

# THE IMPACT OF GLOBALIZATION ON OPERATIONS MANAGEMENT ACTIVITIES IN EGYPTIAN MANUFACTURING FIRMS: AN EXPLORATORY STUDY

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*A manufacturing company, whether in developed or less developed countries, that operates within today's dynamic and hostile environment (i.e., globalization) is vulnerable. The different functional areas within a company need to be mobilized to confront the threat. Production and operations management, as one of the very fundamental functions within a factory, is required to answer an important question: how do firms keep pace? Identification of global factors critical to the anticipated changes in production/operations activities represents the critical concern for the manufacturers. The study proposes that anticipated changes in production/operations activities can be explained by the following global factors: uncertainty, marketing and technology. The propositions were empirically tested by using Logit analysis regression. A mail questionnaire was used to collect data from Egyptian manufacturing firms. This study has provided important insights into the impact of globalization on the anticipated changes in production/operations activities in Egypt as a developing country. Implications for practitioners and directions for further research are provided.*

## RATIONALE OF THE STUDY; LITERATURE REVIEW

While the worldwide economy is moving towards a new era of globalization<sup>1</sup>, namely the free flow of goods, services, ideas, individuals, capital and information among countries (Lutfi 1999),

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<sup>1</sup> The term "globalization" is used in this study to indicate global production. This is how a company in a less developed country can produce a product that compete in an international market or meet global competition in a domestic market.

manufacturers, whether in developed or less developed countries, find themselves in a severe manufacturing environment where they have to act locally and to think globally. Therefore, manufacturing companies should pay enough attention to the process and impacts of globalization; otherwise they waste precious executive resources (Morrison & Beck 2000).

1. *Globalization symptoms.* An extensive review of the literature has been done to explore the key globalization symptoms. The key global factors and the anticipated changes in production/operations (P/O) activities are depicted below. These are global factors or barriers that may represent the symptoms of deployment of globalization.

1.1 *Increased product variety.* One reason for communicating with a customer is to learn what the customer needs and to customize the product accordingly (McLaughlin & Fitzsimmons 1996). The market is no longer satisfied with a mass produced uniform product (Brown, Shivnan & Harhen 1998), whereas increasing product and part variety, in order to meet varied market requirements, is one of the most distinctive characteristics of industrial competition today (Tang & Yam 1996; Da Silveira 1998).

1.2 *Great difficulty in estimating aggregate demand.* Several factors have come together to cause the increase in global competition. One factor that is significant is rapidly changing aggregate demand (Tan *et al.* 2000). Moreover, although measuring aggregate demand is a major input into capacity planning and control, it is very difficult to predict in the global market (Slack *et al.* 1998).

1.3 *Changing standard of raw materials.* Researchers of different disciplines have pointed out that manufacturing companies should adopt a high standard of raw materials for coping with globalization symptoms such as product variety and global competition (Yeh & Chu 1991; Tang & Yam 1996). In addition, authors such as Dey (2001) and Median and Duffy (1998) have argued that high quality in raw materials is required in order to help manufacturing companies to globalize their production.

1.4 *Increased global competition.* Globalization has significantly changed the nature of competition (Ng & Hung 2001). Authors

such as Prasad, Babbar and Motwani (2001) have argued strongly that manufacturing companies are challenged by severe competition not only in local or regional markets, but also in the large international markets. Furthermore, Buxey (2000) reported that manufacturers everywhere should create global manufacturing in order to meet global competition.

*1.5 Increased technology support.* Globalization and technology can be considered as significant drivers of change for manufacturing companies in today's world. By becoming global, firms can achieve effectiveness in their operations. One way for global firms to attain this objective is to adopt and implement new technologies or to upgrade existing technologies, whether tangible or intangible (Kim & Oh 2000; Ng & Hung 2001).

*1.6 Great difficulty in distribution.* In today's world, consumers have increasingly become more attuned and selective in other choices: criteria such as ease, speedy delivery, delivery date and after sale services may now take precedence over price (Jina 1996; Slack *et al.* 1998). Therefore, new distribution networks should be created as a matter of survival (Gill & Allerheiligen 1996). However, it has become very difficult for manufacturers to distribute their products in local and global markets effectively and sufficiently. As a consequence, distribution is currently considered as a feature of globalization.

*1.7 Changing skill levels of workers.* According to Rodríguez-Díaz (2000), Belout, Saba and Dolan (2001) and Ng and Hung (2001), employing highly skilled workers, empowering teams of workers, increased workforce diversity and developing accelerated and integrative learning programs are some of the most important prerequisites for meeting global challenges. Therefore, manufacturing companies are seeking to acquire less expensive, but well-educated, labor (McLaughlin & Fitzsimmons 1996). Furthermore, the increase in global industrialization stimulates manufacturers to have well-trained and flexible workers (Kerslake & Goulding 1997).

*2. Anticipated changes in P/O management activities.* With the rapid evolution of globalization, *i.e.*, worldwide competition and the pace of technological development, increasing pressures have been

placed on manufacturing companies and industries to change. An extensive literature review revealed that operational changes must be associated with globalization. The much proclaimed path of change includes:

2.1 *Changing capacity planning and control.* Production/operations management can deal with globalization symptoms, such as increased product variety and great difficulty in estimating aggregate demand, through adaptive or flexible strategies of capacity (Da Silveira 1998). Accordingly, a company should have flexible capacity plans in order to meet any unexpected increase in demand (Slack *et al.* 1998).

2.2 *Changing quality planning and control.* Global competition has forced manufacturing companies to devise plans to respond to an increasingly competitive market place. Many efforts have been exerted or are being exerted to confront this increase in competition. At the forefront of these efforts have been attempts to improve quality in order to meet varied needs and requirements in different and dispersed markets (Tan *et al.* 2000). Therefore, companies must shift their focus toward customer satisfaction, which is very difficult in this era of globalization (Mehra, Hoffman & Sirias 2001).

2.3 *Changing inventory planning and control.* According to Ng and Hung (2001), in today's manufacturing world, a production plan should be prepared based on the schedule of incoming orders and issued for production. The scheduling is based on standard times estimated from known manufacturing processes, modified as appropriate by material status reports from the material control department. Therefore, a company should have several inventory plans in order to meet any unexpected changes in production and customers' requirements (Chase, Aquilano & Jacobs 1998).

2.4 *Setting global operations strategy.* As a result of global manufacturing, the operations strategy should be rethought and should include the following elements: competitive advantages, the performance of the operating system and the four phases of the so-called operation value chain: design, purchasing, production and distribution (De Toni, Filippini & Forza 1992). Furthermore, in the global environment, the risks associated with strategic errors are

carefully considered. As a consequence, manufacturing companies wanting to enter or to compete, whether in domestic or global markets, must formulate effective global operations strategies, adhere to them and employ resources in ways that support these strategies (Prasad, Babbar & Motwani 2001).

3. *The Industrial Sector Environment in Egypt.* Today, the economic fabric of Egypt has been fundamentally changed. The diversified structure of the Egyptian economy, with its rich natural resource base, a highly integrated manufacturing capacity, a flourishing agricultural sector, tourism with its infinite variety of attractions, coupled with a skillful labor force all provide Egypt with a remarkable potential for sustained and limitless growth (Ministry of Economics and Foreign Trade 2000). As pointed out by several writers, such as Lind (1991) and UNIDO (1996), the manufacturing sector in Egypt is one of the most important sectors in accomplishing Egypt's development goals, which are: raising production, productivity and overall living standards and establishing its market leadership in the face of global competition and protectionism. In general terms, the Egyptian industrial sector is characterized thus:

- a) It is broken down into two main sub-sectors according to ownership. The public sector consists of approximately 200 ex-public manufacturing companies (they are under the privatization process) and the private sector consists of approximately 15,000 private-owned establishments (UNIDO 1996; Department of Trade and Industry 1998).
- b) Most public companies are large in terms of number of employees (*i.e.*, more than 500 employees).
- c) It consists of a limited range of industries. These are textiles, mining and petroleum industries, drink and tobacco, engineering, garments, chemicals, leather, wood, food, paper, printing and plastics.
- d) The greater portion of Egypt's GDP is the commodity sector, with industry and mining and agriculture constituting the greater bulk. In 1998/99, industry and mining constituted 19.5% of GDP and agriculture was 17.4% of GDP. It follows that these sectors employ the greater portion of the labor force. On the other hand,

production services constitute 32.8% of GDP, a figure that is expected to rise in the near future, as tourism regains momentum (Ministry of Economics and Foreign Trade 2000).

- e) The manufacturing sector is responsible for 22% of Gross National Product (GNP) (El-Gebali 1996). It was the fastest growing sector in the last five-year plan, from 1992/1993 to 1996/1997, with an annual growth rate of 8.4% (Egyptian Industrial Chamber 2000).
- f) In the 1990s, the manufacturing sector was responsible for 21% of employed labor in Egypt (Egyptian Industrial Chamber 2000).
- g) Total imports by industrial sub-sectors such as chemicals, engineering and assembling, excavating machinery etc. represent approximately 41.4% of the total imports of all Egyptian economic sectors. On the other hand, chemical products and textiles products were the most important categories of the main exports of the Egyptian economic sectors in the 1990s.
- h) The share of value added in the gross output of manufacturing sector in Egypt rose significantly from the mid-1970s to 1990, from 26.6% in 1975 to 31.4% by 1990 (UNIDO 1996).
- i) The total investment expenditure in the industry and mining sector is 22.8% of the total investment expenditure in the Egyptian economic sectors in the last five-year plan, covering the period from 1992/1993 to 1996/1997 (Egyptian Industrial Chamber 2000).

As a whole, the industrial sector in Egypt, as in many developing countries, is confronted with a variety of obstacles and problems of an economic, organizational and technical nature. Furthermore, the Egyptian manufacturing companies face increasing regional and international competition, specifically from their neighbors such as Israel, Turkey and Iran (El-Gebali 1996). Therefore, the current study is intended to explore the impact of globalization on production/operations management activities based upon the point of view of production managers in the Egyptian industrial sector.

### PROBLEM TO BE STUDIED

The review of the literature reveals that there are several gaps that need to be empirically investigated. They are as follows:

- 1) No previous empirical study has tried to investigate the impact of globalization on operations activities in the Arab world countries, such as Egypt.
- 2) There are numerous studies that have dealt with various aspects of globalization in the marketing domain. However, the only study that has been done to define the main barriers to the effective management of international operations was in the USA.
- 3) No previous study has tried to investigate statistically the relationship between global factors and P/O management activities.

### STUDY OBJECTIVE

This study aims to explore and examine the relationship between global determinants and the expected changes in P/O management activities based on the practitioners' point of view in the Egyptian industrial sector. To the best of the author's knowledge, this research is the first to touch upon that subject from an operational perspective and to bridge the gap in the literature.

### CONTRIBUTION TO CURRENT KNOWLEDGE

This article goes beyond the existing literature, which has a lack of theoretical research concerning the issue under investigation. In addition, this study contributes to what is currently a limited amount of empirical evidence to explore and examine the relationship between global factors and the expected changes must be effected in P/O management activities as a consequence of globalization. This may provide the opportunity for other researchers to execute more research in this field and to merge with other disciplines, such as marketing, finance and information systems.

## STUDY METHODOLOGY

A thorough and well-designed methodology will enhance the quality of the research and the implications to be drawn. In order to achieve the stated objective, the methodology in this paper consisted of four stages:

1. *Data collection.* Questionnaires were used, because they are the most efficient and least time consuming means of collecting data for cross industries survey (Baker 1991). A five-point Likert rating scale was used for all answering categories for accurate reflection of the underlying variables, because it provides sufficient alternatives along the continuum for respondents to express their opinion (see Table 1). The empirical study is restricted to Egyptian manufacturing firms. Therefore, the survey population of this study is defined as all Egyptian ex-public manufacturing companies (200 companies). In the current study, the basic criterion for the choice of the respondents was their ability to provide the necessary information. Consequently, the target respondent in each company was the production manager. A pilot testing questionnaire was produced and pre-tested by academics, consultants and a small number of companies to validate the questionnaire. A reliability analysis was employed to ensure the accuracy and reliability of the items used to measure the factors.

*Table 1. Survey Response Rate*

Mailing list	200
Total responses	83
Unusable responses*	6
Final usable responses	77
Response rate as percentage of mailing list	41.5%

\* Six questionnaires are unusable, because their proportion of missing values is high.

2. *Conceptual Framework.* A conceptual model has been established to provide a greater understanding of the subject matter and a foundation for the development of a statistical model. This

serves to outline the major inputs that have been employed to accomplish the objectives of the study. Figure 1 shows a conceptual model for conducting this study. Accordingly, it may be useful to extract and outline the overall variables of the study as set forth in Table 2.

3. *Formulation of the Study Hypotheses.* From the conceptual framework established in the previous section, relationships between response variable (dependent) and the predictor variables (independent) are determined (*i.e.*, hypotheses). As long as the current research involves testing a hypothesis of change, the null hypothesis will be used for statistical testing purposes.

Table 2. *The Overall Variables of the Study*

Global variables (Independent)	Changes in P/O activities (Dependent)
<u>Global Uncertainty variables</u>	
Increased product variety	<ul style="list-style-type: none"> <li>• Changing capacity planning and control</li> <li>• Changing inventory planning and control</li> </ul>
Great difficulty in estimating aggregate demand	
Changing standard of raw materials	
<u>Global Marketing variables</u>	
Increased global competition	<ul style="list-style-type: none"> <li>• Changing quality planning and control</li> <li>• Changing operations strategy</li> </ul>
Great difficulty in distribution networks	
<u>Technological Global variables:</u>	
Changing skill levels of workers	
Increased technology support	

*Hypothesis 1:* The null and alternative hypotheses that represent the relationship between changes in global uncertainty and changes in P/O management activities can be expressed as follows:

$H_0$ : There is no change in P/O management activities as a result of changes in global uncertainty.

$H_A$ : Changes in global uncertainty will trigger changes in P/O management activities.

*Hypothesis 2:* The null and the alternative that represent the relationship between changes in global marketing and changes in P/O management activities are specified as follows:

$H_0$ : There is no change in P/O management activities as a result of changes in global marketing.

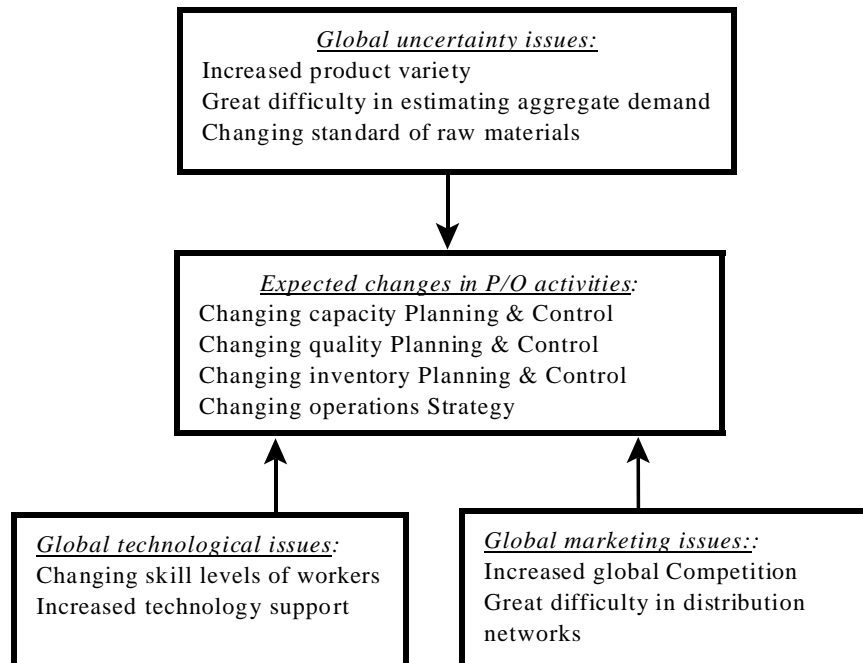
$H_A$ : Changes in global marketing will trigger changes in P/O management activities.

*Hypothesis 3:* Thus, the null and the alternative that represent the relationship between changes in global technology and changes in P/O management activities are specified as follows:

$H_0$ : There is no change in P/O management activities as a result of changes in global technology.

$H_A$ : Changes in global technology will trigger changes in P/O management activities.

*Figure 1. A Conceptual Model Framework of the Relationship Between the Global Factors and the Expected Changes in P/O Activities*



4. *Model Development.* After the conceptual framework and checklist have been established, a statistical model is developed to test the postulated relationship between the global factors and the expected changes in P/O management activities. The procedure for the model development consisted of the selection of a statistical technique and data treatment. Logit analysis is used after due consideration for the characteristics of the data. The details of the model building and the selection of this analysis model are depicted below.

4.1. *Model specifications.* To test for a simultaneous relationship between expected changes and the global factors, a multiple regression is carried out with the expected changes as response variable and the measurements of individual key global factors as predictor variables. Because this study is the first attempt in this field to develop a mathematical model and there is no guidance, the simplest case is proposed, that is, a linear relationship between the dependent and independent variables. Accordingly, a linear multiple regression is specified as follows:

$$ECHA = \alpha + \beta_1 GUNC + \beta_2 GMAR + \beta_3 GTEC + \epsilon \quad (1)$$

where:

- ECHA = the index for expected changes measurements
- GUNC = the index for measurements of global uncertainty
- GMAR = the index for measurements of global marketing
- GTEC = the index for measurements of global technology
- $\alpha$  = the average value of ECHA when each explanatory variable = 0
- $\beta_1$  = the change in ECHA that is expected to result from a change in GUNC
- $\beta_2$  = the change in ECHA that is expected to result from a change in GMAR
- $\beta_3$  = the change in ECHA which is expected to result from a change in GTEC
- $\epsilon$  = the disturbance term

Indices are tabulated as a representative number to reflect the specific variable based on the two or three questions stated in the instrument. All independent variables are treated simultaneously on an equal footing. This research strategy is most appropriate when there is no logical / theoretical basis for preferring any variable rather than the others (Cohen & Cohen 1975).

#### 4.2. *Inputs to the equation.*

4.2.1 *Dependent variable – expected changes measures.* For the dependent variable, four items are used, namely changes in capacity, quality, inventory and operations strategy. To establish input for Equation (1), an index is tabulated based on these items. For example, there are four items in the expected changes (*i.e.*, ECHA) scale; the responses by one company to these items were used to tabulate one index as input to ECHA.

The index tabulation procedure frequently used is an unweighted scale (Rahim & Psenicka 1984). As there is no a priori information on the weighting for the four items, an unweighted average method is used. The index is calculated by adding all responses to the four items and then dividing the total by the number of items:

$$\text{ECHA} = (C_1 + C_2 + C_3 + C_4) / 4$$

where  $C_1$ ,  $C_2$ ,  $C_3$  and  $C_4$  indicate the expected changes variables.

4.2.2 *Independent variables.* For the independent variables, indices as inputs for all the three variables, two- or three- item scales are used. To derive indices as inputs for all the three variables, the procedure is similar to that adopted to calculate an index for the ECHA scale. Therefore, the indices for the independent variables are calculated as:

$$\text{GUNC} = (U_1 + U_2 + U_3) / 3$$

$$\text{GMAR} = (M_1 + M_2) / 2$$

$$\text{GTEC} = (T_1 + T_2) / 2$$

where  $U_1$ ,  $U_2$  and  $U_3$  are uncertainty variables,  $M_1$  and  $M_2$  are marketing variables, and  $T_1$  and  $T_2$  are technology variables.

4.3. *Statistical technique selection.* With the choice of a five-point Likert scale in the research instrument, the ECHA variable (dependent) is restricted within the range of 1 to 5. This restriction prevents the use of the prominent Ordinary Least Square (OLS) technique, which is BLUE (Best Linear Unbiased Estimator), as proven by the Gauss-Markov Theorem (Gujarati 1989). This statistical analysis technique supposes that the dependent variable is continuous and not restricted in any way. In this study, because the qualitative dependent variable can take on only five values, the violation of this assumption is so serious that it merits the choice of another statistical technique.

Accordingly, a Qualitative Linear Model is the only alternative for providing accurate parameter estimates with restricted dependent variable. It attempts to relate the conditional probability of a particular choice being made on the dependent variable to numerous independent variables, that is, the probability of obtaining a particular ECHA variable base on the restricted values conditional upon the inputs from the independent variables. The mathematical form articulated is:

$$P_i = P(\text{ECHA} = \text{ECHA}_i / X_k) \quad (2)$$

where:

$P_i$  = Probability of obtaining  $\text{ECHA}_i$  conditional upon  $X_k$   
 $X_k$  = all three independent variables

The numbering of the response variables (1, 2, 3, 4, 5) cannot be taken to indicate order or magnitude; they just represent mutually exclusive and exhaustive categories. The current scale of 1 to 5 in the study measures the degree of expected change, with 5 indicating high likelihood of change. Thus, the numbering of the scale is not applicable.

With due consideration, the respondents were reclassified into firms with expected changes and those with unexpected changes. The cut-off point on the current scale is 3, the average of 5-point scale. Those items with a tabulated index for the degree of changes less than 3 are classified as companies with no changes in P/O activities, denoted by “0,” and those whose index is greater than 3 are classified as companies with high expected changes in P/O activities, denoted by “1.” At this stage, the inputs for ECHA variable will be 0 and 1; in statistical terms, this known as dichotomous dependent variables.

4.4. *Logit analysis.* Logit analysis was used because of its computational advantages and its wide usage (Aldrich & Nelson 1984). The Logit model is a powerful tool for conducting linear and nonlinear regression analysis for qualitative dependent variables such as dichotomous. The model is an attractive alternative to the Linear Probability Model (LPM). In LPM,  $P_i$  increases linearly with  $X$ . This may lead the ECHA estimates from the regression to go beyond the 0-1 interval.

One way of resolving the problem is to transform the  $P_i$ . For this case of a dichotomous dependent variable, I can take the ratio  $P_i / (1 - P_i)$  and then take the natural logarithm  $[P_i / (1 - P_i)]$ . This ensures that the estimate of  $P_i$  is continuous and can take on any value from 0 to 1.

The Logit model is:

$$P_i = P ( ECHA_i = 1/X ) = \exp ( \sum \beta_k x_{ik} ) / [ 1 + \exp ( \sum \beta_k x_{ik} ) ] \quad (3)$$

where:

- $P_i$  = probability that the firm achieves changes as a result of globalization
- $\exp$  = natural logarithm

The transformed dependent variable is a linear function of  $X_k$  (an assumption made earlier). So, the transformed logistic response function is:

$$\text{Log} [ P_i / ( 1 - P_i ) ] = \sum \beta_K x_{iK} \quad (4)$$

where:

$$\sum \beta_K x_{iK} = \beta_0 + \beta_1 \text{GUNC} + \beta_2 \text{GMAR} + \beta_3 \text{GTEC}$$

The parameters estimated are based on the Maximum Likelihood Estimation (MLE). Here our objective is to estimate the parameter denoted by  $\beta_K$  (where  $K = 1, 2$  or  $3$ ) and the likelihood function is defined to depend explicitly on  $\beta$ . The principle of MLE is to choose an estimate of  $\beta$  that implies the highest probability or likelihood of having obtained the observed sample ECHA. Thus, we seek to maximize this function. The Likelihood function is:

$$L ( \text{ECHA} / x_i \beta ) = P ( \text{ECHA} / x ) = \pi ( P_i )^{E_i} ( 1 - P_i )^{1 - E_i} \quad (5)$$

or, by taking the natural log:

$$\log L ( \text{ECHA} / x_i \beta ) = \sum [ \text{ECHA}_i \log P_i + ( 1 - \text{ECHA}_i ) \log ( 1 - P_i ) ] \quad (6)$$

After the estimation of the parameters, a formal goodness-of-fit test is conducted to test the joint hypotheses that all coefficients except the intercept ( $\beta_0$ ) are zero. The alternative hypothesis is

$$H_A : \beta_1, \beta_2, \beta_3 \neq 0$$

In other words, we are determining whether all the independent variables taken together significantly explain the variability observed in ECHA.

A likelihood ratio statistics, which follows a *chi-square* distribution, is computed based on the likelihood ratio principle. The appropriate formula is:

$$C = 2 ( \log \text{LO} - \log \text{LI} ) \quad (7)$$

where:

- LI = value of the likelihood function when the convergence is obtained  
 LO = maximum value of the likelihood function with only the intercept in the model

The computed statistic C is then compared to a critical value from the chi-square distribution table with K-1 (*i.e.*, 3) degrees of freedom and significance level of 0.05. R<sup>2</sup> is then computed as follows to determine the proportion of the variance in the dependent variable that is explained by the independent variables:

$$R^2 = (\text{model chi-square} - 2K) / (-2 LO) \quad (8)$$

where:

- model chi-square =  $-2 LO - (-2LI)$   
 K = number of parameters in the model excluding intercept

The interpretation is similar to that for the regression R<sup>2</sup> that the higher the coefficient of determination (which is between 0 and 1), the better the fit. In all cases, chi-square tests will be used to evaluate the significance of the individual  $\beta$  (K = 1, 2 or 3). These tests are to determine the significance in the contributions of the individual variables to expected changes in P/O activities. As the study is of exploratory nature and with a small sample size, a significance level of 0.05 is adopted.

#### DATA ANALYSIS AND EMPIRICAL FINDINGS

1. *Response rate.* Of 200 questionnaires sent out, 83 replies were received, giving a response rate of 41.5%, which was regarded as a good response to a mail survey. Of the 83 replies, 77 responses were usable, because they contained a high proportion of missing values. [Table 1](#) indicates the level of responses obtained.

2. *Sample characteristics.* The findings in [Table 3](#) indicate some industries more involved in the expected changes in P/O activities as a result of globalization than others; for example, engineering and electronics, textiles and chemicals industries accounted for 70.0% of the Egyptian companies. These sectoral differences may be influenced by the fact that Egyptian manufacturing companies have very different industrial profiles.

The majority of companies in our sample are governmental owned (*i.e.*, holding companies) and the few are multinational corporations. This reflects a feature of the Egyptian economic structure, where a large public sector has dominating control over the industry. Respondents indicated that manufacturing companies expecting changes in their operational activities as a result of globalization embraced a marketing strategy combination of make-to-order and make-to-stock products. Furthermore, manufacturing companies expecting changes in their operational activities are working in complicated manufacturing processes (assembly and fabrication operations) more than companies with continuous/process flow. These findings explain why most of the manufacturing companies in our sample embraced a marketing strategy combination of make-to-order and make-to-stock products.

3. *Reliability analysis.* Before the data collected could be analyzed, they were subjected to reliability analysis to ensure the accuracy and the reliability of the items used to measure the factors. This step is very significant (especially for the development of a new scale) to enable the development of any measuring procedure to yield a tendency towards consistency found in repeated measurements of the same construct ([Carmines & Zeller 1979](#)).

Results of the reliability analysis of all the scales used in this study are illustrated in [Tables 4, 5, 6 and 7](#). Concerning the expected changes in P/O activities scale, reliability analysis showed that all four items had high item correlations. Together, they gave a Cronbach alpha of 0.8775. For the global uncertainty scale, all items were retained, giving a Cronbach alpha of 0.8294. As for the global marketing scale and the global technology scale, all items of these

two scales were retained, giving Cronbach alphas of 0.9102 and 0.8301, respectively.

*Table 3. Company characteristics reported by the total sample*

<b>Description</b>	<b>Manufacturing Firms</b>
<u>Type of industry</u>	
Textiles	13
Mining and petroleum industries	0
Drinks and beverages	7
Engineering and electronic	22
Garments	3
Chemicals	17
Leather	0
Wood	4
Food industries	6
Paper	3
Printing	0
Plastics	2
<b>Total</b>	<b>77</b>
<u>Ownership</u>	
Government	64
Private	10
Multinational corporation	3
<b>Total</b>	<b>77</b>
<u>Manufacturing process</u>	
Assembly only	12
Fabrication only	6
Assembly and fabrication	42
Continuous/process flow	17
<b>Total</b>	<b>77</b>
<u>Type of products</u>	
Make-to-order only	5
Make-to-stock only	1
Make-to-order and make-to-stock	71
<b>Total</b>	<b>77</b>

*Table 4. Reliability analysis for the expected changes scale*

<b>Description</b>	<b>Correlated item – total correlation</b>
C1. Extent of changes in capacity planning & control	0.7625
C2. Extent of changes in quality planning & control	0.8893
C3. Extent of changes in inventory planning & control	0.8488
C4. Extent of changes in operations strategy	0.7585
Reliability Coefficient	0.8775

*Table 5. Reliability analysis for global uncertainty scale*

<b>Description</b>	<b>Correlated item – total correlation</b>
U1. Extent of impact of increased product variety	0.7631
U2. Extent of impact of difficulty of estimating aggregate demand	0.6906
U3. Extent of impact of changing standard of raw materials	0.7807
Reliability Coefficient	0.8294

*Table 6. Reliability analysis for global marketing scale*

<b>Description</b>	<b>Correlated item – total correlation</b>
M1. Extent of impact of increased global competition	0.8259
M2. Extent of impact of difficulty in distribution	0.8259
Reliability Coefficient	0.9102

*Table 7. Reliability analysis for global technology scale*

<b>Description</b>	<b>Correlated item – total correlation</b>
T1. Extent of impact of increased technology level	0.7418
T2. Extent of impact of changing skill levels of workers	0.7418
Reliability coefficient	0.8301

As a general rule, the reliabilities should not be below 0.80 for the scales used (Carmines & Zeller 1979). Therefore, the items within

the individual scales were reliable and were retained for further analysis of the research. And also, the analysis will help in upgrading the quality of data that serve as inputs for developing a more realistic model.

4. *Regression analysis and empirical findings.* Using data collected from the research instrument, an empirical analysis is conducted to derive a regression for estimation of the probability of changing P/O management activities based on GUNC, GMAR and GTEC. To recapitulate, the statistical tool to be used is the Logit analysis, a qualitative regression model. With this proposed tool, the probability of changing P/O management activities, as defined by  $ECHA = 1$ , is estimated. That is:

$$P_i = P ( ECHA= 1 X_k ) \quad (8)$$

where  $X_k$  are the independent variables: GUNC, GMAR and GTEC.

In the following sections, a goodness-of-fit test is conducted to determine the significance of the equation for testing the postulated relationships. This followed by the testing of postulated significant contributions of the independent variables to the dependent variable.

4.1. *Goodness-of-fit test.* The first step is to determine the significance of the regression as a whole in explaining the dependent variable ECHA. Unlike OLS with tabulated F-statistics, a model chi-square statistics is tabulated with formula as defined in [Equation 6](#). As the model chi-square is 65.98 with a p-value of 0.001 at three degrees of freedom, the regression is highly significant. In other words, all the independent variables (GUNC, GMAR and GTEC), taken together, significantly explain the variability observed in ECHA (dependent variable), as is illustrated in [Table 8](#).

*Table 8. MLE results with Logit analysis*

- 2Log Likelihood for model containing intercept only (2LO)	90.17
- 2 Log Likelihood at convergence (2LI)	24.19
Model Chi-square = 65.98 with 3 df	(-2 Log L.R.) p=0.001

4.2. *Hypotheses testing.* The significance of the relationships between dependent and individual independent variables has been tested with chi-square statistics provided by the Logit model. The regression results are depicted in [Table 9](#).

*Table 9. MLE estimates of the beta values*<sup>a</sup>

Constant	GUNC	GMAR	GTECH	R <sup>2</sup>
9.9375	.76	.92	.53	.6651 <sup>b</sup>
-8.98	(19.07)*	(23.36)**	(10.44)***	

- a. The chi-square values for individual betas are within the parentheses.  
 b. This is calculated with [Equation \(7\)](#).  
 \* Significant at 0.013.  
 \*\* Significant at 0.001.  
 \*\*\* Significant at .154.

Based on [Table 9](#),  $R^2 = 0.67$ , which means that about 67 percent of the variation in changes in P/O activities is explained by variations in global factors (*i.e.*, uncertainty, marketing and technology factors). Furthermore, this shows that combining the three global factors simultaneously does improve our ability to estimate the anticipated changes in P/O activities as a result of globalization.

*Hypothesis 1.* As observed, [Hypothesis 1](#) is significant among manufacturing companies in Egypt. The calculated value is greater than the critical value ( $19.07 > 7.82$  with  $\alpha = 0.05$  and  $df = 3$ ), so one rejects the null hypothesis and concludes that the global uncertainty represented in increased product variety, great difficulty in estimating aggregate demand and increase in the required standard in raw materials has a significant impact on P/O activities. This is consistent with the literature review, which confirms that manufacturing companies will face a very big challenge in meeting the needs and desires of their international customers and forecasting the fluctuations of international demand.

*Hypothesis 2.* Because the calculated value is larger than the critical value ( $23.36 > 7.82$ ), this factor (*i.e.*, global marketing) is

significant to estimation of the probability of achieving changes in P/O activities in manufacturing companies in Egypt. This finding is consistent with past literature in showing that global competition has a very critical impact on changes in P/O activities within manufacturing companies. That is a virtual fact, because the Egyptian manufacturers are facing a severe competition, whether from international producers or regional producers, such as Turkish and Israeli manufacturers.

*Hypothesis 3*. As observed, *Hypothesis 3* is modestly significant among manufacturing companies in Egypt. This may be interpreted in light of the fact that the government is still a major player in the development of the manufacturing sector whether in Egypt. It promotes the implementation of new technology by manufacturing companies, whether through providing support, such as financial assistance, tax relief and grants, and providing education and training by governmental institutions.

## CONCLUSIONS AND RECOMMENDATIONS

1. *Main findings*. The findings can be summarized as follows:

- Our findings demonstrate some industries are more involved in the expected changes in P/O activities as a result of globalization than others, *e.g.*, engineering and electronics, textiles, chemicals and food industries.
- The findings show that manufacturing companies expecting changes in their operational activities as a result of globalization embraced a marketing strategy combination of make to order and make to stock products.
- The study demonstrates manufacturing companies in Egypt attain the same expectations regarding the operational changes that must be associated with globalization. That is, P/O management activities (*i.e.*, capacity, inventory, quality and operations strategy) should be amended and treated simultaneously and on an equal footing.
- The findings provide strong evidence that there is a valuable congruence between production managers' expectations and

what the literature proposed about the relationship between the expected changes in P/O management activities and product variety, standard of raw materials and aggregate demand (*i.e.*, uncertainty factors).

- The findings show that the need to survive and grow in the new era of global competition for the Egyptian manufacturing firms requires achieving effectiveness of the existing capacity and technology, and improving quality.
- Results indicate that manufacturers in Egypt should pay more attention to the importance of technology as one of the very fundamental paths for confronting globalization threats.
- The results of this study were consistent with those of Rodríguez-Díaz (2000), Belout, Saba and Dolan (2001) and Ng and Hung (2001), regarding the impact of human aspects on the effective processes of P/O activities in the Egyptian context.

2. *Implications.* The above results should have some serious theoretical and empirical implications for production and operations managers:

- With the empirical findings of the global factors, I hope to arouse the attention of manufacturers to these important factors. Greater success in anticipating the right changes in P/O activities will allow manufacturers to formulate the relevant strategies and programs of changes, which will place the manufacturing sector in Egypt in a good position in the presence of its global competition.
- It is expected that globalization will create severe competition between manufacturers on quality bases. Thus the Egyptian manufacturing firms should formulate the relevant strategies for continuous improvement in the quality of the products and services the operation produces in order to keep pace.
- The findings of the current study enhance understanding of the impact of globalization on capacity planning and control in manufacturing firms. In this regard, policy makers in the Egyptian industrial sector should augment the capacity of manufacturing firms (*i.e.*, through increased funding and grants)

in order to be able to respond to any unexpected increase in demand as a result of globalization.

- Manufacturing firms' leaders in Egypt should know that globalization will allow the easy flow of materials, parts and components between factories and countries. In turn, they have to plan and control their inventories in order to avoid the risks of any shortage or surplus in the inventory.
- In today's global economic environment, companies are often looking for business partners all over the world. Understanding of how manufacturing companies in other countries, such as Egypt, are preparing themselves for the globalization era is very important for decision makers in Western corporations.
- The exploratory findings in this study identify certain characteristics of Egyptian manufacturers. This will enhance the ability of policy makers in Egypt to take a "mixed grill" approach and provide the necessary professional assistance, such as enhancing training programs for improving workers' skills, and financial assistance, such as grants and incentives.
- Empirical validation of the conceptual model proposed provides a stronger conceptual foundation for the research in this area. I hope that insights provided in this study will enable further research in this area.
- Although no practical guidelines were provided in this study (*i.e.*, how to change P/O activities in the face of globalization?), qualitative understanding of the global factors and the probability of changes in P/O activities should be viewed as being equally valuable.

3. *Further Research.* The research in this area still requires further refinement and development. Further research could be directed at the following areas:

- Possible extensions of the study including more Arab countries, to seek further generalization.
- Comparative study can be undertaken between less developed countries and developed countries concerning the impact of globalization on P/O activities.

- Having established the significance of the independent factors (*i.e.*, global factors) to P/O activities exposed to change, future efforts can be undertaken to include more global factors, such as organizational, social, information and logistics factors, and more P/O activities, such as layout, location, scheduling, process design and loading.
- Finally, case studies need to be conducted to present more details concerning the processes of changes in P/O activities as a result of globalization.

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