Obstacles Restraining Productivity Improvement Programs in a Developing Country

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Abstract

Since manufacturing is a key sector in Oman, efforts should be made to improve its productivity. The need for such efforts is becoming increasingly important in the present era of globalization. However, manufacturing organizations can face obstacles that make productivity improvement efforts ineffective or even prevent improvement operations. This report summarizes a study investigating the internal obstacles restraining productivity improvement in the manufacturing sector of Oman. Data required for this study were collected through a questionnaire from production and operations managers at 51 manufacturing organizations of different size. The results of applying factor analysis to a data set of 15 obstacles showed that these obstacles can be reduced into three major factors which directly relate to poor management, employee dissatisfaction, and lack of proper training.

Keywords
Manufacturing organizations, productivity improvement, obstacles

1. Introduction

Today's intense market competition forces organizations to examine how they can improve performance as they seek to enhance their competitiveness. Productivity is one of the most widely used tools for evaluating, monitoring, and improving the performance of industry and the national economy. At national level, productivity indicates how well an economy uses its resources in producing goods and services. A deterioration in productivity can lead to slow economic growth and high inflation. On the other hand, improved productivity leads to a higher trend rate of economic growth and higher living standards for a nation.

At an organizational level, productivity measures how well an organization converts input resources (labor, materials, machines etc.) into goods and services. A decline in productivity means an increase in costs and therefore a deterioration in the competitive position of an organization. On the other hand, an improvement in productivity can lead to a decrease in cost and duration of production, an improvement in quality, and therefore a growth in the market share (Kazaz and Ulubeyli 2007).

In addition to assessing its performance, an organization can use productivity measures to:

- compare its performance with that of other competitors in the same sector
- assess the relative performance of its individual departments
- compare relative benefits of various inputs
- plan the most effective use of resources

Productivity measures the relationship between the physical volume of goods and services produced and the resources used in the production processes adopted by the economy. In other words productivity is a measure of the efficiency with which labor, capital, and natural resources are combined in the economy. It is possible to define a variety of productivity measures, depending on whether measurements of variables are made in physical or financial terms and depending on which resource inputs are selected for performance evaluation (Eilon 1985). Generally, productivity measures can be classified into:

- Partial factor productivity: the ratio of output to one type of input (labor, capital, material, or energy)
- Multifactor productivity: using more than a single input.
- Total factor productivity: using all the inputs of production (labor, capital, material, and energy).

In order to improve the productivity, a large number of interacting factors should be considered. These factors vary from environment to environment. However, the main factors can be classified into the following:

- Sociology factors: Attitude of the employees towards the work and the approach of the management towards the working force and the provision of working conditions.
- Technological Factors: Technological advancement always struggles to achieve the increased of production with minimum of costs and efforts, which always result into increased productivity.
- Managerial Factors: Delegation of authority, true recognition of human factor, etc.
- Natural Factors: Geographical, physical, and climatic conditions.
- Government Policy: Financial incentives, labor laws, etc.
- Economic Factors: Salary and financial incentives. .

However, due to some factors, implementing productivity improvement methods are not always successful. Factors that make productivity improvement efforts ineffective or even prevent improvement operations are called obstacles to productivity improvement (Rantanen 2001). There are two types of obstacles: internal and external. Internal obstacles are those that originate inside the organization. Managers and stakeholders can usually control them. Examples of these obstacles include, lack of top management support and lack of time and other resources. On the other hand, external obstacles are those that stem from outside the organization. Examples of these factors include government of regulations and market conditions.

2. Related Research

Several studies have investigated factors affecting productivity in different industries, e.g. Carnevale (1992), Leaman, (1995), Shikdar and Sawaqed (2003), Karjalainen et al. (2005), Steenhuis and de Bruijn (2006), Chan and Kaka (2007), Kazaz and Ulubeyli (2007), Hameed and Amjad (2009), and Lan et al. (2010). It is beyond the scope of this paper to review these studies. However, since they address the issue of obstacles restraining productivity improvement, the studies by Hoffman and Mehra (1999) and Rantanen (2001) are perhaps the most relevant studies to the work presented in this paper.

In order to identify the critical factors that are potentially “fatal” to productivity improvement programs, Hoffman and Mehra (1999) conducted a two- stage study. The first stage consisted of forming an expert panel to be interviewed by the Delphi method. The panel had five participants each having significant experience in the productivity related issues. On the basis of the Delphi method results and existing literature, 20 factors were identified as possible obstacles to productivity improvement programs. These factors were then used in the second stage of the study to design a questionnaire to solicit response from 100 randomly selected production operations managers within the regional American Production and Inventory Control (APICS) group about the critical productivity factors that influence the outcomes of productivity improvement programs. Based on 41 responses, it was concluded that seven critical factors can cause the failure of a productivity improvement program. These factors fall into the issues of top management, planning, coordination, communication, training, and employee relationships.

Rantanen (2001) conducted a survey investigating the major internal obstacles to productivity improvement in small industrial firms in two regions of Finland, Päijät-Häme and Pirkanmaa. On the basis of analyzing data collected from 141 respondents from small firms in these two regions, it was concluded that the major obstacles to productivity improvement programs can be classified into two major categories: (1) factors involving the lack of time and other resources and (2) shortcomings in knowledge and education on productivity.

The studies by Hoffman and Mehra (1999) and Rantanen (2001) addressed issues relating to the obstacles to productivity improvement programs in developed countries. The aim of this study was to investigate the internal obstacles restraining productivity improvement in the manufacturing sector of a developing country, Oman. For this country, the manufacturing sector is considered an important source of the national income. In 2005, this sector contributed 8.5% to GDP compared to 4.7% in 1995. By 2020, it is expected to contribute 15% of GDP (PEIE, 2007). Moreover, manufacturing is a key sector of the government's vision 2020 economic diversification plan.

3. Methodology

The methodology applied for analyzing the internal obstacles restraining productivity improvement in the manufacturing sector of Oman is the subject of this section. It mainly includes the method of collecting data as well as the analysis tools.

3.1 Questionnaire Design Data Collection

In order to control the data collected and for easier analysis, it was decided to use a questionnaire with closed type question forms where most of the questions are based on a 5-point Likert scale. The clarity and completeness of the questions were ensured by conducting a pilot study that included eight different organizations. The responses received from these organizations were used as a guide for refining the questionnaire. The refined questionnaire consisted of two major parts. The first part of the questionnaire contained questions relating to the organization profile including the number of employees, the owner of the company, and type of product that the company manufactures/makes. The second part of the questionnaire was designed to address the aspect being investigated in this study, which obstacles restraining productivity improvement programs. These obstacles are as follows:

- O_1: Insufficient investment in workforce training
- O_2: Poor financial controls and/or information systems
- O_3: Weak middle managers
- O_4: Decline of the work ethic
- O_5: No clear connection between employee effort and rewards
- O_6: Insufficient capital for improving plant and equipment
- O_7: Poor employee relations
- O_8: Weakness in industrial and manufacturing engineering
- O_9: A piecemeal, unplanned approach to improving productivity
- O_{10}: Inadequate/ineffective coordination among departments or functional areas
- O_{11}: Insufficient investment in management and supervisor training and development
- O_{12}: Poorly trained supervisory personnel in the area of productivity related problems
- O_{13}: High worker turnover
- O_{14}: Lack of loyal workforce
- O_{15}: Impossibility of programs implementation

Using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), respondents were asked to indicate the extent to which they agree that each of the above is an obstacle restraining productivity improvement programs in their organizations**.** It is worth noting that the works by Hoffman and Mehra (1999) and Rantanen (2001) , and the results of the pilot study were the basis for selecting these 15 obstacles.

The refined questionnaire was then distributed to production/operations managers at 80 manufacturing organizations in the Sultanate of Oman. A total of 51 respondents completed the form, representing a 63.75% response rate. As shown in Figure 1, 31% of responses were received from organizations with no more than 50 employees, 49% of responses were received from organizations with 51 to 250 employees, and 20% of responses were received from organizations with more than 250 organizations. It is worth noting that organization size can be classified in different ways; however, the number of employees is the most widely used classification. The sample distribution by owner type is summarized in Figure 2. As shown in this figure, 2% of responses were received from government organizations, 4% of responses were received from government/private organizations, 72% of responses were received from local/private organizations, 8% of responses were received from both international/private and international/local private organizations, and 6% were received from other types of organizations.

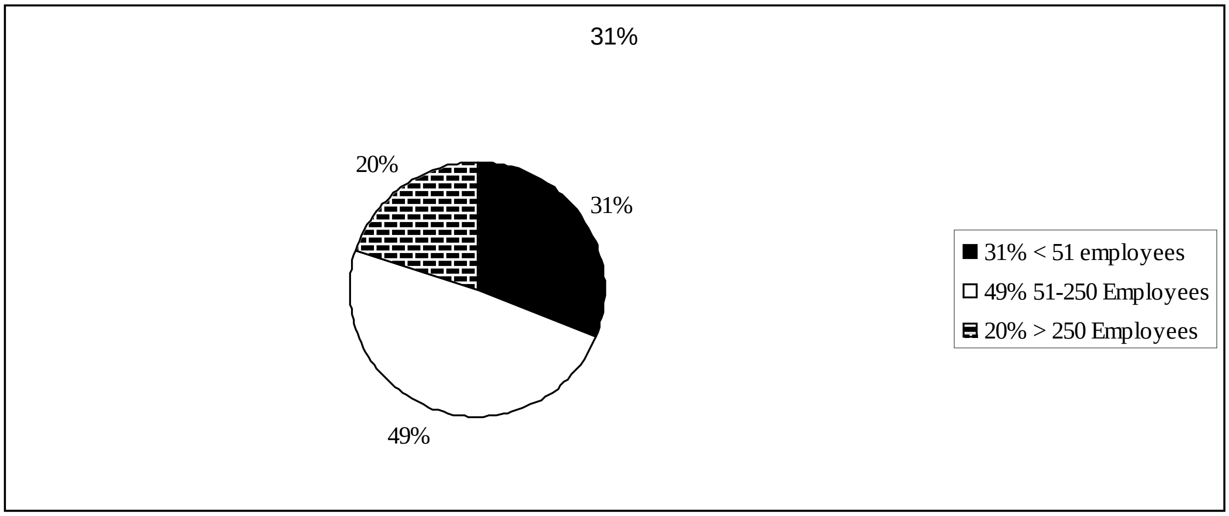

Figure 1: Response distribution based on organization size

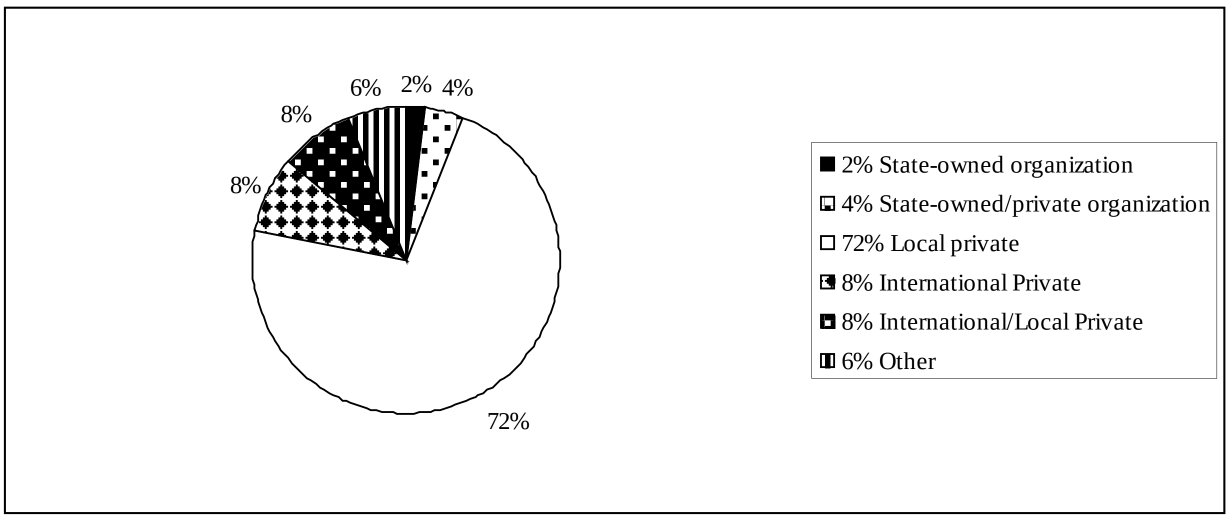

Figure 2: Response distribution based on organization owner

3.2 Analysis Tools

To analyze the collected data, two statistical tools were used: Cronbach's alpha and factor analysis.

Cronbach's alpha is a coefficient of reliability, which is generally used as a measure of internal consistency or reliability of a psychometric instrument. It indicates the extent to which a set of test items can be treated as measuring a single latent variable. Its value ranges between zero and one. The closer that Cronbach's alpha coefficient is to one, the greater the internal consistency of the items in the scale**.**

Factor analysis is a statistical technique, which enables a user to see whether an underlying pattern of relationship exists in a certain data set, such that the data may be rearranged or reduced to smaller sets of interpretable factors. These factors are independent and account for the variance in the original data. Factor analysis involves the following steps:

Step 1: Generation of a correlation matrix for the attributes.

Step 2: Extraction of initial factors. Factor analysis uses different methods for determining the minimum number of factors that would satisfactorily produce the correlation between the variables. These methods include common factor analysis, principle components analysis, image factor analysis, and canonical factor analysis. However, principal components analysis (PCA) is the most widely used method (Kleinbaum and Kupper 1998). In this method, a set of attributes is linearly transformed into a number of factors (principal components), such that the transformed factors are independent. The first factor accounts for the largest amount of the variation in the data. The second factor accounts for the next largest amount of the variation not accounted for by the first, and so on. To extract out the factors, equation (1) is solved for the eigenvalues and the eigenvectors (factor loadings).

$$(A - I\lambda)Y = 0 \qquad (1)$$

where A is the correlation matrix; I is the unit matrix; λ is the characteristic root (eigenvalue); and Y is the eigenvector.

Step 3: Rotation to terminal factors. To achieve more interpretability, the factors corresponding to the resulting eigenvalues are further rotated through one of the many rotation techniques, such as the Varimax method. Since most statistical packages such as the Statistical Package for the Social Sciences (SPSS, 1999) can perform the Varimax algorithm, there is no need to describe the computation involved in further detail.

Step 4: Determination of factor score coefficients and ultimate scores. The factor scores for the individual alternatives are calculated from the factor score coefficient matrix. The factor score coefficient matrix (f) is defined by equation (2).

$$f = (S^T S)^{-1} S^T \qquad (2)$$

where S is the rotated factor matrix and S^T is the transpose of S.

A composite scale (factor score) is then built for each factor in the final solution, and for each solution alternative, a vector of factor scores (F) is computed by using equation (3).

$$F = f\,Z \qquad (3)$$

where Z is the vector of standardized values of the variables which have been analyzed.

The above brief outline of the technique is presented only to highlight certain salient features. The detailed mathematical elaboration may be referred to in the relevant literature.

4. Analysis of Results

Analysis of results of responses on obstacles restraining productivity improvement is summarized and presented in this section. The results are summarized under two headings:

- Reliability testing results
- Factor Analysis results

4.1 Reliability Testing Results

The computed Cronbach's alpha coefficient value was found to be 0.93. This value was considered acceptable since it exceeded the minimum acceptable level of 0.70 (Nunnally and Bernstein 1994).

4.2 Factor Analysis Results

In order to reduce the 15 obstacles criteria into a smaller set of factors, the responses were analyzed to yield the correlation matrix shown in Table 1. The correlations were further analyzed for eigenstructures and eigenvalues. Table 2 shows the first stage computation results of the PCA procedure using SPSS/PC. This table contains the percentage of the variance attributable to each of the factors. The following is noted with reference to Table 2:

- The factors are arranged in descending order of associated variance.
- The eigenvalue greater than or equal 1 criterion (Kaiser's rule) indicates that only three factors are needed to account for most of the variation.

The procedure further computed an initial factor matrix presented in Table 3. This table simply contains the elements of the three extracted factors (eigenvectors) corresponding to the highest eigenvalues. The absolute values of the elements of the eigenvectors (the factor loadings) reflect the associations between the extracted factors and obstacles. To achieve more interpretability, the initial factors corresponding to the resulting eigenvectors was optimized by applying the Varimax rotation technique. The result of this application yielded the final rotated matrix shown in Table 4.

Table 1: Correlation matrix

	O_1	O_2	O_3	O_4	O_5	O_6	O_7	O_8	O_9	O_{10}	O_{11}	O_{12}	O_{13}	O_{14}	O_{15}
O_1	1.00														
O_2	.637	1.00													
O_3	.270	.445	1.00												
O_4	.352	.499	.624	1.00											
O_5	.605	.436	.532	.467	1.00										
O_6	.300	.376	.442	.277	.357	1.00									
O_7	.358	.508	.787	.595	.576	.469	1.00								
O_8	.392	.538	.598	.438	.382	.445	.616	1.00							
O_9	.380	.473	.725	.494	.430	.391	.617	.545	1.00						
O_{10}	.513	.415	.688	.497	.589	.348	.683	.524	.602	1.00					
O_{11}	.575	.571	.501	.297	.446	.605	.501	.411	.495	.518	1.00				
O_{12}	.451	.467	.694	.539	.507	.406	.658	.570	.530	.637	.576	1.00			
O_{13}	.206	.420	.256	.331	.429	.358	.441	.283	.160	.338	.411	.234	1.00		
O_{14}	.262	.399	.492	.345	.509	.475	.530	.245	.381	.367	.529	.415	.533	1.00	
O_{15}	.150	.424	.711	.501	.387	.452	.636	.608	.631	.422	.443	.552	.443	.559	1.00

Table 2: Percentage of variance associated with each factor

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	7.692	51.281	51.281
2	1.308	8.721	60.002
3	1.219	8.128	68.129
4	0.885	5.897	74.026
5	0.753	5.018	79.044
6	0.567	3.778	82.822
7	0.493	3.285	86.107
8	0.460	3.064	89.171
9	0.424	2.826	91.997
10	0.312	2.080	94.078
11	0.241	1.607	95.685
12	0.195	1.298	96.983
13	0.190	1.265	98.248
14	0.163	1.087	99.335
15	0.100	0.665	100.000

Table 3: Initial factor matrix

	Factor		
	1	2	3
O_1	0.591	0.496	-0.560
O_2	0.703	0.306	-0.191
O_3	0.839	-0.399	0.029
O_4	0.683	-0.210	-0.089
O_5	0.711	0.254	-0.127
O_6	0.617	0.198	0.282
O_7	0.851	-0.191	0.074
O_8	0.717	-0.221	-0.122
O_9	0.748	-0.313	-0.126
O_{10}	0.771	-0.083	-0.252
O_{11}	0.730	0.370	0.002
O_{12}	0.783	-0.154	-0.170
O_{13}	0.523	0.399	0.504
O_{14}	0.649	0.242	0.491
O_{15}	0.748	-0.306	0.374

Table 4: Rotated factor matrix

	Factor		
	1	2	3
O_1	0.161	0.062	0.938
O_2	0.335	0.319	0.640
O_3	0.884	0.254	0.133
O_4	0.654	0.168	0.249
O_5	0.369	0.350	0.572
O_6	0.299	0.595	0.234
O_7	0.751	0.382	0.237
O_8	0.690	0.155	0.280
O_9	0.775	0.127	0.241
O_{10}	0.650	0.139	0.472
O_{11}	0.295	0.507	0.570
O_{12}	0.698	0.178	0.383
O_{13}	0.076	0.807	0.173
O_{14}	0.274	0.790	0.145
O_{15}	0.723	0.515	-0.072

5. Discussions

In this study, factor analysis has reduced the 15 criteria into three independent factors:

Factor 1: This factor explains 51.28% of the variance in the data set. As weak middle managers (O_3), decline of the work ethic (O_4),poor employee relations (O_7), weakness in industrial and manufacturing engineering (O_8), a piecemeal, unplanned approach to improving productivity (O_9), inadequate/ineffective coordination among departments or functional areas (O_{10}**),** poorly trained supervisory personnel in the area of productivity related problems (O_{12}), and impossibility of program implementation (O_{15}**),** are its chief contributors with criteria loadings of 0.884, 0.654, 0.751, 0.690, 0.775, 0.650, 0.698, and 0.723, respectively, this factor may be termed poor management. This finding is consistent with that of Hoffman and Mehra (1999). Since it accounts for the highest variance in the data set, this factor can be considered as the most important obstacle restraining productivity improvement. This means that any project on improving productivity cannot be successful without careful planning, organizing, staffing, directing, and controlling of its activities.

Factor 2: This factor explains 8.721% of the variance in the data set. As insufficient capital for improving plant and equipment (O_6), high worker turnover (O_{13}), lack of loyal workforce (O_{14}) are its chief contributors with criteria loadings of 0.595, 0.807, and 0.790, respectively, this factor may be termed as employee job dissatisfaction. Therefore, the second factor that should be considered in order to make productivity improvement efforts effective is to improve employee job satisfaction. This is because the productivity of employees depends not only on their skills and knowledge, but also on their attitude towards the job. If the attitude is positive and there is internal satisfaction with the job, there will be a sense of commitment and loyalty, and the attitude of such employees in the work place be better than those who are not internally satisfied. The link between employee job satisfaction and productivity has been addressed by several studies, e.g. Graham (1996) and Steindel and Stiroh (2001). The main findings of these studies are as follows**:**

- Unhappy employees are less productive and more likely to have higher absence rates
- Satisfied employees are more productive, innovative, and loyal
- Increased job satisfaction leads to increased employee morale, which in turn leads to increased employee productivity
- Increased job dissatisfaction leads to increased employee turnover.

Therefore, in order to improve the chance of success of a productivity improvement program, mangers should ensure job satisfaction for employees by addressing specific needs such as incentives and salaries, health and safety, and other such needs.

Factor 3: This factor explains 8.128% of the variance in the data set. As insufficient investment in workforce training **(**O_1**)**, poor financial controls and/or information systems**(**O_2**)**, no clear connection between employee effort and rewards **(**O_5**)**, and insufficient investment in management and supervisor training and development (O_{11}) are its chief contributors with criteria loadings of 0.938, 0.640, 0.570, 0.572, respectively, this factor may be termed as lack of proper training. This might be due to the fact that, the manufacturing sector of Oman is still in its infancy and does not have enough experience for providing quality training programs. This is not unique to the local industry in Oman; it is a common problem in developing countries. Since they are out of the scope of this study, the possible causes and remedies for this problem may be referred to in the literature (Herschbach, 1997; Ko et al., 2010). However, the remedies suggested in the literature might need some kind of strategic policy by industry.

6. Conclusions

The literature review reveals that although a significant body of work does exist on investigating factors affecting productivity both positively and negatively, only a small number of studies have dealt with the issue of obstacles restraining productivity improvement. This paper presented the results of an empirical study aimed at exploring this issue in manufacturing organizations operating in Oman. Using a survey from**,** data were collected from 51 randomly selected manufacturing organizations of different size. The results of applying factor analysis showed three major factors restraining productivity improvement in the manufacturing sector of Oman. Ranked in order of importance, these factors are: (1) poor management, (2) employee dissatisfaction, and (3) lack of proper training. Therefore, in order to improve the chance of conducting a successful productivity program, the following actions are recommended:

- People to be appointed as managers of productivity improvement programs should possess good management skills including that ability to plan, organize, coordinate, and control program activities.
- Organizations should find ways and means to improve their employees' job satisfaction.
- Before conducting a productivity improvement program, an organization should invest in providing effective and sufficient training for employees at all levels, that is, managers, supervisors, and ordinary workers. It worth mentioning that training is a crucial factor for the success not only for productivity improvement, but for all organizational activities.

The finding of this study is of value to production and operations managers of manufacturing organizations who plan to carry out a productivity improvement program in Oman, but also for organizations in other developing countries operating in an environment similar to Oman such as GCCs**.**

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