provide more jobs.

To emphasize the cost savings, David Butler compiled a list of what he calls PONQ Elements – Price of Non-Quality elements:

| 1. Accident/injury lost time/investigation | 17. Incomplete, inaccurate, untimely submissions |
| 2. Accounts receivables (bad debts)       | 18. Inefficient resource management |
| 4. Casual absenteeism                     | 20. Non-conforming parts |
| 5. Effort wasted due to unclear specifications | 21. Overtime due to non-conformance |
| 7. Excess and obsolete materials          | 23. Premium freight, mail, transportation, etc. |
| 8. Excess manpower                        | 24. Project cost over run |
| 9. Excessive equipment rental             | 25. Repair |
| 10. Excessive inventory                  | 26. Rework, scrap |
| 11. Failure analysis and reporting        | 27. System failures, computer downtime |
| 12. Fines and penalties                   | 28. Unplanned maintenance |
| 13. Frequent budget revisions             | 29. Warranty costs |
| 14. Frequent unplanned priority changes   | 30. Wasted utilities |
| 15. Grievances                           |               |
| 16. Lawsuits                             |               |

Figure 3. The Cost of Doing it Wrong (PONQ Elements); Adapted from Butler (1996)

ISO 9000 is not the only quality standard on the board however. Russia has its own, GOST, which is mandatory for any products sold within its borders. This can create a conflict for firms that export to Russia as well as to Western Europe and other areas of the world that do not accept the GOST standard. In addition, there is the European Model for Total Quality Management and various standards
from different professional associations or industries. For example, American automobile manufacturers created their own QS9000 standard.

3. Methodology

3.1 Collecting the Information

Various types of data collection techniques were used for this study including:

- **Eastern European Managerial/Technological Survey** - This questionnaire helped to collect data about Eastern European management, technology, and quality beliefs. It consists of 40 questions divided into 4 categories: demographics, management beliefs, information/technology beliefs, and quality/TQM beliefs. The survey was distributed via e-mail, postal mail, and face-to-face sessions to 10 companies in each of the three Baltic States: Lithuania, Latvia, and Estonia. Firms were selected to give a sufficient representation of Baltic States companies in terms of size, ownership, and industry. The questionnaires were completed via interviews held during February/March 1999.

- **Personal Interviews with Leading AI/ES Experts in Lithuania** - meetings were held at the Universities of Vilnius and Kaunas, as well as with members of the Lithuanian Computer Society - AI Sections, and the Institute of Mathematics and Informatics, and Quality Management and Information Technology Consultants. These interviews were conducted during September/October 1998. Conversations and updates were continued via the use of electronic mail.

- **Secondary Research** covered computer science, information systems, expert systems, artificial intelligence, organizational factors, problem solving techniques, management theory, quality systems and TQM philosophies, knowledge management, global competition factors, and Lithuanian/European management practices and uses of technology, from such diverse resources as: books, articles, industry journals, periodicals, Internet, organizational and association contacts, Lithuanian contacts, etc. These sources span the time period between 1992 and 1999.

3.2 Analyzing the Information

- **Eastern European Managerial/Technological Survey** – three approaches were used in analyzing the information gathered from this survey: a country by country approach, a comparative approach across countries, and a comparative approach across industries (manufacturing, services, and agriculture). This allowed us to have a general picture of the Baltic States and to compare Lithuania with its neighbors.

- **Personal Interviews with Leading AI/ES Experts in Lithuania** – the information gathered from the interviews was summarized in “meeting reports.”

- **Secondary Research** was used to substantiate claims made by interviewees or to elaborate on issues presented as fact throughout the research.

3.3 Assumptions

Although data was collected from 30 company subjects, one company was removed from the data set for failure to answer over 5% of the questions asked on the questionnaire. The remaining 29 participant’s responses were compiled and graphed first as a group, second on a country by country comparison, and last, by industry. Questionnaires were answered through interviews held with the help of Baltic Surveys, Ltd. Located in Lithuania, this survey company also assisted in the translation of the questionnaire into Lithuanian, Estonian, and Latvian, and the translation of the responses back into English.
The respondent companies were contacted a second time in the first quarter of 2000 to clarify their perception on the relationship between information systems and quality goals. They were specifically asked “to what extent do you feel that your information system(s) is/are important to meet your quality goals?” Although all respondents answered that IS was “very important” to achieve quality goals, further elaboration to their answers revealed that cultural paradigms still needed to be changed for full benefits and implementations of these same systems.

4. Hypotheses and Discussion

The premise underlying this research was to provide empirical evidence that the technology level of implemented quality systems is a determining factor in global success for Eastern European countries. There are four (4) main findings. First, influence from Soviet occupation is an obstacle to the mindset of a market economy in terms of quality and openness. Second, exporting has an important role in the Eastern European States in terms of technology transfer, incentive to meet global quality standards, and as a catalyst for transition into a market economy on the road to EU acceptance. Third, the more advanced and strategically implemented the technology quality system, the more the goods or services are accepted in the global market place. Last, the government of the Eastern European states must take a proactive step in creating the business environment where quality is a priority.

4.1 Lithuanian cannot compete globally without exporting goods that meet with worldwide quality standards set by industry, governments, and consumers via regulations, compliance, and the marketplace.

   a) Substandard quality is an obstacle to exporting.
   b) Exporting is an essential key for global success for the Baltic States.

The research indicates that only 6 out of the 29 respondents companies (under 21%) export, 4 of these manufacture goods, and 2 are in the service industry. Out of these 6, only one responded with a dollar amount, one with a percentage (40%), and one with “significant.” The other three respondents refused to give an export dollar amount. Another example of the Soviet secrecy mindset.

According to the Time Almanac 2000, the Baltic States (Estonia, Latvia, and Lithuania) exported approximately $6.9 billion in 1996. For Lithuania, this represented a 14.1% increase. However substantial this amount seems, when placed in comparison to other countries its deficiency is accentuated. In 1996, the United States exported $625.1 billion, Finland exported $38.4 billion, and Poland exported $26.4 billion. Even a small island such as Puerto Rico recorded exporting $27.9 billion during the same year. The Baltics exports combined make up less than 25% of this total.

Lithuania, as well as the other two Baltic States, must increase their exports. The 14.1% increase for Lithuania can be attributed in part to the increase in quality awareness and the current momentum to join the European Union and therefore the global economic market. The underlying pattern of global competition has changed imposing competitiveness in terms of quality, diversity, and innovation as well as prices, emphasizing the capacity to be flexible, the role of skills, and the necessity to improve cooperation between the designers and producers (Garrouste &Villeval, 1997, pg. 190).

Exports do not just serve the function of increasing revenue for the country but can also create long-term relationships providing a conducive contact for technology transfer, as well as more opportunities for them to happen (Bell, 1997, pg. 83).
4.2. Compliance with these forces can only be achieved through the implementation of quality management programs.

All respondents that had a quality program in place found the program to be effective. The fact that no two programs were the same did not detract from this finding. As most experience shows, programs of nature must be customized to each individual company to maximize the benefits that can result depending on the good or service, and the objectives of the company.

The importance for the Baltic companies is that some kind of system is in place and that that system’s purpose is to monitor and improve quality, at least at this stage in their transition to an open market economy. They have taken the first step, which is their own acknowledgement that quality is important for them to achieve their goals – for themselves, for their businesses, for their country. Next, they have implemented simple quality management tools and programs, starting informally with paper and pen and progressing to more advanced technological alternatives. Having a quality management program is important. Quality management systems serve to keep the focus in target – global acceptance of a company’s goods or services by meeting the global standards of quality. It provides a guidepost to follow and discipline to keep one on track, as well as motivation to keep one going, and satisfaction at its achievement.

The quality management systems also serve as a substitute for the planned economy quotas so entrenched in many newly independent countries. Instead of meeting the quota numbers, now companies can work to meet the world quality standards – something tangible and, therefore for them, real.

4.3. The level of technology used in the quality management program is one of the factors that determines the rate of successful acceptance of Lithuanian exported goods and services in the global market.

Once the “habit” of using a quality management system is in place, the progression of its infrastructure becomes of more and more relevance. The more advanced the technology used in the quality management system the more strategically implemented it is and the more the final output (good or service) complies with global standards. The more the good or service complies the more it is accepted by the consumers. Some companies may take a progressive approach to quality, choosing to implement incremental improvements in the good or service. This can be good for the company in that it takes its time to make changes to a product that may already be established. It also means that they do not have to immediately invest high amounts in equipment and technology.

On the bad side, consumers may not be patient enough to allow the evolution of the product from bad to acceptable to good. At the first try at the substandard level, they may choose not to try the product or service gain. To combat this a more aggressive and holistic approach to quality through advanced technology may ensure that the consumer never encounters the substandard good or service ever.

To explain in detail I will be contrasting Figure 4 (Raleigh, 4 Levels of QM Systems) with Figure 5 (Rabbitt, Quality Progression). Keep in mind that Rabbitt’s model is a general one, whereas the model in Figure 1 was developed from the research in this dissertation and so reflects the context of QMIS in the Baltic States.
In the first level in Figure 4 – Quality through Compliance Paper Systems (Minimum) – there is no guarantee that quality is even being pursued except in the papers themselves. The most informal of all levels, paper compliance is usually seen as a type of “lip service.” Not much is invested except for the completion of the papers and the filing for the certificate. Capital outlays for equipment, technology, or quality expertise is minimal, if not non-existent. When these goods or services are put in the marketplace, the certification label on them may reassure consumers. But if there is nothing more than that paper “lip service” the product’s reputation will be hurt in terms of no repeat sales. In Figure 5, the first level is a reactive one of Quality Control. The company has product specifications and tries to meet those so as to pass inspections.
In the second level in Figure 4 – Quality through Compliance Automation (Basic) – we see the implementation of free standing computer systems isolated to a particular department or section of the company. These systems may do little more than present impressive computer reports with graphs versus the old paper system. Rabbitt’s level 2 (Figure 5) is called Quality Assurance. He indicates the company has achieved stability and is now focused on quality not just in goods or services, but also in procedures. Rabbitt’s chart indicated that this is where ISO 9000 may be introduced. However, some of the respondent companies who were at Paper Systems Level 1 also based their quality control on ISO 9000 standards.

Quality through Strategic IT (Intermediate) is the third level in Figure 4. Here we see managers approach quality as a way of running the company successfully and for strategic advantage. Technology systems are implemented not as isolated systems but in networked configurations so that quality is monitored through every stage of the product’s life cycle. Rabbitt’s third level (Figure 5) is Total Quality Control, which consists of Quality Control, Quality Assurance, and Customer Satisfaction and Supplier Involvement.

The fourth and final level of Figure 1 is Quality through TQM (Advanced). Here, such advanced technology as Expert Systems and Management Decision Support Systems are everyday tools used to surpass global standards and ensure long-term success of the company in the global market. This level corresponds nicely to Rabbitt’s fourth level of TQM with its focus on attitude and behavior for market leadership.

4.4. The biggest challenge to successful technology implementation is the cultural factor in this time of transition from Soviet central planning to free market economy.

For most Eastern Europeans silence was, and still is, truly golden. Most of them do not want to open up to new concepts of doing business. But openness to the modern world is a necessary precondition as a way of liberation from the forced isolation of the Soviet period (Kuzmickas, 1996). During the 50 years of Soviet occupation, the ideas of a “Soviet man” and “socialism” were promoted. All aspects of public life were strictly supervised. Lithuania became part of a repressive state. During the Soviet times, Lithuania (as well as the other Baltic States) was locked into a superficial economically safe society – full employment and no wasted goods. With the transition to the market based economy, Lithuanians were not prepared for freedom – or the responsibilities to make decisions that freedom brings with it. Lithuanian society is living through a crisis of confidence. If the community does not trust its own institutions, then competition becomes an intimidating circumstance.

Simply having any level of technology is not enough to ensure success. The core paradigm of how to run a successful operation must be changed drastically. The concept of “quality” must become more than just a buzz word people in businesses are familiar with. They must proceed to accept it as what the consumer desires, and then embrace it for the competitive advantages it can offer. Finally, Lithuanian companies need to internalize the idea of quality so that it permeates through each aspect of their business, ensuring them acceptance by the global community.

Figure 6: Cultural Progression Needed for Successful QMIS Implementation
4.5. Quality systems must be a strategic decision.

Strategic management is one of the cornerstones of international competition. When companies talk strategy they are skillfully planning a blueprint of a business model that they believe will grow and strengthen their companies’ sustainable competitive advantage for long-term success. This overall imperative is then divided into specific functional and operational strategies to be deployed by the entire firm or individual departments to achieve the goals and objectives set forth by management.

There are three basic value propositions that a company can focus their strategy making on: 1) customer priority, 2) product development, or 3) operational excellence. None of the three are mutually exclusive, and they often appear in various places in the same strategic blueprint. Originally, it was thought that the issue of “quality management” was the domain of operational excellence. However, today there are numerous case studies presenting “quality” as an integral component of all three focus areas (TQM, etc.)

In order to begin the strategy making process the company must be able to answer some basic questions:

1. Where do we want to be?
2. How will we know we are there?
3. Where are we now?
4. How do we get where we want to be from where we are at now?

With the first question, the company is setting objectives – a destination for its blueprint. The second question is asking about measurements and evaluations. The third is asking the company to look honestly at itself. What are today’s problems, obstacles, and strengths? It is important at this time that the company undertakes an environmental scan - an external review of the trends, changes, or issues that are outside the organization that can affect the organization. Along with identifying these external factors, the company has to acknowledge whether it can control or have influence over them. The last question is where the company lays down its recipe for success, one step at a time.

It is at this point in the process that companies must develop and commit themselves to explicit strategies to achieve their goal of global success. They must intentionally dedicate resources specifically to the acquisition of information, the know-how, and the experience required to strengthen the company’s own competencies, above and beyond required equipment (refer to Discussion under #5.3).

Information technology has evolved from simply being a tool to implement business strategy to having a role on increasing the range of options for business strategy and to help management make better decisions. In today’s business environment Information Technology is used to:

1. Add value to a product or service – it can create new assets like speed, reach, knowledge, insight, and intelligence.
2. Enable new channels of distribution – it can make geographic borders irrelevant.
3. Gain access to new markets – through new channels or through strategic partnering.
4. Redesign key business processes – the core of quality improvement and management.
5. Create new methods of communication – by offering the three dimensions of freedom – time, place, and form.
6. Facilitate new ways of analysis and interpretation through programmed filters and monitoring systems.
7. Affect the type and quality of decisions taken – through the use of artificial intelligence and expert systems.
Each of these seven (7) uses can be employed by Lithuanian businesses to improve their quality to meet EU and worldwide standards. For Lithuanian businesses to succeed they must embrace a cultural paradigm shift in terms of planning for a competitive global marketplace instead of a planned local economy. They must be willing to go beyond transitional leadership to transformational leadership. This can be done if they view quality management through information technology as a strategic decision.

4.6. The Baltic governments must create national systems for quality innovation and standards.

Considering the centrally planned scenario the Baltic countries are used to, Government will have to take a leadership role in helping their countries’ companies make the transition by instituting national programs for the improvement of quality in goods and services, especially where exports are concerned. Technology has to be promoted as a national policy for the transition economies. Whereas the West’s corporations and private companies have a developed relationship with the market system, CEE companies have just started to produce these types of institutions with privatization. Until these companies have advanced enough to hold their own, they will require the protection and help only a national government can provide. For Lithuania, the LII program is a good start for technology innovation and can be used as a guide to implement a quality program on a national scale.

According to Keith Pavitt in his *Transforming Centrally Planned Systems of S & T*, 1997, the functions of the state include:

- Support for technological change in specific sectors
- Establishment and maintenance of compatibility standards
- Regulation to deal with negative externalities
- Consumer sovereignty
- National systems of finance, management, education, and training.

In addition, the state must develop policies and strategies to attract technologies. Lithuania needs government programs to provide financial assistance to firms and other entities to develop innovative technologies. This is not completely selfless – the payments need to be made with the expectation that these developments will contribute to the country’s future economic strength.

In order for Lithuania to accomplish its goal of attaining membership in the European Union and access to the global marketplace, it must upgrade the quality of its exported goods and services to meet established standards. This can only be accomplished with the implementation and use of quality management information systems. This use has to be endorsed as a national imperative and the cultural aspects of Lithuanian businesses’ adoption of technology must be worked in as one of the key factors to the system’s success.

Without this capability to compete Lithuania will not meet the criteria set for EU membership. The solution is the country-wide implementation and use of quality management information systems, beginning with paper systems and leading up to expert systems as Lithuanian businesses become more sophisticated in the use and strategic advantage of the technology available to them thus providing the means to comply with EU criteria and become successfully competitive.

5. Conclusion

It is apparent from this research that this national endeavor must be endorsed by the government and focused in its initial stages in an educational program that is strategically planned, long-term, and ongoing. What is required is a cultural paradigm shift – learning, training, and knowledge can be considered as the cornerstones of a new, emerging production system (Garrouste & Villeval, 1997). There is no effective transition without transformation of the human capital stock (if you do not change
the thinking, you cannot change the action). “If one wants to alter our technologies, the place to look is not the molecular structure but the social structure, not to chemistry of materials but to rules of man, especially the economic rules of who decides on technology” (Melman, 1975, pg. 71). In short, the balance must be made between education and the use of resources that become available. For what good is money or equipment or technology if you do not know how to use it for your benefit?

As a last note, another element necessary to the success of this national quality program is the establishment of a national quality management association, dedicated to the improvement of quality in the entire country. The association’s role would include serving as a catalyst between Eastern and Western quality advances through technology and knowledge transfer, including educational programs. They would also ensure compliance to standards through monitoring of inspections, certifications, etc. Statistical data from this study is available by request to the author, Dr. Raleigh.

6. References


Stevenson, William J. *Production/Operations Management*, 4th Ed. 1993