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Globalization Issues in the Industrial Technology Transfer Supply Chain

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Abstract

As more and more equipment and tools for manufacturing are produced in one country and used in another, differences between quality dimension standards and usage specifications become apparent. Some differences impact the ability to use these technologies and equipment. Differences such as product/service requirements, regulations, standards, and societal expectations of each of the organizations/nations involved in a particular supply chain can negatively affect delivery and utilization of industrial technology.

This paper discusses examples of organizational/national differences in regulations, standards, and societal expectations of technology and how these differences affected a Midwest manufacturing firm. This paper is based on the experience of the author while a senior manager at a multinational firm. The paper provides a proposed model that includes a checklist of issues to consider in the global industrial technology transfer supply chain.

Introduction

Globalization affects manufacturing in many ways. An example of unanticipated differences may be found in the import and export of manufacturing equipment and tooling. This includes production of equipment in one country for use in another or shipment of materials and goods between sister plants in different countries. In such situations, differences such as technology requirements, regulations, standards, and societal expectations of each organization/nation involved in a particular supply chain arise [1]. Being aware of these issues and dealing with them become critically important in delivering and utilizing industrial technology in the global supply chain.

Much has been written about societal issues in globalization. This paper does not intend to address societal issues directly. This paper will provide examples of technological, regulatory, and ethical differences experienced directly or indirectly by the author while working in the global automotive interior supply chain for a decade. The name of the automotive company and the name of the firms in this paper have been changed due to the nature of the subject matter discussed.

Technological Issues

During the preparation for production of a new car, component parts are created by non-product equipment and by hand for the purpose of design, fit, function, and testing. As the design of a component is finalized, production equipment can be specified and tooling created or customized for the component. As the deadline for production approaches, pre-production parts are fabricated on production equipment and tooled to prove the process and test the parts for accuracy [2].

During the 1990s, company T was a supplier to automobile company A. In 1992, company A's new car model required development of a new product line for company T. The new product line was the front back board for company A's new car, AXE. The front back boards are the back portion of the driver and passenger bucket seats, see example Figure 1. (The example is for demonstrative purposes only; it is not the model or make described in this discussion.)

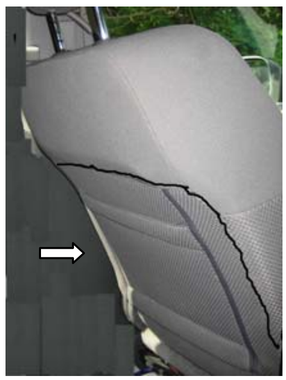

Figure 1: Front Back Board

The part of the fabrication of interest in this paper is the front back board assembly. In this process, an adhesive is applied to the plastic substrate, the top coat (fabric or vinyl) is placed on the adhesive, and then these components are forced together in a press to form a bond As the die press closes, the topcoat is forced against the contours of the front back board substrate and held in place to allow the adhesive to cure. This process uses a rotary index press (see Figure 2).

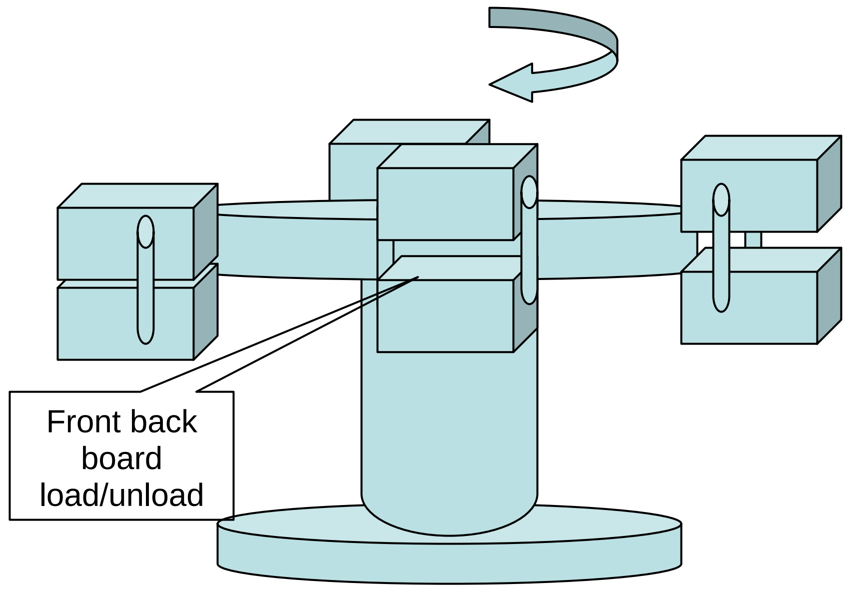

Figure 2: Rotary Index Press

The press utilized one load/unload station. This press indexed clockwise to allow the following mold to open for removal of the cured part and loading of the next part for pressing. The press was designed and placed in service in Japan where company T's national headquarters were located. Production of the model AXE car started in Japan several months before the U.S. production. This allowed time for the author to review the press in operation in Japan before shipment of an identical machine to the U.S. T plant. Upon observing the press in operation, the author noted that the press indexed on a timer and had no safety initiation devices (such as palm switches) or emergency stop devices (such as a light curtain). Such safety technology was not required on this type of equipment in Japan at the time. The machine also needed to be adapted for U.S. electrical power supply. These safety devices and electrical adaptations had to be integrated into the operation of the machine before shipment to the United States; otherwise, the unit would not have operated in the United States without additional monetary and time investments, which were not planned. Such delays could have been detrimental to startup timing of production of parts in the United States.

Regulatory Issues

The following example illustrates how regulatory issues differ from country to country. The previously discussed adjustments to the press were made before shipment to company T in the United States. The press was received, installed, and operational just in time to meet the test parts schedule from company A. Along with the press, the corporate office in Japan sent buffer component parts inventory, such as front back board plastic substrates, cut fabric and vinyl parts, and adhesive, to fulfill the requirements for the test part production requirements.

This buffer inventory allowed time for the substrate manufacturer in the United States to start production, as well as for company T's purchasing department to source adhesive in the United States, and for the fabric and vinyl cutting production area to produce parts for pre-production requirements for company A.

Production of the test parts proceeded with the parts from Japan. Substrate production started, cut fabric and vinyl production started, but sourcing of the adhesive became a problem. The adhesive used in Japan was available in the United States but contained chemicals that were more stringently regulated in the United States than in Japan. The use of the adhesive in company T's U.S. manufacturing facility would require installation of additional equipment for ventilation, application, curing, storing, and vapor recovery. In addition, permits and detailed tracking of the chemicals would also be required. Acquiring permits and tracking would increase capital and production costs.

Eventually, the decision was made to find an adhesive that was not so tightly regulated and that would not require the unplanned costs. Several adhesives were tested, and all potential candidates had to be sent to company A for performance testing (heat, humidity, aging, etc.). Before final selection, the adhesive had to perform at least as well as the original specified adhesive.

An adhesive was finally sourced that met the required standards, but the process of identifying the substitute created many issues with the customer due to the delays caused by repeated testing. As the U.S. production date of the model AXE car approached, company T faced the possibility that it might not have the components needed to fulfill its contractual obligations to company A. Even though the car was in full production in Japan, a seemingly small difference in regulation of an industrial adhesive could have delayed the release of cars produced in the United States.

Ethical Issues

Contemporaneous to the safety regulation issues related to the industrial adhesives, a separate issue of globalization and industrial technology arose in the area of ethics. The context was the opening of company T's new manufacturing plant in a country south of the U.S. border. Despite attempts to activate telephone/data communication service to the new plant, company T was not having much success in getting the government provider to activate the telephone service. The ethical dilemma was whether to pay a bribe for service or face not having the facility IT systems ready at startup. A general manager was sent from the corporate office in Japan to oversee the construction and startup of the new plant. In this case, it was non-U.S. citizens involved, but a U.S. citizen could have just as easily been placed in this situation.

In the country that the new plant was being constructed, application forms were required to be filled out months in advance for data lines to be connected and activated for new facilities. The data communication network is government-owned. All required paperwork was completed in advance of the required timelines to ensure data line activity by the time the plant was to commence operation. The time of planned activation of data line came and went with no line to the plant or activation. The general manager visited the governmental office responsible for the data line and was assured that the forms were completed, but it would just take time until the data line was installed. Time passed, and with the opening of the plant quickly approaching, the general manager consulted a local attorney who informed him that he needed to make an appointment with the manager of the governmental office in question and take $2,000 with him to make a donation to that individual's campaign chest. He did, and the next day the data line was connected to the plant, and within three days the line was active.

Upon further investigation, the general manager was told that this is the standard way business is conducted at this location, and that this type of donation is expected and was part of the benefits of holding such an office.

Proposed Model

The issues presented in this paper all deal with technology globalization issues. Each is an issue that could have had negative consequences to the manufacturer and its supply chain if not resolved. In each situation, these issues increased costs by requiring additional capital for equipment, materials, and/or time than originally anticipated. If an appropriate model existed that engineers and technologists could consult when planning an international project, finances and project timelines could be better controlled.

This author did not find such a model while conducting a literature search. Models were found that proposed:

- A safety checklist of products coming into the United States [3].
- Factors affecting transfer logistics [4].
- Economic models of knowledge offshoring [5]
- Hidden costs of offshoring [6].

More models were found, but all were general and did not provide enough detail to assist individuals dealing with technology globally. For this reason, this paper proposes the following model based on the adaptation of a fishbone diagram or cause-and-effect diagram. The cause-and-effect diagram can be used to identify factors leading to an overall effect (Ishikawa, 1986). Figure 3 provides an example of this model.

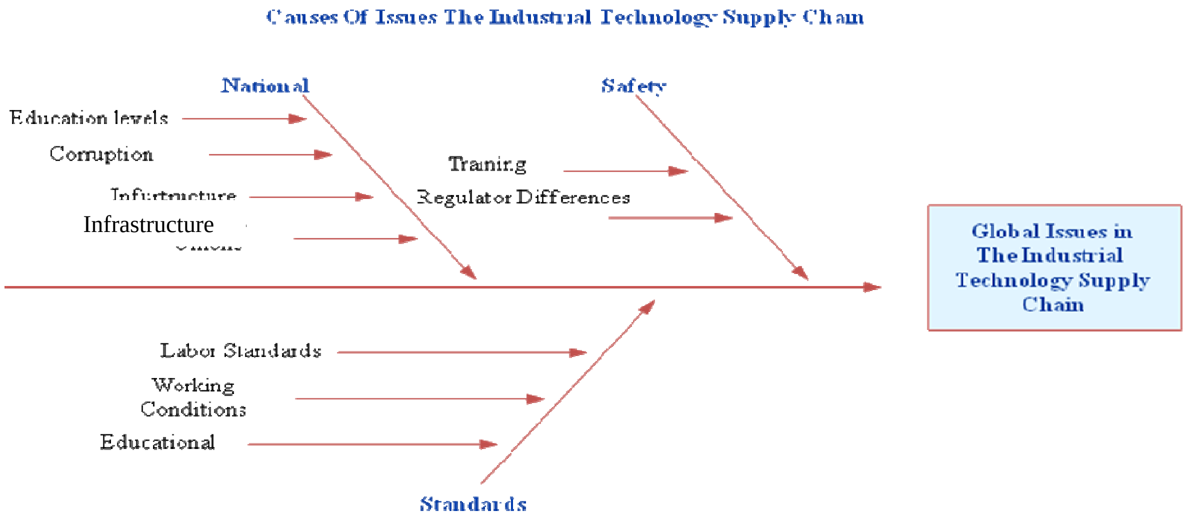

Figure 3: Abbreviated Model

Due to the size limitation of graphics for this paper, the following bulleted list notes the items that should be included in the full cause-and-effect model.

- National
  - Infrastructure
  - Unionization
  - Fraud
  - Corruption
  - Work environment
  - Prohibitions
  - Tariffs
  - Culture
  - Educational system
  - Technology levels
  - Property protection
  - Intellectual property laws
  - Percent ownership
  - Regulation
- Safety
  - Equipment age
  - Ethics
  - Education
  - Labor standards
  - Work environment
  - Law
  - Union
  - Counterfeiting
  - Personal

- Supply chain
  - Affordability
  - Capability
    - Capacity
    - Consistency
  - Property protection
  - Counterfeiting
- Standards
  - Labor standards
    - Benefits
    - Education
    - Pay
    - Working Hours
  - Communication
    - Data
    - Interpersonal
  - Monetary
  - Power
  - International harmonization
- Person
  - Misinterpretation
  - Interpersonal skill
  - Culture
  - Preconceptions
  - Social structures
  - Ethics
  - Education
  - Flexibility
    - International travel
    - Teamwork
  - Safety expectation
  - Performance expectation
- Equipment
  - Performance
  - Affordability
  - Warranty
  - Transferability
  - Adaptability to global standards
- Environment
  - Culture
  - Law
    - Regulation
    - Litigation
  - Compliance

Model Application

Those engaging in the global technology supply chain may utilize this model by reviewing it and evaluating the risk associated with each of the possible causes listed. Also, new possible causes may emerge based on reviewing this model. Each cause where risk is deemed to have an unacceptable potential for occurring should be examined and evaluated based on its potential costs and effects. Based on this examination, a preventive action plan should be developed, as well as a contingency plan to mediate the risk in case the preventive action fails [7]. An example of this process is presented in Table 1.

Table 1: High Risk Cause, Action, and Contingency Plan

Item # Based on Risk	Major Cause (Major Bone)	Detail Cause (Minor Bone)	Preventive Action	Contingency
1	Standards	National power of equipment manufacture is different than that of the United States. If shipped with manufacture, national standard equipment will not work in the United States.	Ensure the contract states clearly U.S. power requirements.	(A) Contact supplier and confirm power requirement before shipment. (B) Identify steps needed to convert equipment if delivered with non-U.S. electrical service standards.
2				
3				

Conclusion

Utilizing this model may improve issue spotting for multinational projects and may identify proactive measures or contingency plans. This list model is proposed and should be tested, confirmed, and refined. The shortcomings of many models currently available are that they provide only the larger constructs and not the details. It is at the detail stage when problems often arise. By providing a list of as many potential issues as possible, users can have an issue illuminated and avoid that problem or be prepared to deal with it before it becomes an urgent problem.

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Biography

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