

**TRANSFERRING AND ADOPTION OF TECHNOLOGY TO ACADEMIC
ORGANIZATIONS: CASE STUDY OF KADIR HAS UNIVERSITY**

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Abstract

To be successful and competitive in the globalizing and rapidly changing world, most organizations are under pressure to effectively either develop or transfer technology. Technology transfer is a managed process of conveying a technology from a point of origin to its potential users. Transferring technology from universities to private sectors results in economic development and welfare improvement of the issued country. But, for a sustainable development, the universities should also transfer the available technology until they can be enough sufficient to develop it internally. Especially, new-established universities like the foundation those recently established in Turkey need to transfer the technology in order to become a potential technology developer as being other old and long-established ones. Therefore, this paper represents a case study of how to transfer and adopt the technology from a private sector to Kadir Has University, as a newly established private university, which should be rational on investment decisions. This study is a work of technology strategy development through positioning-based approach, and includes three sections as follows: in the first part, a SWOT analysis, the issues of technology scanning are presented, in the second part, the selection of technology transfer method is included, in the final part, the criterion are determined to have a successful technology transfer process.

Key words: Technology strategy development, positioning-based approach, technology transfer, SWOT analysis

1. INTRODUCTION

To be successful and competitive in the globalizing and rapidly changing world, most organizations are under pressure to effectively either develop or transfer technology. Technology transfer is a managed process of conveying a technology from a point of origin to its potential users. Transferring technology from universities to private sectors results in economic development and welfare improvement of the issued country. But, for a sustainable development, the universities should also transfer the available technology until they can be enough sufficient to develop it internally. Especially, new-established universities like the foundation those recently established in Turkey need to transfer the technology in order to become a potential technology developer as being other old and long-established ones.

In Turkey, there are 111 universities educating 2.242.995 student: 67 government, 30 foundation, 1 foundation vocational school, 5 military, 1 police academy, 5 in Turkish Republic of Northern Cyprus and 2 special status government schools [1]. To establish a university, there are rules made by a government agency called YOK. Since 1992, foundations have a chance to establish university. Kadir Has University (KHU) is one of the foundation universities and was founded in 1997, in Istanbul [2]. The mission of KHU is to educate bright individuals in international relations, technology, and culture. The school hopes to turn out students who have consciously assimilated Ataturk's principles and reforms and who have thus become better citizens. They will use the knowledge and experience that

they have attained for the welfare of the country, nation and humanity. The university is composed of three campuses. The main campus is in the Cibali (Halic or Golden Horn) area. The English preparatory school and vocational schools are located at the Bahcelievler and Selimpasa campuses, respectively. The faculties and departments of the university are as follows:

- ✓ Faculty of Engineering offering BS degrees in Computer Engineering, Electronics Engineering and Industrial Engineering
- ✓ Faculty of Economics and Administrative Sciences offering BA degrees in Economics, Business Administration, International Relations, International Finance and Tourism Management
- ✓ Faculty of Arts and Sciences offering BA degrees in American Literature and Culture and the BS degree in Statistics and Computer Sciences
- ✓ Faculty of Communication offering BA degrees in Communication Design, Advertisement, Television and Cinema, Public Relations
- ✓ Faculty of Law offering the BA degree in Law
- ✓ Faculty of Fine Arts offering BA degrees in Industrial Design, Interior Design and Graphic Design
- ✓ Vocational Schools offering a pre-BA degree in Social Sciences and a pre-BS degree in Technical Sciences and Health Services
- ✓ Graduate Schools offering the MA degree in Social Sciences and MS degrees in Technical Sciences and Health Sciences

In order to be successful, a university should have some features like the quality and the quantity of teachers, laboratories, library, relationships with national or international universities and social medium.

In KHU, the number of teachers including from research assistant to professors is 205. On the other hand, KHU outsources professors, assistant professors and adjunct professors in the number of 105.

The Computer Technologies Center supports IT use for all members of the University. A total of 700 computers are in use by staff, all Internet connected. KHU has eight computer laboratories (two of them are Sun-Ray 1 Thin-client based) at the Cibali campus, two laboratories at Bahcelievler campus, and four laboratories at the Selimpasa campus. All laboratories are equipped with multimedia technology. All students at KHU receive their own internet access accounts for computers located in the laboratories and the entire KHU information system. Departments also have their special labs like chemistry, software, control, physics etc.

KHU library supplements its traditional services with several technological innovations like dedicated computers and up to date databases. It serves 225 users in over 1000 squares of meters of space in Cibali campus. Its collection consists of nearly 50000 published materials, over 1000 DVDs, 500 video tapes, 30 000 electronic books, and 13 online databases including more than 12 000 electronic journals.

KHU is a partner of ERASMUS program and has exchange or dual degree programs with USA universities. The USA universities are Wayne State College, Southern New Hampshire University, Virginia State University, Purdue University, Fordham University, Montana State University and Ball State University.

University student clubs help students to develop themselves, encouraging them to fill their spare time efficiently, to extend their knowledge and creativity. There are 38 clubs to total 3694 students. Clubs organize activities such as panels, conferences, forums organized with the participation of important scholars, businessmen, experts. On the other hand, KHU with 17 sport branches participating in

official university leagues takes it very seriously to get its students improve themselves in sports in addition to their education.

When KHU is compared other universities in Turkey, it is seen that the number of the students in KHU is %0.16 of the total number [1]. In the rank of universities according to the number of publications per faculty member in SCI+ SSCI+ AHCI journals in 2006, the whole universities in Turkey has a ratio of 0,52 and KHU is 64th with 0,23 ratio.

This study is a work of technology strategy development in KHU. For technology strategy development there are 2 approaches: resource based approach and positioning based approach. Resource based approach assumes that the organization has its own competences and should make its competitive strategies based on the competences. It suggests that organizations compete and create value on the basis of resources that are unique, rare, valuable, and not easily imitable or substitutable [3, 4, 5]. Competencies develop when such resources are combined to create specific organizational abilities [6]. On the other hand positioning based approach is about where in the competitive environment, firm wants to see itself. Porter's generic strategies and strategy development phases are included in the approach [7].

As a new established university, KHU has no competences and wants to make technology investment in order to gain some tangible and intangible competences like choosing the right technology, applying that technology into its training process and to develop new technologies [8]. In the study, positioning-based approach is used.

2. POSITIONING BASED APPROACH METHOD:

In order to develop a technology strategy, firm should evaluate its environment, both internal and external. After taking the whole picture of the market, it should choose a strategy that will fulfill the hole of the market place and firm internal structure; and a technology to perform the strategy. The chosen technology can be get or develop inside the technology or outside.

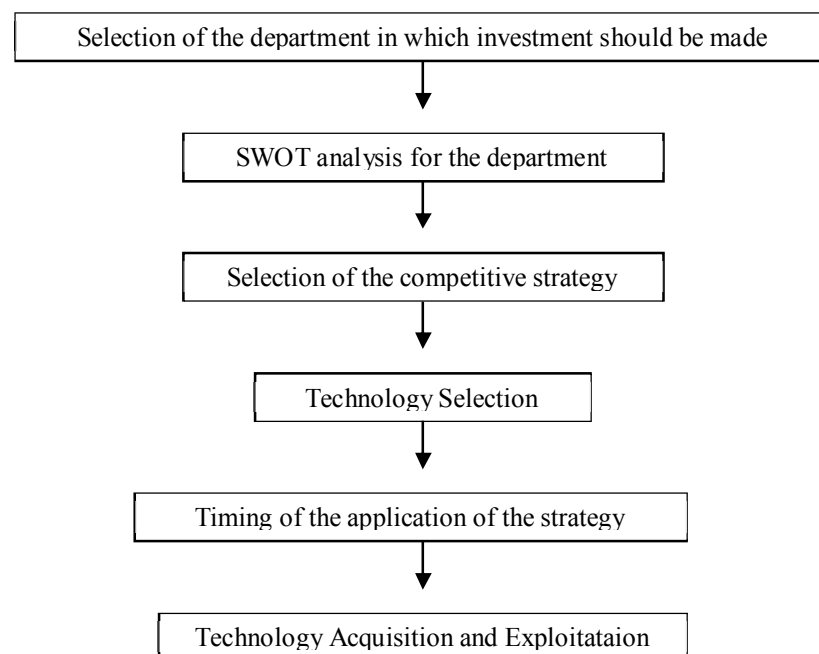


Figure1. Positioning based approach phases

2.1. Selection of Department

In order to determine to which department investment should be made Porter's 5 forces evaluation method is used [7].

2.1.1. Threats from Potential Entrants

To establish a university there are too many barriers in Turkey made by YOK the government agency. Capital requirement is so high. But established universities reserve only several rooms for their new faculty members because they've already provided necessary infrastructure such as laboratories. An enormous demand for university education has caused such an increase in the number of departments. Especially private universities start education in a specific department by recruiting several successful and experienced faculty members and the members necessary for other lectures are provided by recruiting part time faculty staff from state universities. They assure their need for research assistants again from the pool of doctorate and master students in state universities. Building departments in such a way is especially observed in departments such as industrial engineering and management which do not require too much investment on instrument and laboratory materials and are demanded highly by students.

2.1.2. Threat of Substitutes

Recently, many enterprises providing courses on management, industrial engineering and software, started in market. So the idea that people who do not get university education are not able to specialize and find a job is not valid anymore. People are able to specialize in certain areas in shorter time and with fewer prices by the help of courses provided by enterprises like Bilge Adam. Also increase in national income and easier access to abroad increase the potential number of foundation universities in our country. State universities are still a strong alternative because they provide cheaper education, more stable establishment and have a much longer history.

2.1.3. Students Bargaining Power

The increased number of specialized courses and universities gives successful students the chance to bargain more strongly. All universities try establish legitimacy and to increase the quality of their education by offering scholarships to successful students. Especially private universities offer high scholarships. Another method to recruit successful students is to advertise connections with universities at abroad. Students, who have economical competency and have education in private universities without scholarship, are able to go abroad because the prices are almost same in foreign countries. The thought that US is advanced in management and industrial engineering, forces universities to make education in American style and make cooperation with US. Especially, 95% of math based students who participate in university presentations prefer industrial engineering.

2.1.4. Supplier Bargaining Power

Students, faculty members, business people and companies selling instruments can be considered as suppliers of universities. Demands of students are on in industrial engineering. Business people prefer more multi disciplinary education. The idea that engineering education is not enough by itself increases the demand for master and double major programs. Industrial engineering and management are most preferred areas in double major because they increase the chance to be a manager. System approach has caused an increase in demand for sonar industrial engineering. It's hard to find academics that are well educated and have a bright career. Especially in Turkey, the number is low. It's possible to observe transfers from state universities to private universities. The one who stay in state universities are satisfied with the student quality and infrastructure of state universities. Private universities generally recruit faculty members as part time staff. The cost of faculty members is high for universities because the number of qualified ones is low.

2.1.5. Competition among Universities

Industrial departments are built in all universities because of the demand from both students and industry. In these departments, business people can take courses in addition to students. Generally universities with established infrastructure, increase their rankings by advertisement and success stories. Not only students, but companies also prefer these universities as consultants. The amount of income from state depends on the student quality; this is another reason why scholarships are so high.

2.1.6. Evaluation Results

Continuous increase of demand to universities and industrial engineering to be a department to be preferred among students, low cost of infrastructure to build the department, demand by not only students but also companies for industrial engineering, increase of need for educated people in industrial engineering in industry, make industrial engineering one of the most preferred as a department to invest in. KHU must be one of the leading among its competitors and must educate its students adapted to recent advancements and requirements.

2.2. SWOT Analysis

In order to be a world class department in the university, industrial engineering department should make environment analysis to complete inefficiencies. The best method enabling the analysis of the environment and the organization itself is SWOT analysis. It is used for several reasons:

- ✓ Developing strategies
- ✓ Understanding relationship between internal and external issues
- ✓ Evaluate strategies

Determination strength and weakness includes determination of the main value added activities, determination of the requirements of customers, determination of the resources for each requirement, determination of competitors, evaluation of the rareness of each resource, and evaluation of the imitated possibility of each resource. Universities resources can be classified into three categories of physical capital, human resource and organizational resource:

- ✓ Capital is high.
- ✓ In faculty of engineering there are three departments; industrial, computer and electronic working together. So investment should be a kind of that all of them benefit from.
- ✓ There is no hierarchy in the faculty. Communication and decision taking speed are high.
- ✓ Campus is in the center of Istanbul.
- ✓ Lecturers who took education abroad are chosen.
- ✓ Because income level of students is high, they can get what is required easily.
- ✓ The faculty building is small, so small.
- ✓ Full time lecturers are only in number of 2; other required ones are supplied from other state universities.
- ✓ Nearly every university in Turkey has industrial engineering department. Competitors number of KHU Industrial Engineering department in Istanbul is 18 and only 6 of them are state universities [1]. On the other hand there are big and successful universities in other cities of Turkey like Ankara, Izmir.
- ✓ Competitors' industrial engineering departments have their specific hardware and software fixture.
- ✓ Students successful in the exam of OSS (student selection exam) do not prefer KHU.

- ✓ Because of its founder Kadir Has, KHU has an image of conservative and the image make KHU preferred by the families living in Anatolia.
- ✓ In the rank of industrial engineering departments according to the number of publications per department member in SCI+ SSCI+ AHCI journals in 2006, KHU is 2nd with 2,5 ratio.
- ✓ KHU industrial engineering department does not have a plant for manufacturing techniques like lathe, cutter etc.

In order to determine OT (opportunities and threats) PEST analysis is made which is abbreviation of political, economical, social and technical environment:

- ✓ Population and economic welfare increases and people give weight to their education much more than past.
- ✓ If the department wants to be a developer in the future, it should take care of current technologies forming basis for next generation technologies.
- ✓ Industry needs employees informed in ERP and statistics.
- ✓ Expectations of students from universities about practice education increase.
- ✓ Legislations are enacted about working conditions; so ergonomics should be understood not only by industrial engineers, but also every employee.
- ✓ Today to see and understand an industry with its suppliers and agencies is a necessity. So there should be simulation software packets for the integrity.
- ✓ Number of corporations other than universities giving education about CAD and ERP increases.
- ✓ YOK can impose restrictions and requirements for departments' education fixture.
- ✓ Visual education makes students learn better.

2.3. Selection of Competitive Strategy

Porter has argued that a firm's strengths ultimately fall into one of two headings: cost advantage and differentiation [7]. By applying these strengths in either a broad or narrow scope, three generic strategies result: cost leadership, differentiation, and focus. Cost leadership generic strategy calls for being the low cost producer in an industry for a given level of quality. A differentiation strategy calls for the development of a product or service that offers unique attributes that are valued by customers and that customers perceive to be better than or different from the products of the competition. The focus strategy concentrates on a narrow segment and within that segment attempts to achieve either a cost advantage or differentiation. The premise is that the needs of the group can be better serviced by focusing entirely on it. A firm using a focus strategy often enjoys a high degree of customer loyalty, and this entrenched loyalty discourages other firms from competing directly.

The competitive strategy of KHU is both differentiation and cost leadership. By investing to the software and hardware which competitors have, cost leadership is aimed. By investing the software and hardware which competitors do not have and which are used in the industry, differentiation is aimed.

2.4. Technology Selection

All of the reasons listed above, university has decided to set up a laboratory special to industrial engineering department including ergonomics, CIM, ERP, optimization, simulation and statistics, and DVD about lectures.

ERP software is seen as the survivor of firms. Employee demand informed of ERP increases, so the number of corporations giving ERP education like Bilge Adam does. Research in the ERP Laboratory

addresses both basic and applied research issues, including supply chain management, enterprise resource planning and optimization, production logistics, manufacturing systems modeling, business process reengineering, and manufacturing information systems. For business world ERP is in its key level on S curve of commitment and performance. In Istanbul because of the number of foundation universities is bigger than state ones, ERP implementation is higher than whole Turkey.

Computer-integrated manufacturing (CIM) is a method of manufacturing in which the entire production process is controlled by computer. Typically, it relies on closed-loop control processes, based on real-time input from sensors. It is also known as flexible design and manufacturing. The mission of the universities having CIM is to provide a facility where students and researchers can study manufacturing systems and develop tools for better decision-making throughout the product realization process, and to provide a place where students and researchers can discuss research, present research results, and demonstrate software.

To have an optimized decision, if the cost of wrong decision is high, the alternative solutions are simulated. Computer simulation has become a useful part of modeling many natural systems in physics, chemistry and biology, and human systems in economics and social science as well as in engineering to gain insight into the operation of those systems. Key issues in simulation include acquisition of valid source information about the referent, selection of key characteristics and behaviors, the use of simplifying approximations and assumptions within the simulation, and fidelity and validity of the simulation outcomes; in other words statistics knowledge. Nearly all of the universities are aware of the importance of simulation and optimization.

Ergonomics definition adopted by the International Ergonomics Association is the application of scientific information concerning objects, systems and environment for human use. Ergonomics is commonly thought of as how companies design tasks and work areas to maximize the efficiency and quality of their employees' work. Using special ergonomics software is new to both universities and business world.

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. A significant thrust in RFID use is in enterprise supply chain management, improving the efficiency of inventory tracking and management. However because it is a new technology, in business world its commitment and usage performance is low.

2.5. Timing of Application of the Strategy

KHU should apply its strategy about industrial engineering laboratory as soon as possible by thinking of learning curve effect and the impact of the laboratory to other engineering department education curriculum.

2.6. Technology Acquisition

Technology acquisition phases are scanning of technology and selection of technology transfer method.

2.6.1. Technology Scanning

Technology scanning areas are current& new technologies, competitors, common technologies and potential applications. Information can be found from two basic sources: "open to public" channels and "organizational" channels. Open to public channels are general channels like internet, newspaper and industrial channels like scientific publications, books, databases etc. Especially by using internet it is possible to reach every university's industrial engineering departments in the world. Organizational channels are internal reports. Firstly, competitors in Istanbul and Turkey are analyzed and their laboratory specifications are listed in Appendix A. There are 44 universities having industrial engineering department and 7 universities are on their establishment phase. 19 universities having the

department locate in Istanbul and 63% of them are foundation universities. The second data resource is business world in order to understand which software is used and which can be used.

21 % of universities in Istanbul and only 23% of universities in Turkey have ERP laboratory: 40% SAP, % 40 IAS and %20 Oracle. But the problem is not nor can foundation or state use ERP efficiently. SAP is the most favorite ERP software in the business world and universities in Turkey. Although it has IAS/ CANIAS ERP package, KHU decided on SAP in order to reposition.

But because of its huge cost most of the universities do not have a manufacturing laboratory. In Turkey some of the universities like Istanbul Technical University have their own machine tool plant; and give their student a summer internship program. Some of the universities have CNC machines to be used in their manufacturing courses. But only 31% of universities in Istanbul and 39% of universities in Turkey have manufacturing laboratory. %83 of the universities in Istanbul has special CIM sets offering alternatives that software and hardware can be bought separately, made by COSIMIR or Intelitekt. At first hand, KHU decided to buy only software because of financial issues.

89% of universities in Istanbul and 82% of universities in Turkey have simulation and optimization laboratory. KHU has decided to buy some of the software that it does not have.

Only 43% of universities has ergonomics laboratory and 21% has software. But KHU not nor has hardware or software, and firstly it decided to buy some hardware that can be used in work study.

Universities have just realized RFID's opportunities and the necessity education of it. RFID is seen as an electronic engineering issue in Turkey and only 5% of universities industrial engineering department have it. Because KHU is in short supply of lecturer number and financial, it decided not to have RFID laboratory.

The technologies chosen for KHU laboratory is listed in Appendix B.

2.6.2. Selection of Technology Transfer Method

As a new founded university it is impossible for KHAS to improve any of the selected technologies internally, so it has to transfer them. The investment's economic and physical nature [9] and, familiarity to the technology and market determine the transfer method. Current tools, human resource, capital resource and management support are some of the factors. In the majority of cases, technology is transferred not through formal search, but through some prior relationships among individuals [10].

From the list of technology transfer methods including joint venture, venture capital, internal venture, training agreement, licensing, company acquisition, research consortia, innovation network, external R&D; 3 of them are suitable for KHU:

- ✓ Licensing and Training Agreement
- ✓ Joint venture

A software license agreement is a memorandum of contract between a producer and a user of computer software which grants the user a software license. Most often, a software license agreement indicates the terms under which an end-user may utilize the licensed software, in which case the agreement is called an end-user license agreement. But licensing is not a whole solution because of short supply of is human resource. So KHU should make training agreement with the firms that software is licensed and with experienced teachers from other universities. The reason why teachers' selection is called as technology transfer is because technology transfer includes information transfer too.

The other method is joint venture. A joint venture is an entity formed between two or more parties to undertake economic activity together. The parties agree to create a new entity by both contributing equity, and they then share in the revenues, expenses, and control of the enterprise. New founded universities try to establish their infrastructure with a high capital cost, and generally they have to wait

for years in order to implement their plans. On the other hand none of the universities use their infrastructure in 100% capacity. In order to use laboratory facility effectively and efficiently, KHU can make a joint venture with other universities not having laboratory. But this choice brings some problems along with itself like where to built laboratory, how to chose the university, how to make the laboratory in use of students, etc.

3. SUCCESS CRITERIA

Technology transfer should give know-how and know-why. It involves cooperation and communication between actors [10]. So the differences of situation, organization, society and culture should be eliminated [11]. To win the sufficiency in technology, technological, physical try and human resource is needed [12]. Characteristics of technology, transfer level and extent, modification, management experience, resource level and time management are other factors affecting the success of the transfer [13].

The first criterion for KHU's success depends on is human resource sufficiency. There should be 2 groups of people. First group is lecturers. The course curriculum should incline towards usage of the laboratory. There should be course projects and homework that make students really learn how to use software. The second group should be concentrated to use the software in university multidisciplinary and university- industry joint projects. The group should include students, research assistants and lecturers. The other problem is physical laboratory situation. As mentioned before in SWOT analysis, KHU building is small and it will be a problem for laboratory to have sufficient area.

4. CONCLUSION

Technology transfer is a managed process of conveying a technology from a point of origin to its potential users. For a sustainable development, the universities should transfer the available technology until they can be enough sufficient to develop it internally. KHU a new established private university developed a technology strategy via positioning based approach. It decided to have an industrial engineering laboratory including CIM, ergonomics, ERP, simulation and optimization laboratories. To be successful in technology transfer process, the transfer method should be selected according to characteristics of technology, transfer level and extent, modification, management experience and resource level. There are 3 methods can be selected: licensing, training agreement and joint venture. But for the university the biggest barrier for its success is human resource and physical area insufficiency an. It can surmount difficulties by support of management.

6. APPENDIX A

University Name	Manufacturing facility	Simulation& Optimization	Ergonomics	ERP	RFID	Lecturer Number
Anadolu		•	•	SAP		20
Balıkesir		•				5
Boğaziçi	•	•	•			17
Çukurova		•	•	Oracle		8
Dokuz Eylül				IAS		13
Dumlupınar		•	•			4
Erciyes	•	•	•			
Eskişehir Osmangazi		•	•			12
Galatasaray	•	•				
Gazi	•	•	•			18
Gaziantep	•	•	•			6
Hacettepe		•				6
İstanbul		•				3
İstanbul Teknik	•	•	•		•	21
Kırıkkale	•	•	•			4
Kocaeli		•	•	SAP		10
Marmara		•				15
Ondokuz Mayıs						
Orta Doğu Teknik	•	•	•			20
Pamukkale						3
Sakarya				IAS		20
Selçuk		•				10
Süleyman Demirel						2
Uludağ	•	•	•			8
Yıldız Teknik		•		SAP		11
Atılım	•	•	•			8
Bahçeşehir	•	•				3
Başkent	•	•				10

Bilkent	•	•	•			22
Çankaya	•	•				9
Doğuş		•				10
Haliç		•				2
Fatih	•	•	•			11
Işık		•				5
İstanbul Kültür		•		IAS		8
İstanbul Ticaret		•				3
Kadir Has		•		IAS		3
Koç		•				7
Maltepe						4
Okan						1
Sabancı	•	•	•	Oracle		11
Tobb						7
Yaşar	•	•	•	SAP	•	
Hava Harp Okulu		•	•			9

7. APPENDIX B

KHU laboratory specifications

CIM	Ergonomics	ERP
FESTO “Digital Factory in iCIM” COSIMIR Factory	Accustudy 3.3 Testo 506 manometer Oregon Scientific SL888 Chronometer Thermometer Photometer Extech 407113 CFM wind meter Bicycle Ergonomics Lifecycle	IAS CANIAS ERP SAP R/3

Simulation, Optimization & Statistics	DVD Material
ARENA	Basic Hole making
Catia V	Basics of Grinding
CPLEX	Computer Numerical Control
Crystal Ball 2000.5	Ergonomic Safety
Expert Choice	Five S Factory Makeover
Expert Fit Professional	Flexible Material Handling
GAMS 22.3	Flexible Small Lot Production for JIT
LGO	Fundamental Manufacturing Processes Sampler
Lindo/ Lingo	Geometric Tolerance Program Sample
Matlab VI A	Introduction to Lean Manufacturing
MPL	Kanban Systems
Premium Solver	Metal forming Simulation
Promodel	Milling & Machining Center Basics
Quality Companion 2 by Minitab	Six Sigma
SPSS	Supply Chain Management
MS Project 2003	Toast Kaizen
C ++	Turning and Lathe Basics
	Work Measurement

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