

Chapter 2

Globalization and International Issues

Globalization is one of the major drivers/motivations for sustainability not only from an economic perspective but also from social and environmental perspectives. Many issues surround globalization in manufacturing enterprises, but in this chapter we will focus on just five aspects: supply chain management (SCM), information and communication technology (ICT), energy prices, emerging markets, and business models. These issues can have a significant influence on the sustainability and sustainable development of manufacturing enterprises. A description of each one with its sustainability indicator with the associated performance measure will be illustrated. Also, the sustainability and sustainable development index regarding globalization and international issues will be discussed and presented.

2.1 Introduction

An analysis of globalization and international issues first requires identification of the major necessary elements for the sustainability of enterprises. These elements or issues are assigned based on the fundamental requirement of enterprises to be updated and consequently to survive. The issues under consideration are SCM, ICT, energy prices, emerging markets, and business models. Although globalization and international issues create opportunities and challenges for manufacturing companies that produce durable goods (Garbie 2013), incorporating these elements/issues in one mathematical performance measure would give a greater indication regarding opportunities and challenges. Figure 2.1 shows the major aspects and issues associated with globalization and international issues, and the following sections will describe each issue individually.

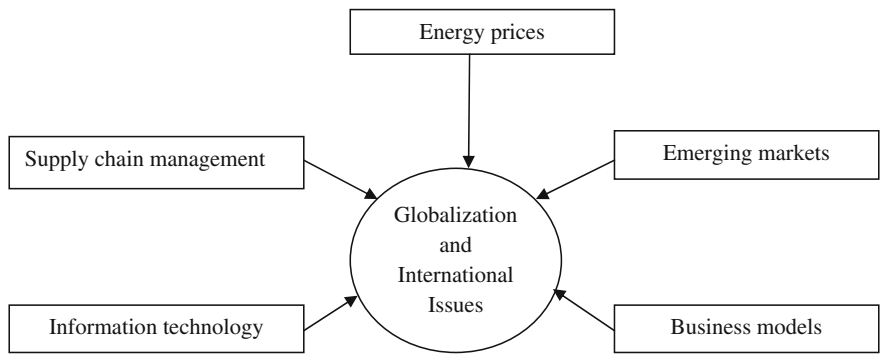


Fig. 2.1 Aspects of international and globalization

2.2 Supply Chain Management

SCM has become a central theme in sustainability. As SCM is considered a strategic function in any manufacturing enterprise, assigning the stages that affect this strategy is important not only in the SCM itself but also in whole enterprises. A regular/type SCM consists of many different stages, including suppliers, production systems, and customers (Fig. 2.2). The most important stage in this section for manufacturing enterprises/systems is the supplier selection for outsourcing components/parts or raw materials. The responsiveness and reliability of suppliers as well as the relationships fostered with them are urgent, as suppliers hold the potential to grant a competitive advantage as well as additional criteria for evaluation of SCM. The SCM must also remain aware of environmental concerns including climate change, environmental contamination, and resource consumption. Manufacturing enterprises must establish a unique department for SCM which includes highly trained, specialized employees who can keep the criteria values at a

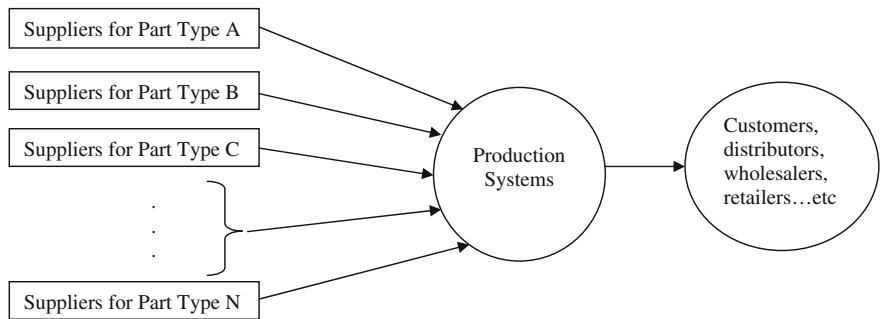


Fig. 2.2 A simple typical sketch of SCM

peak point. Also, all manufacturing enterprises need to develop relations with local and international suppliers who can work competently with enterprises to deliver on a just-in-time (JIT) basis wherever possible.

2.3 Information and Communication Technology

ICT is the nervous system of any manufacturing enterprise meaning that, without ICT there would be no connection between entire departments. That a manufacturing enterprise would claim that it lacks ICT is unbelievable since electronic business, internet, and advancements in ICT are considered collaborative and coordinating enablers of manufacturing enterprises. The internet is the most popular and familiar type of information technology. It links suppliers, producers, and customers together to share information. Other powerful information technology is represented by enterprise resource planning (ERP) software, wireless communication technologies, global positioning systems (GPS), and radio frequency identification (RFID). Advances in ICT have the greatest impact on manufacturing enterprises, and changes in ICT have enabled the birth of the concept of a global economy. Therefore, an ICT system design is an important component not only of globalization and international issues but also of sustainability of these systems.

2.4 Energy Prices

Energy is created, transferred, transformed, and consumed. The ability of an enterprise to consume less energy brings a significant economic advantage. One of the main challenges of sustainability and sustainable development in manufacturing systems or enterprises is providing sufficient energy at reasonable prices. Energy demands are growing due to manufacturing and/or remanufacturing processes, such as recycling. Therefore, it is necessary and urgent to enact strategies to implement sustainable energies based on different types of energy sources, especially renewable ones. The energy solutions enacted should be easily controlled, and the price of energy should be monitored.

Designing a renewable system to provide energy stability at a comparable price to non-renewable energy is not only the responsibility of individual manufacturing systems/enterprises but also of countries, regions, or industrial estates in which enterprises are located. Energy prices gradually increase year after year and economic sustainability is affected by those increases. Diverse resources such as solar energy, biomass energy, biogas, wind energy, geothermal, and hydropower energy are clear means by which enterprises can take advantage of those resources which are essential. Additionally, infrastructure by which renewable energy might be generated is necessary. The wind energy sector is considered one of the most

rapidly growing areas and includes wind farms. It is also considered a cheaper option than solar energy (Golusin et al. 2013). For manufacturing systems and enterprises, combining wind with other renewable energies such as solar energy is urgent and highly recommended.

A reduction in consumption of energy from non-renewable resources and an increase in energy consumption from renewable resources will have a significant effect on the economic sustainability of enterprises. Energy efficiency is not only very important for the environment but also for sustainable production and associated economic pillar which are considered a critical factor for business competitiveness.

2.5 Emerging Markets

An emerging market is a market that has some characteristics to offer and/or admit a designed product. Although the world has many markets, the emerging market is the only one that can meet the standards of a newly developed, innovative product. Emerging markets are supposed to provide greater potential for profit as they are considered channels for transitioning from a dictatorship period to a free market and a corresponding free economy. This phenomenon will lead manufacturing enterprises to gradually integrate with the globalization of a marketplace with an expanding middle class due to social stability and well-being and an improvement in standard of living.

Currently, it is difficult to identify all of the world's emerging markets. However, there are developed, emerging, and developing markets based on the country. Emerging markets are most likely to exist in developing countries based on the factors that accompany the evolution of the country's industries and population growth. Emerging markets are found in most European countries and especially in eastern Russia, some countries in Southeast Asia, many countries in Africa, and some countries in Latin America and the Middle East. Some countries have unified aspects of their economies and new terms have emerged to describe these market alliances. For example, BRICS is one of the largest market alliances and consists of Brazil, Russia, India, China, and South Africa. The BRICS countries are newly industrialized countries that exist in an intermediate category between fully developed and developing. This means that their economies have not yet reached a first-world class of development but have outpaced developing countries.

There are also major emerging markets appearing in developing countries such as Argentina, Indonesia, Mexico, Poland, South Korea, Turkey, Egypt, Iran, Nigeria, Pakistan, Saudi Arabia, Taiwan, and Thailand. Although these countries' markets are considered developing countries, manufacturing enterprises consider them sites for new investment opportunities. Also, there are other emerging markets in the Gulf States, Jordan, Morocco, Tunisia, Sudan, Ukraine, Venezuela, Estonia, Hungary, Romania, and the Czech Republic. Ultimately, new manufacturing enterprises consi-

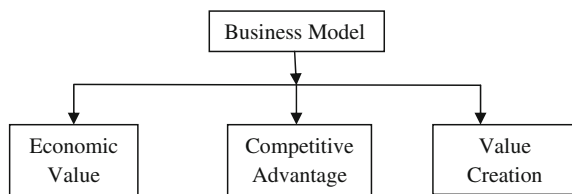
dering moving into an emerging market must take into consideration the level of development achieved by the countries (developed, emerging, or developing), the level of industrialization completed, a country’s population, and the standard of living of a country’s citizenry.

2.6 Business Models

For manufacturing or industrial enterprises to be successful in a global market, they have to know and understand their customers’ needs as well as local and international culture. This knowledge is sometimes called mass customization (MC) and has some overlapping definitions with business models. Any business model that has worked well elsewhere can be applied to another country’s market, and a business model is actually considered the major driver of a manufacturing enterprise because it is responsible for the business unit of a manufacturing enterprise for marketing, selling, and converting innovation and technology to economic value. For example, the type of business model chosen might depend on how technology is used and adopted. For example, by using the internet, businesses can reach a huge number of customers locally and internationally with optimum costs and/or prices.

A business model is defined as a strategic technique for generating economic benefits for an enterprise while considering the importance of the competitive advantages of the enterprise and improving the value of the product for its customers (Koren 2010). As such, there are three essential components for designing a business model: economic value, competitive advantage, and value creation (Fig. 2.3). Economic value focuses on how revenue is generated from sales and identifying profit margins. Competitive advantage looks at how the manufacturing enterprise will attempt to develop a sustainable advantage for its product by concentrating more on growth and maturity stages in the product life cycle (PLC) as compared to competitors. This can be done by minimizing costs, differentiating, and/or targeting niche markets. The last component of the business model focuses on creating value for customers. This value is one of the main targets of the business model and basically concentrates on value creation for customers based on their perspectives. For international manufacturing enterprises, a business model is considered one of the main issues of globalization, and establishing a competitive advantage is the most important consideration.

Fig. 2.3 Components of business model



2.7 Sustainability Assessment of Globalization and International Issues

Generally, an important facet of measuring and assessing sustainability and efforts to enhance it are sustainability indicators. Indicators help to identify the status of something and the progress made towards an objective and the challenges (Rosen and Kishawy 2012). A challenge of estimating the sustainability of performance indicators is always in uncertainty parameter or issue due to the rapid changes in economic situations, requirements of community and society, and environment data and information. The sustainability indicators are also important for the firms' continuous improvement in the environment (Tseng et al. 2009). It can be noticed that one indicator is not enough to represent the whole dimension of sustainability (e.g., energy consumption is not necessarily a proxy for environmental impact). It is important and critical to include several indicators in measuring the sustainability issue or aspect. Effective indicators for sustainability dimensions have different sustainable performance metrics. These sustainable performance metrics are required for decision making at all levels of a manufacturing enterprise. These sustainable performance metrics are also needed to measure progress towards the achievement sustainability and identifying appropriate sustainability indicators.

Also, the sustainable performance metrics have general characteristics representing: easy to be measurable values (quantitatively and/or qualitatively), relevant and comprehensive, understandable and meaningful, manageable, reliable, cost effective, and timely manner (Rosen and Kishawy 2012). A big challenge in selecting sustainable performance metrics is that it is not an inherently intuitive process (Weiser et al. 2008). As, the sustainability/sustainable development of the manufacturing enterprises is a main goal to be achieved, there is no sufficient standard metrics and target (benchmark) values to measure the performance metrics of sustainable development regarding manufacturing enterprise. Sustainability performance metrics indicate the performance of an indicator in maintaining a sustainable level of this indicator. A complete picture of sustainability/sustainable development requires a huge number of performance metrics, and choosing an appropriate set of these metrics is critical as the choice will have a significant impact on the whole conclusion of the analysis (Weiser et al. 2008).

The sustainability assessment regarding the globalization and international aspects (E1) is based on several major items (components) such as: global supply chain management (E11) which represents mainly the number of stops caused by supplier(s); information technology (E12) which represents the percentage of using the Internet and e-commerce; stability in energy price (E13) (e.g., oil price) which can be estimated through price of oil (\$ per barrel); emerging markets (E14) which represents number of global markets around the world and creating business models (E15) which represents an increase in competitive advantages of the innovative products through estimate the number of new customers per year (Fig. 2.4).

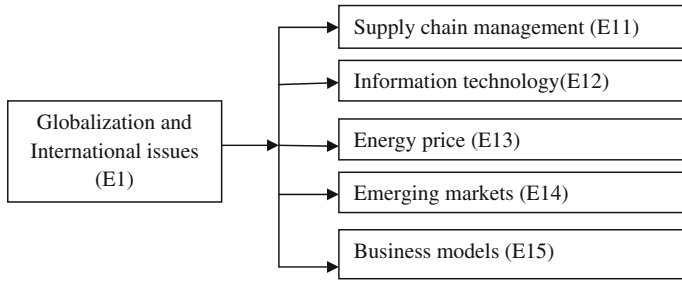


Fig. 2.4 Elements of globalization and international issues

Sustainability/sustainable development (S/SD) of major issue or aspect i is calculated by using Eq. (2.1). Equation (2.1) can be modified as Eq. (2.2) as follows (Garbie 2014)

$$S/SD_i = f(I_{ij}) \quad (2.1)$$

$$S/SD_i = \left\{ \begin{matrix} I_{i1} \\ I_{i2} \\ \dots \\ \dots \\ I_{inj} \end{matrix} \right\} = f(I_{i1}, I_{i2}, \dots, I_{inj}) \quad (2.2)$$

where

S/SD_i Sustainability/sustainable development (S/SD) index of major aspect/issue i
 j represents the aspects in each major issue or aspect of economic sustainability model, $j = 1, 2, \dots, n_{ij}$, n_{ij} = number of indicators (performance metrics) in each major issue i . The overall model to evaluate the sustainability assessment regarding each major issue regarding economic sustainability is clearly presented as a function of them in Eq. (2.3). Equation (2.3) can be represented as an exponential power-sizing sustainable model after modification to be suitable to estimate the sustainability index. Equation (2.3) is also modified for including all aspects (Garbie 2014).

$$S/SD_i = \prod_{j=1}^{n_{ij}} (I_{ij})^{Y_{ij}} = \left(\frac{S_{i1}}{E_{i1}} \right)^{Y_{i1}} \cdot \left(\frac{S_{i2}}{E_{i2}} \right)^{Y_{i2}} \dots \left(\frac{S_{n_{ij}}}{E_{n_{ij}}} \right)^{Y_{n_{ij}}} \quad (2.3)$$

where

I_{ij} Performance metric of aspect j in major issue i representing ratio between towards the sustainability (S) and the existing (E).

$$I_{ij} = S_{ij}/E_{ij}$$

- S_{ij} Value of aspect j in major issue i towards the sustainability (S) (benchmarking),
 E_{ij} Value of aspect j in major issue i regarding the existing (E) status,
 Y_{ij} Exponent of the change towards the sustainability (S) for aspect j in major issue i represents absolute value of difference between the existing status (E) and target (benchmarking, S),

$$Y_{ij} = \log|s_{ij}|,$$

- s_{ij} Value of the difference between target value and existing value for aspect j in major issue i

The overall assessment model to the sustainability/sustainable development (S/SD) index for issues/aspects regarding globalization and international is clearly presented as a function as in Eq. (2.4). Equation (2.4) is modified for assessing the S/SD index regarding globalization and international issues as in the Eq. (2.5) (Garbie 2014).

$$S/SD_{E1} = f(E11, E12, E13, E14, E15) \quad (2.4)$$

$$S/SD_{E1} = (I_{E11}^{Y_{E11}} \cdot I_{E12}^{Y_{E12}} \cdot I_{E13}^{Y_{E13}} \cdot I_{E14}^{Y_{E14}} \cdot I_{E15}^{Y_{E15}}) \quad (2.5)$$

where

- S/SD_{E1} Sustainability/sustainable development (S/SD) index for globalization and international issues (E1)
 I_{E11} Ratio between the change towards the sustainability (S_{E11}) and the existing (E_{E11}) supply chain management (Ec11), For example, $I_{E11} = \frac{S_{E11}}{E_{E11}}$,
 S_{E11} Value of supply chain management towards the sustainability (S),
 E_{E11} Value of supply chain management regarding the existing (E)
 I_{E12} Ratio between the change towards the sustainability (S_{E12}) and the existing (E_{E12}) information technology (E12)
 I_{E13} Ratio between the change towards the sustainability (S_{E13}) and the existing (E_{E13}) price of energy (Ec13)
 I_{E14} Ratio between the change towards the sustainability (S_{E14}) and the existing (E_{E14}) emerging markets (E14)
 I_{E15} Ratio of change between towards sustainability (S_{E15}) and existing (E_{E15}) of business models (E15)
 Y_{E11} Exponent of the change towards the sustainability (S_{E11}) of supply chain management (E11)
 For example, $Y_{E11} = \log|s_{E11}|$

Y_{E12}	Exponent of the change towards the sustainability (S_{E12}) of information technology (E12)
Y_{E13}	Exponent of the change towards the sustainability (S_{E13}) of price of energy (E13)
Y_{E14}	Exponent of the change towards the sustainability (S_{E14}) of emerging markets (E14)
Y_{E15}	Exponent of the change towards the sustainability (S_{E15}) of business models (E15)
s_{E11}	Value of the change towards the sustainability for supply chain management (E11)
s_{E12}	Value of the change towards the sustainability for information technology (E12)
s_{E13}	Value of the change towards the sustainability for the price of energy (E13)
s_{E14}	Value of the change towards the sustainability for emerging markets (E14)
s_{E15}	Value of the change towards the sustainability for business models (E15)

Table 2.1 is used to illustrate the sustainability indicators of globalization and international issues with performance metrics of each indicator with existing and target values.

Table 2.1 A framework for assessing the sustainability index regarding of globalization and international issues

Issue or aspect	Sustainability indicator	Performance measure	Performance metrics	
			Existing	Target
Globalization and international issues (E1)	Supply chain management (E11)	Number of stops caused by supplier		
	Information technology (E12)	Percentage (%) of using internet and e-commerce		
	Energy price (E13)	\$/barrel		
	Emerging markets (E14)	Number of markets around the world		
	Business models (E15)	Competitive advantage value to the business		

2.8 Illustrative Example 2.1

A numerical example is used to determine the value of the globalization and international issues regarding sustainability using Eq. (2.5). The information required to illustrate these values is shown in Table 2.2. It can be seen from Table 2.2 that there are increases towards the sustainable manufacturing enterprise compared to the existing in the information technology, emerging markets, and business models by 17.65, 66.67, and 17.65 %, respectively. There are also important issues that should be decreased towards sustainability taking into consideration globalization issues represented by stability of suppliers and energy prices by 66.67, 20 %, respectively. The exponents of the E11, for example, is estimated as $\log|-2| = 0.30$. Also, the exponents of the E12, E13, E14, and E15 are calculated as $\log|15| = 1.176$, $\log|-10| = 1.0$, $\log|10| = 1.0$, and $\log|15| = 1.176$, respectively. These values are represented in Eq. (2.5) which represents the level of sustainability of manufacturing enterprises regarding the globalization and international issues.

$$S/SD_{E1} = \left(\frac{1}{3}\right)^{0.30} \left(\frac{100}{85}\right)^{1.176} \cdot \left(\frac{40}{50}\right)^{1.0} \cdot \left(\frac{25}{15}\right)^{1.0} \cdot \left(\frac{100}{80}\right)^{1.176} = 1.51 = 151 \%$$

It can be seen from the results that 151 % of the effort towards sustainability compared with the existing is needed regarding the globalization and international issues especially in supply chain management and emerging markets. The stability in the energy price and information technology and business models plays an important role in the sustainable manufacturing enterprise.

Table 2.2 Data related to globalization and international issues

Indicator code	Existing (E)	Target (S)	Value of change (s)	Percentage	Remarks
E11	3	1	-2	66.67	There is a decrease in the number of stopping due to suppliers of 66.67 %
E12	85 %	100 %	15	17.65	There is an increase in using information technology and e-commerce of 17.65 %
E13	\$50/barrel	\$40/barrel	-10	20.00	There is a decrease in the price of oil of 20 %
E14	15	25	10	66.67	There is an increase in emerging markets around the world of 66.67 %
E15	85	100	15	17.65	There is an increase in the competitive value to the business of 17.65 %

2.9 Conclusions

A sustainable mathematical model for analyzing and assessing the sustainability/sustainable development index related to globalization and international issues for manufacturing enterprises was discussed through an identification of important aspects of internationalization of business. Definitions, concepts, and an analysis of issues were introduced in order to explore the fundamental requirements of manufacturing enterprises to survive and remain current in the marketplace.

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