Advanced manufacturing technology transfer and implementation in developing countries
The case of the Cypriot manufacturing industry

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Abstract

This paper investigates the transfer and implementation process of advanced manufacturing technologies (AMTs) in developing countries using the Cypriot manufacturing industry as a case study. Specifically the paper addresses: (1) the management processes followed during the transfer of technology into the manufacturing environment, and (2) the steps followed both before and after implementation and productive operation of the technologies. The results indicate that despite the distance between the manufacturer and the technology suppliers, no difficulties were experienced in acquiring information about the available technologies and the suitability of these technologies for the specific manufacturing environment. Preparations and human resource development prior to the introduction of the technologies were found, in general, not to be carried out at the level expected from the international literature to ensure successful implementation, but these problems were more effectively addressed after the introduction of AMT. In general, these deficiencies did not prove detrimental to the successful operation of the new technologies. © 1999 Elsevier Science Ltd. All rights reserved.

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1. Introduction

The process of technology selection and transfer is very complicated and requires skills and managerial know-how. The process is also highly delicate and costly and as a result there is a need to put much effort and time into the transfer phase of AMT introduction into the organisation. Very often, the buyer of technology is in a weak position, especially when facing a stronger and more experienced supplier from an industrialised country. Djeflat (1988) suggests that the buyer can strengthen his bargaining power by following the steps outlined below:

- breaking up the technological package as much as possible;
- gathering correct information about the supplier and the product;
- using group buying; and
- avoiding any form of financing from the supplier.

Particular attention should be paid not only to the kind of AMT to be transferred but also to the type of contract to be used and the type of channel through which the technology should be transferred. There are two types of contract commonly used in the transfer of AMT. These are known as “turnkey contracts” and “product in hand contracts”. In the “turnkey contract” the whole implementation process is entrusted to a single foreign supplier who accepts the responsibility to implement the project of technology transfer up to the point where he hands the keys over to the client. In the “product in hand” contract the responsibility of the supplier is not limited to the equipment installation but also includes
the initial management and operation of the equipment and training of the operators (Love and Walker, 1986).

Advanced manufacturing technologies can be imported through the following channels:

1. direct investments;
2. joint ventures; and
3. state controlled import modes.

The most commonly used modes are direct investments, and joint ventures. Under the joint venture category there are three types of technology transfer, based on the level and type of contribution of the firms (Djeflat, 1988; Edosomwan, 1988). These are:

1. supply of machines from the foreign firm;
2. supply of patents, licenses or manufacturing processes; and
3. supply of personnel to oversee the start-up of the machines and provide technical assistance.

The performance of companies using AMT depends to a large extent on how well they implement it and not on the technology itself. The way the technology is implemented has a serious effect on its performance and as a result on business performance (Ford, 1988). Weill et al. (1991) suggest that “changes in organisational structures and practices as well as worker skills and knowledge are needed for successful implementation of AMT”. As technologies become more powerful and complex, the source of competitive advantage lies less in the particular hardware or software package purchased than in the ability to deploy it (Bessant, 1993).

The existence of a sound supporting infrastructure is characterised as one of the most important factors in successful implementation of AMT into the company (Love and Walker, 1986; Weill et al., 1991; Zahra, 1994; Swierczek, 1991). The organisational infrastructure can be split into two elements (Tippett, 1989):

1. knowledge, i.e. what the employees know; and
2. policies, i.e. the organisational rules, procedures, systems and structure.

The creation of an adequate infrastructure may require reorganisation of the company. However, the benefits that can be obtained through reorganisation, can in many cases be obtained independently of the introduction of new technologies (Rush and Bessant, 1992). There are many companies which managed to develop a competitive advantage just around their internal capabilities and their infrastructure even though their hardware (i.e. plant and equipment) were not exceptional. On the other hand, nobody managed to gain competitive advantage by employing technology on its own (Gifi et al., 1991). Bessant (1993) points out that benefits from AMT arise not only from the equipment and software used but also from changed working practices, skills disposition, inter-functional relationships, planning and control procedures.

As a general guideline three steps can be taken by the organisation to ensure that the firm’s infrastructure will support effectively the introduction of AMT. These are (Tippett, 1989):

1. Acquisition of a thorough understanding of the present infrastructure, that is understand how the existing manufacturing processes are working. There are many companies which do not understand how they presently do their own business.
2. Rationalisation of current processes and identification of current foul-ups and bottlenecks. If these are fixed and work flow is smoothed out, the need for new systems may be reduced.
3. Definition of an infrastructure project plan. This should take into consideration all the existing supportive systems which must be modified, if necessary, to become compatible and supportive of the new technology.

There is no doubt that the human resource is the greatest asset for any organisation, without which the use and development of technology will not happen. Effort should be made so as to minimise the negative impact of technology on human beings in order to achieve successful technology implementation (Zahra, 1994; Swierczek, 1991). From the literature it is generally widely accepted that employees should be involved from the beginning by being updated about plans for new technology and the reasons why this new technology is needed. They should be aware of the impact the new technology will have on their job security, working conditions, promotion opportunities, job classifications and training requirements. Special emphasis should be given to the involvement of the workforce to the maximum possible extent in the selection and implementation of the new technology (Towers, 1986). It was suggested by Tippett (1989) that “companies seeking to achieve successful technology implementation found it necessary to introduce some changes in basic Human Resource Management (HRM) areas, and in the overall role HRM professionals play in the implementation process”.

The main problems or reservations that may surface with regards to the attitudes of the workforce are:

1. fear of redundancy or job loss; and
2. fear of being unable to cope with the new system.

The above reservations can be resolved by guarantees of no compulsory redundancies related to the introduction of new technology and by continuous training (Love and Walker, 1986). Experience has shown that even in
cases where one of the objectives of the introduction of AMT was to eliminate skilled workforce, this did not happen as it was soon realised that skilled workers were required if system utilisation was to remain high (Rush and Bessant, 1992). In terms of workforce skills, the operators of AMT may regard themselves as more skilled, or on the other hand, they may see the job they perform after the introduction of AMT as more de-skilled. In many cases, the introduction of new technology has meant an increase in job satisfaction, and increased job security for the workers. The attitudes of the unions may also play a significant role in the introduction and implementation of AMT, and in many situations it may not be possible to implement AMT without their co-operation.

The aim of this paper is to examine the transfer and implementation processes of AMT in developing countries using the Cypriot manufacturing industry as a case study. Specifically the paper analyses the management processes during the transfer of the technology into the manufacturing environment as well as the steps taken both before and after its implementation and actual productive operation. Special emphasis is given to human factors and the preparation of the infrastructure for the introduction of the new technologies.

2. Historical development of the manufacturing industry in Cyprus

Cyprus is a small island in the north-eastern part of the Mediterranean Sea with a total population of around 650,000. Before the country’s independence in 1960 the dominant sector in economic activity was agriculture which accounted for 16% of GDP and 45% of employment. Manufacturing activity was essentially restricted to the processing of locally produced agricultural raw materials. Between 1961 and 1973, upgrading of the economic and social infrastructure led to a rapid annual growth in GDP of about 7%, a low inflation and unemployment and a surplus in the balance of payments. This rapid growth and sustained socio-economic development were disrupted by the Turkish invasion in 1974 and the occupation of more than a third of the territory of the country. The invasion led to an increase in unemployment to a record 30% and a drop in GDP by 18% per annum in real terms between 1973 and 1975. To overcome these problems the government of Cyprus adopted expansionary and fiscal monetary policies and the promotion of labour incentive projects.

The rapid reconstruction programme that followed led to the rapid development of the manufacturing industry, which was initially geared to serve the local construction industry. This development was sustained through the 1980s due to the steady growth of the local housing market and exports to the Middle Eastern and North African markets.

The late 1980s and early 1990s, however, saw a considerable erosion of these markets due to the development of local industry and competition from much lower labour cost countries of the Far East. The custom union agreement signed between Cyprus and the European Union in 1988 and the GATT agreement implemented in January 1997 compounded the problem by opening up the Cyprus market to manufacturers from the European Union and other countries with products of higher quality and higher design content than locally manufactured goods.

These competitive pressures are offering both a challenge and opportunities to the Cypriot manufacturing industry. The challenge arises from the need to compete with European and other manufacturers in terms of cost and quality in the local market. The removal of trade barriers presents opportunities for the manufacture and export of high quality high value added products to the European and other more quality conscious markets. This changing competitive environment, demands that Cypriot manufacturers be able to supply products of high quality and design content, in greater variety and smaller volumes. Success in this endeavour, however, requires new approaches to technology, human resource development, company structure and management philosophy. One of the most critical factors will be how successfully manufacturers anticipate, acquire and apply new technology. It is widely believed that the introduction of AMTs offers a means of resolving the above problems but their implementation is a risky venture.

The Cypriot Industrial Strategy which was established in 1987 has attributed particular importance to the technological restructuring of the manufacturing sector. This strategy indicates that the introduction of AMT into the manufacturing industry is a must for its competitiveness and even its survival. This present study aims to contribute to this effort by investigating the current state of transfer and implementation of advanced manufacturing technologies with the view to identifying weaknesses and problem areas and providing guidelines though which successful transfer and implementation can take place.

3. Research methodology

The study was based on the results of a comprehensive questionnaire which was used as a basis of extracting information from the companies. The design of the questionnaire was based on the international literature and recent developments in the subject area and guidelines on case study research (Yin, 1984). The questionnaire is split into four major sections, each one addressing separate issues (Efstathiades, 1997).

The first two sections deal with the general characteristics of the companies and the application of AMT. The
third section determines the impact of AMT on the company product/market characteristics, competitive priorities and manufacturing parameters, while the remaining section examines the management processes followed during the introduction and operation of AMT in the manufacturing environment.

The survey of the 40 companies was conducted using personal interviews based on the aforementioned questionnaire. The surveyed population consisted of firms in the machine tool manufacturing industry, the pump manufacturing industry, the metal and wood furniture manufacturing industry, the refrigerator manufacturing industry, the printing industry, and the ice cream manufacturing industry. It is interesting to mention that the above sample covers nearly all the companies in the Cypriot manufacturing industry that have introduced AMT. The surveyed technologies are shown in Fig. 1.

Descriptive statistics were used in the questionnaire to indicate the level of significance of the various company and product/market characteristics and management parameters on the introduction of AMT. The parameters were scored on a 10-point scale with 1 indicating a low level of significance and 10 indicating a high level of significance.

4. Results and discussion

4.1. Technology transfer

As mentioned earlier, the process of technology selection and transfer is quite complicated and requires skills and managerial know-how. The results of the questionnaire indicate that all the AMTs were transferred to the companies under the joint venture channel and the contract signed in the majority of cases was the turnkey one. Only in three cases the contract provided for an indicative technical service to operate the technology. No direct investment channel or state import mode was used to finance technology acquisition.

During the selection and transfer process, special emphasis should be given to the factors which strengthen the buyer’s power. Table 1 presents the level of consideration of the above factors during the transfer of AMT in the Cypriot manufacturing industry. It can be seen that in more than 80% of the 40 cases examined, the Cypriot manufacturer investigated thoroughly the available technologies and the suppliers before selecting a particular technology for his organisation. The fact that the Cypriot manufacturer is far away from the AMT manufacturers did not prove to be an impediment in obtaining information on competing technologies.

It can also be seen from the results that technology selection was not significantly influenced by budgetary or other constraints, provided the manufacturer was convinced that the selected technology was the “right” technology for his organisation. Cypriot manufacturers in general avoid group buying and breaking the technological package (buying different parts of an overall technological package from different suppliers). The former is mainly due to severe local competition and an attempt by the manufacturers to gain competitive advantage through the application of advanced technologies. The latter was attempted by only two companies and in both cases it was found to produce significant delays and to be an impediment to the fast adaptation of the technology to local conditions.

4.1.1. Factors hindering the technology transfer process

The technology transfer process can be hindered by factors which can normally be classified as company related, supplier related and government related. Tables 2–4 give the degree of hindrance that these factors exerted in the transfer of AMT to the Cypriot industry.

The results reveal that company related factors (Table 2) had the highest negative influence on the technology transfer process. Amongst these, the lack of knowledge/skills in the workforce related to the technologies as well as the general lack of skilled staff were the most important. With regards to the supplier related factors (Table 3), the major negative influence was found to be the distance from the supplier of the technology which also made provision of post-implementation tech-
Table 1
Factors considered during the selection and transfer process

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group buying</td>
<td>1.00</td>
<td>0.00</td>
<td>40</td>
</tr>
<tr>
<td>Break the technological package</td>
<td>1.70</td>
<td>2.34</td>
<td>40</td>
</tr>
<tr>
<td>Foreclosing options at the selection stage due to budgetary constraints</td>
<td>3.35</td>
<td>3.36</td>
<td>40</td>
</tr>
<tr>
<td>Proper information about the supplier and the product</td>
<td>8.03</td>
<td>2.54</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 2
Company related factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of staff</td>
<td>3.50</td>
<td>3.04</td>
<td>40</td>
</tr>
<tr>
<td>Limited managerial resources</td>
<td>2.03</td>
<td>2.06</td>
<td>40</td>
</tr>
<tr>
<td>Management have little experience outside their own particular company</td>
<td>2.05</td>
<td>2.25</td>
<td>40</td>
</tr>
<tr>
<td>Lack of knowledge in the workforce</td>
<td>4.15</td>
<td>2.69</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 3
Supplier related factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureaucratic delays with foreign countries instituted by individuals or groups not knowledgeable about technology transfer</td>
<td>1.50</td>
<td>1.78</td>
<td>40</td>
</tr>
<tr>
<td>Cultural and social deferences from supplier of technology</td>
<td>1.20</td>
<td>1.26</td>
<td>40</td>
</tr>
<tr>
<td>Distance from the supplier of technology</td>
<td>1.93</td>
<td>2.13</td>
<td>40</td>
</tr>
<tr>
<td>Lack of communication with the supplier of technology</td>
<td>1.58</td>
<td>1.69</td>
<td>40</td>
</tr>
<tr>
<td>Lack of trust and goodwill with the supplier of technology</td>
<td>1.18</td>
<td>.64</td>
<td>40</td>
</tr>
<tr>
<td>Lack of support (technical) from the supplier of technology</td>
<td>2.33</td>
<td>2.49</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 4
Government related factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government intervention and regulations</td>
<td>1.25</td>
<td>1.58</td>
<td>40</td>
</tr>
<tr>
<td>Taxation effect</td>
<td>1.08</td>
<td>0.47</td>
<td>40</td>
</tr>
<tr>
<td>The transmission channels</td>
<td>1.28</td>
<td>1.58</td>
<td>40</td>
</tr>
<tr>
<td>Lack of appropriate legislation</td>
<td>1.00</td>
<td>0.00</td>
<td>40</td>
</tr>
<tr>
<td>Frequent changes in current policies and commercial laws</td>
<td>1.00</td>
<td>0.00</td>
<td>40</td>
</tr>
</tbody>
</table>

tical support by the supplier difficult. The results in Table 4 show that government related factors had no significant negative influence on the transfer of technology.

4.2. Infrastructure preparation

The performance of companies using AMT depends to a large extent on how well they implement it. Weill et al. (1991) stated that “changes in organisational structures and practices as well as worker skills and knowledge are needed for successful implementation of AMT”.

The adequacy of a sound supporting infrastructure is characterised as one of the most important factors to be considered in implementing AMT into the companies. Table 5 shows the level of improvements in the infrastructure performed by the companies both before and after AMT introduction. The results reveal that there were only small improvements in the manufacturing activities (operational, inspection, transport and storage) of the companies prior to the introduction of AMT. There were, however, more significant improvements in the manufacturing activities after the installation and actual productive operation of the technologies. These post installation improvements were deemed necessary for the efficient utilisation of the technologies.
The levels of modification performed on the companies’ policies and procedures are illustrated in Table 6. Again, the modifications performed prior to the installation of the technologies were very small. More significant modifications were performed after installation, particularly in procedures covering design, quality control, scheduling and testing. Only very minor changes were implemented in procedures related to wages and salary systems and purchasing practices.

Changes in work organisation procedures are shown in Table 7. The results indicate that modifications performed before the implementation of the new technologies were non-significant with a small exemption being changes in the plant layout. In many cases changes in the layout to accommodate the new plant were unavoidable. More significant changes were carried out after the implementation and productive operation of the technologies. The most pronounced were changes in the manufacturing philosophy and decision structure of the companies and in the planning and the setting of targets. There was also a move towards closer collaboration between the various departments in order to support the implementation of the new technologies.

### 4.3. Human resource policies

There is no doubt that human resource is the greatest asset for any organisation, without which the development and use of the technology will not happen. Table 8 shows the level of workforce preparation that took place in the various companies both before and after the
The results indicate that in the majority of cases there was only a minor involvement of the workforce in the decision to introduce AMT. However, the information given to the employees about the plans for AMT introduction and the reasons behind these investments was found to be at a reasonable level both before and after the productive operation of the technologies. Employees were informed about the anticipated impact that AMT would have on job security, working conditions, promotion opportunities etc.

In almost every case, there was a person appointed as the project champion to promote and oversee the project implementation process. This task was, however, carried out without the formulation of representative cross-functional implementation teams (i.e. teams formulated with personnel from all the company departments). A reason for this might be the small size of the manufacturing firms and the rather small scale at which new technologies were introduced.

Interestingly, the questionnaire also revealed that the workforce did not appear to show significant reservations or fear with regards to the introduction of new technologies. In certain cases the workforce expressed some fear of redundancy or job loss but these worries disappeared after the actual productive operation of AMT. Most concerns were raised by specialists who felt that they would be displaced by newcomers trained in the latest technologies and attempted to minimise the threat to their skills and employment by trying to prove that the new technology was not needed. Even in these cases, however, the reservations disappeared after the introduction of AMT which proved to have no negative implications on the working conditions. It was also found that the unions presented no problems to the introduction of AMT and the employers did not view the unions as being anti-technology. These findings correlate well with the results of a survey performed by Zairi (1992) on consultancy companies which were involved in the implementation of AMT projects.

The questionnaire also revealed that in the majority of cases existing personnel was utilised to operate the new technologies (Efstathiades et al., 1999). Recruitment of newly appointed personnel was done in only very few cases where the availability of personnel with the necessary skills was limited. It was also found that the operators had a tendency to regard themselves as being more skilled as a result of using the new advanced technologies.

4.4. Training provision for the operators

Analysis of the results indicated that even though operators did not initially have the necessary skills to operate the new technology, in the majority of cases they were able to acquire the required skills through adequate training after the introduction of the technology.

Table 9 shows the type of training provided for the operators (users) of the different types of technologies. It can be seen that most of the training provided was delivered by specialists from the equipment suppliers. In the majority of cases this training was provided within the manufacturing environment after the installation of the technology. In some cases engineers and operators were also sent abroad to receive the training. An exception to the above was CAD training, where in all cases it was provided either by organising in-house training courses with experts from Cyprus or by sending the operators to open courses organised by various institutions in Cyprus.

Table 10 shows that the level of support given to the companies by the suppliers of AMT was quite high. The highest support was found to be needed in cases where CAD/CAM technologies were introduced and, as expected, the lower support was needed where only CAD was introduced. In the case of CAD/CAM continuous support was needed, even after the productive operation of the technologies mainly for software modifications and upgrading.

During the process of AMT implementation it is very important to proceed with ongoing adjustments,
### Table 9
Type and level of satisfaction with the training provided

<table>
<thead>
<tr>
<th>Variable</th>
<th>No of companies</th>
<th>CAD</th>
<th>CNC</th>
<th>CAD/CAM</th>
<th>Robotics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(before AMT install.)</td>
<td>(after AMT install.)</td>
<td>(before AMT install.)</td>
<td>(after AMT install.)</td>
<td>(before AMT install.)</td>
</tr>
<tr>
<td>Training abroad</td>
<td>13</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>In-house training with experts from abroad</td>
<td>3</td>
<td>29</td>
<td>0</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>In-house training with experts from Cyprus</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Private institutions in Cyprus</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 10
Supplier support

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>CAD</th>
<th>CNC</th>
<th>CAD/CAM</th>
<th>Robotics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(before AMT install.)</td>
<td>(after AMT install.)</td>
<td>(before AMT install.)</td>
<td>(after AMT install.)</td>
<td>(before AMT install.)</td>
</tr>
<tr>
<td>Support given by the equipment manufacturer</td>
<td>7.29</td>
<td>7.58</td>
<td>6.22</td>
<td>6.20</td>
<td>7.14</td>
</tr>
<tr>
<td>Dependency on the supplier for AMT operation, software system modifications or upgrading</td>
<td>4.60</td>
<td>7.23</td>
<td>3.67</td>
<td>5.40</td>
<td>3.88</td>
</tr>
</tbody>
</table>
Table 11
Ongoing adjustments on AMT implementation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>CAD</th>
<th>CNC</th>
<th>CAD/CAM</th>
<th>Robotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and budgeting to realise the benefits</td>
<td>6.93</td>
<td>6.40</td>
<td>6.53</td>
<td>8.38</td>
<td>6.50</td>
</tr>
<tr>
<td>Periodic evaluation of achievements relative to interim targets</td>
<td>7.07</td>
<td>6.80</td>
<td>6.82</td>
<td>7.88</td>
<td>6.75</td>
</tr>
<tr>
<td>Identification of the nature and extent of shortfalls and the reasons for them as the basis for considering proposed remedial efforts</td>
<td>7.23</td>
<td>7.00</td>
<td>6.88</td>
<td>8.13</td>
<td>7.00</td>
</tr>
<tr>
<td>Analysis to cover shortcomings, not only on the performance of AMT but also in the effectiveness of supporting procurement, marketing and other managerial efforts</td>
<td>6.74</td>
<td>6.44</td>
<td>6.63</td>
<td>8.00</td>
<td>5.67</td>
</tr>
</tbody>
</table>

measurements and control in order to optimise and realise the full benefits from the technologies. Table 11 shows the level of implementation of these adjustments by the Cypriot manufacturers during the process of introduction of advanced manufacturing technologies in their organisations.

The level of planning and budgeting performed in order to realise the full benefits from the acquisition of the technologies was found to be at satisfactory levels. Closer attention was placed on the identification of shortfalls during the process of AMT implementation and the examination of the reasons behind them, in order to propose remedial efforts.

In general it was found that the Cypriot manufacturer tried to perform, to the best of his knowledge and skills, all the necessary improvements so as to realise the benefits from the introduction of advanced technologies. Specifically it was found that the greatest effort was made in the introduction and operation of CAD/CAM technologies which obviously were the most complicated and expensive technologies.

5. Conclusions

This paper has focused on the processes involved in the introduction of advanced manufacturing technologies in developing countries, using the Cypriot manufacturing industry as a case study to test the applicability of the general theories developed over recent years.

It was found that the Cypriot manufacturers who invested in AMT were well informed about competing technologies and their suppliers. Nearly all the manufacturers proceeded with the adoption of the technology that was considered to be more applicable to their manufacturing needs and avoided foreclosing options at the selection stages due to budgetary or other constraints. It was also found, as is the established view about strengthening the buyer’s power, that Cypriot manufacturers avoided any form of financing from the suppliers. Against the established view, however, they also avoided using group buying or breaking the technological package. This can be mainly attributed to the rather small and very competitive internal market and the lack of expertise to help the manufacturers source and put together parts of a particular form of technology from different suppliers.

It was found that, in general, very little preparation and only minor modifications to the companies’ infrastructure and policies took place prior to the introduction of the new technologies. However, substantial changes were performed on these activities after the installation and actual productive operation of the technologies to ensure maximum productive utilisation.

Interestingly the workforce did not appear to show considerable reservations or fear with regards to new technologies. The expressed fear of redundancy or job loss was small and it became even lower after the actual productive operation of AMT. It was also found that although training prior to the introduction of the technology was minimal, adequate training was provided after the installation of the technology. In the majority of cases existing personnel were in a position to productively use the technologies after receiving adequate training.

The area where the Cypriot manufacturer was found to lack compared to his western counterparts is in the involvement of the workers in the selection of AMT, and giving appropriate attention to supportive human resource practices. Irrespective of these deficiencies, however, the results indicated that in the majority of cases AMT implementation proved to be quite successful.

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