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A Survey of Flexible Manufacturing Systems Implementations

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U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

ABSTRACT

This report presents descriptive data on three hundred manufacturing facilities that are using computer integrated manufacturing (CIM) techniques to machine component parts for commercial, industrial, and military products. Of these, 258 were categorized as Flexible Manufacturing Systems (FMS). Key descriptive statistics were gathered for each system. The data is organized into records by the user's country, company, and geographic location. Each record is made up of 24 fields that describe the facility, the product, and the operating parameters, as well as providing a reference to the source(s) of information. In many instances the information has proven to be sparse. Nevertheless, taken in aggregate, a picture of the state of the art for FMS has emerged from the study. This picture is reflected in the graphical summaries of the data, which are presented by region for Eastern Europe, Western Europe, Japan, and the United States. An analysis of trends in FMS implementation, product and material characteristics, and materials handling technology is made for each the above regions.

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ACKNOWLEDGEMENTS

It is most appropriate to acknowledge the National Bureau of Standards (NBS), whose policies foster joint research projects with U.S. colleges and universities. In particular I would like to acknowledge Dennis Swyt, who was most helpful in securing an NBS appointment for the writer as a Guest Worker. Of equal importance was the contribution of the personnel in the Factory Automation Systems Division, especially Howard Bloom, Albert Jones, and Charles McLean, who were instrumental in establishing the project goals, and who have continued to offer encouragement throughout the life of the project.

Early on in the project contact was made with Thomas Gallogly and John Mearman of the Department of Commerce (DOC), Office of Capital Goods and International Construction Sector Group, in the International Trade Administration (ITA). The International Trade Administration had just completed the first draft of "A Competitive Assessment of the U.S. Flexible Manufacturing Systems Industry," (the ITA report) which has since been publisned. The ITA report had many of the same objectives as the present study. The Office of Capital Goods personnel cooperated fully with the author in preparing this report, including sharing a number of their source documents. There is no question that their support greatly strengthened the study at hand, and that the ITA report provided the most comprehensive study of FMS implementations published to date.

George Hutchinson at the University of Wisconsin-Milwaukee, who has done extensive research on Eastern European manufacturing technology, was kind enough to provide a number of his publications. His work has proven to be the single most valuable source of information available on manufacturing technology in the Eastern Block countries.

ACKNOWLEDGEMENTS (CONT'D)

Towson State University's Department of Business Administration provided moral support, and absorbed the mileage costs incurred in traveling between the university and both NBS and the DOC. These costs were substantial, and their contribution greatly appreciated. Charles Mott, the Department Chair, is recognized in particular for promoting research among the business faculty. The Faculty Research Committee, at Towson State, provided funding for the purchase of reference materials, which is gratefully acknowledged.

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INTRODUCTION

The introduction briefly summarizes the background, objectives, and benefits of this project. This is followed by a discussion of the methodology used to carry out the project. The scope, and limitations of this project are given, along with a working definition of FMS. This section also includes a comparison and contrast between this report and a related report produced by DOC/ITA.

Background

This research was done while the author was affiliated with the NBS as a Guest Worker. The work was first suggested by Howard Bloom, Charles McClean, and Albert Jones of the Factory Automation Systems Division of the National Bureau of Standards (NBS). The Factory Automation Systems Division is responsible for the continuing development of elements of a hierarchical control system for the bureau's Automated Manufacturing Research Facility (AMRF). The personnel working on the AMRF project have consistently maintained close communication with both industry and the academic community, and thus were very much aware of what was going on in FMS technology. However, they had never formally undertaken an international survey. These interests were consistent with the author's own interests in manufacturing research, and inspired the project at hand.

Objective

The objective of this research was to survey the existing literature on FMS implementations and develop a data base to assess the state of the art in flexible manufacturing systems. Included in this objective was the development of data for each system implementation that described the facility, the products, and the operating parameters.

Benefits

There are four main benefits expected to result from this work:

1. Providing a data base for further study of FMS implementations
2. Identifying broad FMS technological trends in terms of:
   a) Design and implementation
   b) Product characteristics
   c) Materials handling systems
3. Providing additional data to assess the state of the art for FMS from an international perspective
4. Providing a bibliography on FMS implementations

Methodology

Appendix D of this report lists a data base of 300 records that was put together based upon the results of a literature survey. The data provides descriptive information on FMS system design in terms of the machine tools used, tool management, and the materials handling technology. Both the computer and control systems used are identified. In addition systems

capabilities such as real time scheduling, the use of alternate operations, automated inspection, and the use of adaptive control are noted. Product data is collected in terms of the part geometry, part cube, the material used to fabricate the part, production rates, and the part's product application. Management practices in terms of lot sizing, labor and machine scheduling, and financial justification are also included. All data is tied to the year of system implementation, thus providing the raw data for trend analysis.

A subset of the data base, consisting of 253 records which were classified as FMS, was used to develop a set of 26 graphs. The graphs were used to analyze broad FMS technological trends in terms of design and implementation, product characteristics, and materials handling systems.

An international perspective was provided for by partitioning the FMS data into four parts representing Eastern Europe, Western Europe, Japan, and the United States. While the main objective of the study was not to evaluate international competitiveness, this turned out to be a convenient framework for analysis.

The report includes a bibliography of 86 articles which were referenced by the data base. Each record includes a field with specific references to the appropriate source document(s). This provides a convenient way of locating additional information about a particular implementation, or about any subset of the data base. Further analysis is facilitated by the fact that this information is available on a floppy disk as a DBase III file.

Scope and Limitations

The scope of the report is limited to FMS that are used in machining, or metal cutting, applications. A number of FMS systems have been encountered in

both electronic and mechanical assembly operations. There have also been recent reports of FMS systems used for sheet metal and grinding operations. However, the vast majority of FMS continue to be in metal cutting operations, and that area serves as the focus of this report. The scope of the report is further refined below, where a working definition of FMS is developed.

The principal limitation was restricting this investigation to a literature survey. Other techniques would have included the use of survey forms, telephone interviews, and plant visitations. These other techniques were ruled out, as a practical matter, due to lack of funding for the project. This limitation did not turn out to be as severe as it was first thought to be. The region most affected by lack of funding was the United States, where other means of data collection would be most applicable. However, data for US implementations was readily available in technical publications.

A second limitation is the lack of complete information. This is especially true of the Eastern European countries. There is no question that this region's numbers are understated due to the lack of published information on advanced manufacturing capabilities in Eastern Europe. This problem is quite serious. However, if the reader thinks of the information presented for the Eastern Bloc as a lower bound on their true capabilities, the report makes a contribution to an assessment of the state of the art for FMS implementation in Eastern Europe.

A third limitation is the rapid growth and diffusion of this technology, which appears to be exponential at the present time. This study represents a "snapshot" of the technology taken in the Fall of 1985, which can be used to understand the evolutionary trends in this industry.

A Working Definition of FMS

There is at present no consensus on a definition for FMS. The working definition in this report is a system defined by the following attributes:

1. A set of two or more general purpose metalworking machine tools
2. A host computer linking the machine tools to supervise computer numerical control (CNC) operations
3. An automated materials handling system, linking the machine tools and the other work centers in the system together

This definition is virtually identical to that given in the Flexible Manufacturing Systems Handbook (22).

There are other attributes that are desirable, and in the future may be incorporated into a definition of FMS. For example:

1. Flexible scheduling
   a. Alternate routings
   b. Alternate operations
   c. Real time schedule revisions
2. The ability to process a variety of parts
   a. A number of parts in a given part family
   b. A number of different part families
   c. The ability to economically produce a lot size of one part
3. The ability to have random (non-unidirectional) flow of material
4. Automatic tool changing (ATC)
5. Adaptive control
6. Automated part inspection

Many of the systems reported in this study have one or more of these advanced features, and a few systems have all of the above capabilities.

Comparisons and Contrasts Between the NBS and the ITA Report

The ITA report, " A Competitive Assessment of the U.S. Flexible Manufacturing Systems Industry," (14) and this report (the NBS report) share the objective of trying to develop descriptive information about FMS implementations. The main difference is in focus. The ITA report attempts to assess FMS technology in terms of international trade and competition, while the NBS report focuses upon FMS technology in terms of system design and operating practices. As a result, the ITA report is organized from the perspective of suppliers of FMS technology, while the NBS report is organized from the user's perspective. Differing objectives also lead to the inclusion of operating parameters in the NBS report.

There was also a highly significant difference in methodology. The ITA report is based largely on first hand information made by contacting FMS suppliers and users in the USA. Information on overseas implementations was obtained from reports submitted by both US foreign service officers stationed overseas, and from foreign embassy officials stationed in Washington D.C. Another difference in methodology is the availability of computer data base containing the results of this project on a floppy disk (DBase III format for IBM-PC compatible computers).

As previously acknowledged, the ITA report provided an excellent foundation, upon which this report was able to build.

ANALYSIS OF SURVEY RESULTS

There are 300 records in the data base. The analysis section is based upon a subset of the data base made up of 253 records. This subset is made up of all of the systems, for the regions of interest, that were classified as either a FMS or as a Flexible Transfer Line (FTL). Most of the other records included in the data base were for Machine Cells (MC). The main reason for including Machine Cells in the study was to disseminate information on Eastern European manufacturing technology. This region has a significant level of activity in Computer Aided Manufacturing (CAM). However, as in other regions, many of the CAM facilities can not be properly classified as FMS.

Flexible transfer lines, as classified herein, are technologically the same as FMS. The only difference is that the FTL is dedicated to the production of one or two specific parts, while the FMS has demonstrated greater flexibility by producing a greater variety of parts. The main difference between FTL and a traditional transfer line is the use of general purpose machine tools in the former, and custom designed machinery in the latter. It is the flexibility of the FTL that makes it an economically viable alternative to the traditional transfer line.

The 258 records in the data base representing flexible systems were then sorted by region. The four regions used were Eastern Europe, Western Europe, Japan, and the United States (USA). A series of graphs, which are presented in the next section of this report, were developed to support the analysis that follows. There were five FMS implementations omitted from the analysis, four in Taiwan and, one in Korea. This was done to clearly focus attention on the Japanese systems, rather than to try and include the Japanese in an broader definition of an Asian region.

In order to have a common basis for comparison between regions, the number of machine tools in the FMS (or FTL) systems was used. For example, in evaluating product mix for a given region, each category of product was weighted by the number of FMS machine tools (not the number of FMS implementations) associated with the production of that class of product. If the number of machine tools for a given implementation was not found in the literature, a conservative estimate of two machines was used. This assumption was necessary, as omitting the records without machine tool counts would distort the analysis much more than any bias introduced through estimation.

The year of implementation is often difficult to assess through the literature. This comes about because there are several milestones in an FMS project that are newsworthy. When given, the date used was the date that routine production began. Otherwise the best date available was used. Unfortunately, in a number of cases it was necessary to take the date of the publication which first referenced the FMS as the year of implementation. Fortunately, the uncertainty about the exact implementation date does not obscure the underlying trends.

FMS Implementations By Region

When looking at the number of FMS implementations, shown in Figure 1, the West Europeans lead with 107 systems, an impressive 42.3 % of the total. The USA and Japan follow with 64 and 59 systems, representing shares of 25.3 % and 23.3 % respectively. Eastern Europe trails with 23 systems, which accounts for the remaining 9.1% of the reported FMS implementations.

Perhaps of greater significance is the fact that Western Europe leads all other regions in terms of the number of firms with FMS experience, with at

least 82 different firms having reported FMS installations. Both the USA and Japan have at least 39 firms with FMS experience, while only 13 unique firms were identified for the Eastern Block. Although economic conditions and government policy can greatly influence the growth and diffusion of FMS technology, the number of firms with experience is a key factor in determining the potential of any region.

When the comparison is based upon the number of FMS machine tools, as in Figure 2, Western Europe loses share to both Japan and Eastern Europe, while the USA share remained essentially unchanged. This shift reflects the fact that many Western European FMS installations have only two machine tools. It also reflects the fact that the machine tool count for a large number of West European facilities was not available. In the latter case, a bias may have been introduced, as an estimate of two machine tools was used. The increase in Japanese share is not due entirely to a bias in estimation. Several Japanese installations have large numbers of machine tools under computer control. Using this method of comparison, Western Europe and Japan are roughly equal at shares of 31.5 % and 30.9 % . The USA is close with a share of 25.2 % ,while Eastern Europe trails with a 12.4 % share.

The growth of FMS technology is shown for each region in Figure 3 thru Figure 6. Each figure plots the cumulative number of machine tools, for the given region, by year. Each graph is a stacked bar chart, including prismatic, rotational, and other systems. The other systems either handle both prismatic and rotational parts, or they are unclassified. The figures show a rapid exponential-like growth in both Western Europe and Japan. The USA also exhibits an exponentially shaped growth curve. However, the curve for the USA reflects a significantly slower rate of growth. The growth curve for Eastern

European countries shows a slow, nearly linear, rate of growth.

Eastern European systems are under represented in this report. This follows directly from the limited amount of published information available on Eastern European manufacturing technology in general, and in particular to policies relating to publication of technology related to their defense industry.

In comparing rotational versus prismatic systems, the former are found to represent a small but nearly constant proportion of the installations for all regions except Eastern Europe. In Eastern Europe, rotational systems predominated in the seventies, and continue to account for approximately half of the FMS facilities.

Lot sizing data is shown by category in Figures 7 thru 10. The definition for each category is given below:

Category	Lot Size
1	1 - 10
2	11 - 50
3	51 - 100
4	101 - 500
5	Over 500

The data for Eastern Europe is inconclusive, as it is based upon two observations. It is included because it shows that at least one system has a high enough degree of automation to produce minimal lot sizes. The distributions for both the USA and Japan are skewed to the left, which is an indication of a high degree of flexibility. The distribution for Western Europe is significantly different, indicating the likelihood that a typical lot size is in excess of 50 parts.

Product Characteristics for FMS

The product mix for each region is represented as a series of pie charts in Figure 11 thru Figure 14. Unknown product applications, which are shown on the graphs, are omitted in the estimates of product mix given below. This results in the numerical values for product mix figures used in the report being different than the corresponding figure as shown on the graph. Product and materials categories were developed to analyze product characteristics, as indicated below:

Product Categories	Material Categories
1. Machine Tools	1. Steel or Cast Iron
2. Heavy Equipment (Commercial)	2. Aluminum
3. Heavy Equipment (Military)	3. Stainless Steel
4. Aerospace (Commercial)	4. Nonferrous Alloys
5. Aerospace (Military)	5. Unclassified
6. Automotive	
7. Consumer Products	
8. Industrial Products	
9. Unclassified	

Little is known about the product mix in Eastern Europe. The sketchy information presented in Figure 11 reflects traditional product applications of FMS technology in the machine tool and heavy equipment industries. Notably absent is any information on military products. The Eastern block countries are world leaders in arms production, and yet there are no military product applications reported for Eastern Europe. A much more representative range of products is seen in graphs for the other regions.

Japan, as might be expected, has no significant application of FMS

technology to military products. Japan's primary focus is in manufacturing machine tools , which represents 61.4 % of the mix, and other industrial products, which accounts for an additional 25.2 % of the product mix.

Western Europe has a balanced product mix. Traditional applications such as heavy equipment, industrial products, and automotive products account for 76.9 % of the mix. Machine tool applications are a surprisingly small 14.3 % of the mix, and military applications only accounted for 5.1 % of the mix.

The USA has a mix featuring 29.9 % heavy equipment (civilian), 25 % various industrial products, and 27.2 % military products. Only 7.1 % of the mix represents the machine tool industry. The USA differs from its international competitors in having a much larger military component, and a much smaller machine tool component in its product mix.

Materials applications are shown in Figures 15 - 18 As expected, they correspond to the product mix. The predominant materials being used in every instance are iron and steel. The use of aluminum and stainless steel is evidenced in both Western Europe and the USA, where aerospace products make up a significant part of the mix. The use of other nonferrous materials is rare.

Early product applications in FMS were typically for large prismatic parts used in heavy equipment applications such as housings for transmission and differential gears on trucks, tractors, and construction equipment. In looking at trends in FMS product applications it is useful to look at the part cube. The part cube distributions are shown in Figures 19 - 22. Eastern European systems have a wide range of part volume capabilities, as do those of Japan. Part volumes in Western Europe are skewed toward smaller part volumes, and yet none of the reported part volumes is less than a cubic foot. The part cube distribution for FMS machine tools in the United States ranges from a minimum of a 1 foot cube up to a 4 ft x 4 ft x 5 ft part volume. The number of

part cubes less than or equal to one cubic foot in volume suggests that there is a greater diversity at present, by comparison with earlier FMS product applications. The categories used to evaluate part cube distribution are listed below:

Category	Cube Size (Edge Length)
1	Up to 1 foot
2	Between 1 and 2 feet
3	Between 2 and 3.28 feet
4	Between 3.28 and 6.42 feet
5	Over 6.42 feet

Materials Handling Trends for FMS

Summaries were made for seven different types of materials handling equipment. The frequency of use for each type of equipment is shown by category for each region in Figures 23 thru 26. Any installations that did not have information of materials handling technology was excluded from this summary. The resulting sample sizes were 13, 71, 42, and 46 for Eastern Europe, Western Europe, Japan and the USA. The categories are defined below:

Category	Materials Handling Equipment
1	Roller Conveyor (RC)
2	Cart with Towline (CT)
3	Rail Guided Cart (RG)
4	Automatic Guided Vehicle (AGV)
5	Robotic Application(s) (RA)
6	Stacker Crane (STK)
7	Automatic Storage and Retrieval System (ASRS)

As the categories are not mutually exclusive, the percentages may add to more than 100 % for any region.

One of the surprising observations is the large number (53.8 %) of facilities in Eastern Europe that have robotic applications. Though based upon a small sample size of 13, this suggests a high degree of automation. The data for Western Europe and in the USA includes a representative mix of each of the available technologies. The only marked difference between these two regions appears to be in the use of ASRS, where the USA has an estimated 17.4 % usage versus a 5.6 % usage in Western Europe. Japanese FMS installations make a greater use of ASRS (40.5 %) and AGV's (47.6 %) than other regions, while making smaller but substantial use of robotic technology (26.2 %). Overall, the use of AGV's is becoming more common in the more recent systems.

GRAPHICAL ANALYSIS OF FMS TRENDS AND ATTRIBUTES

FIGURE 1 Distribution of FMS Technology

Based Upon Number of Systems

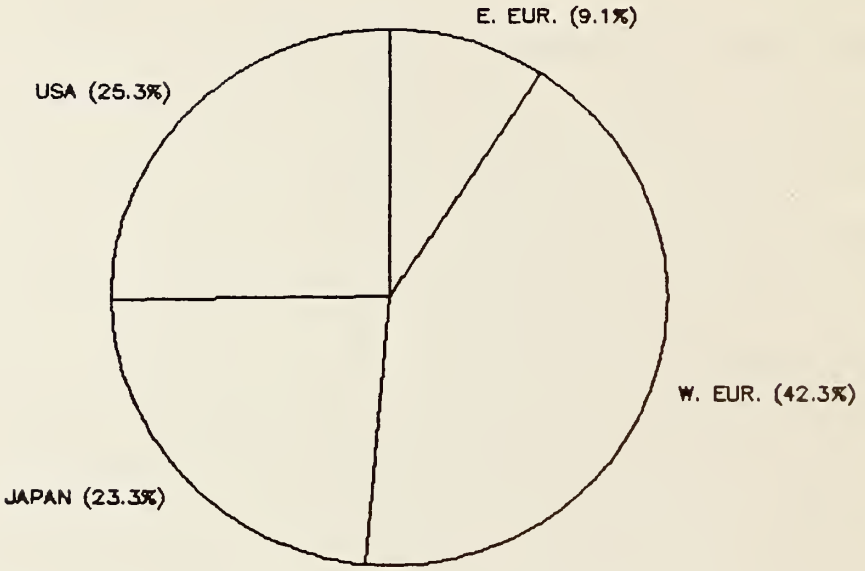


FIGURE 2 Distribution of FMS Technology

Based Upon Number of Machine Tools

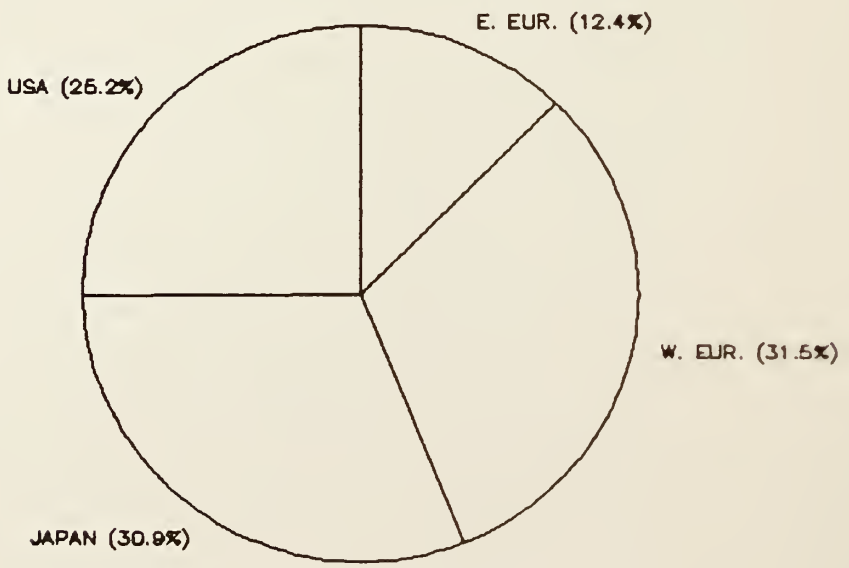


FIGURE 3. Eastern Europe

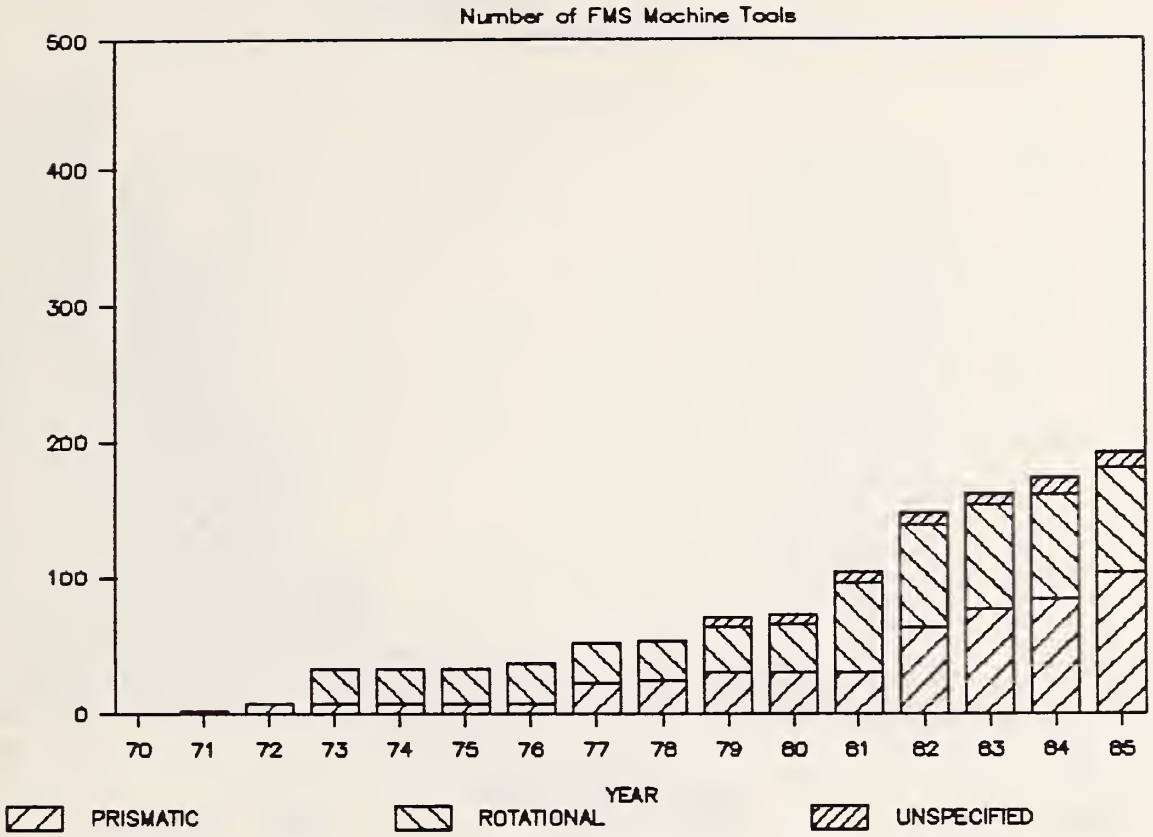


FIGURE 4. Western Europe

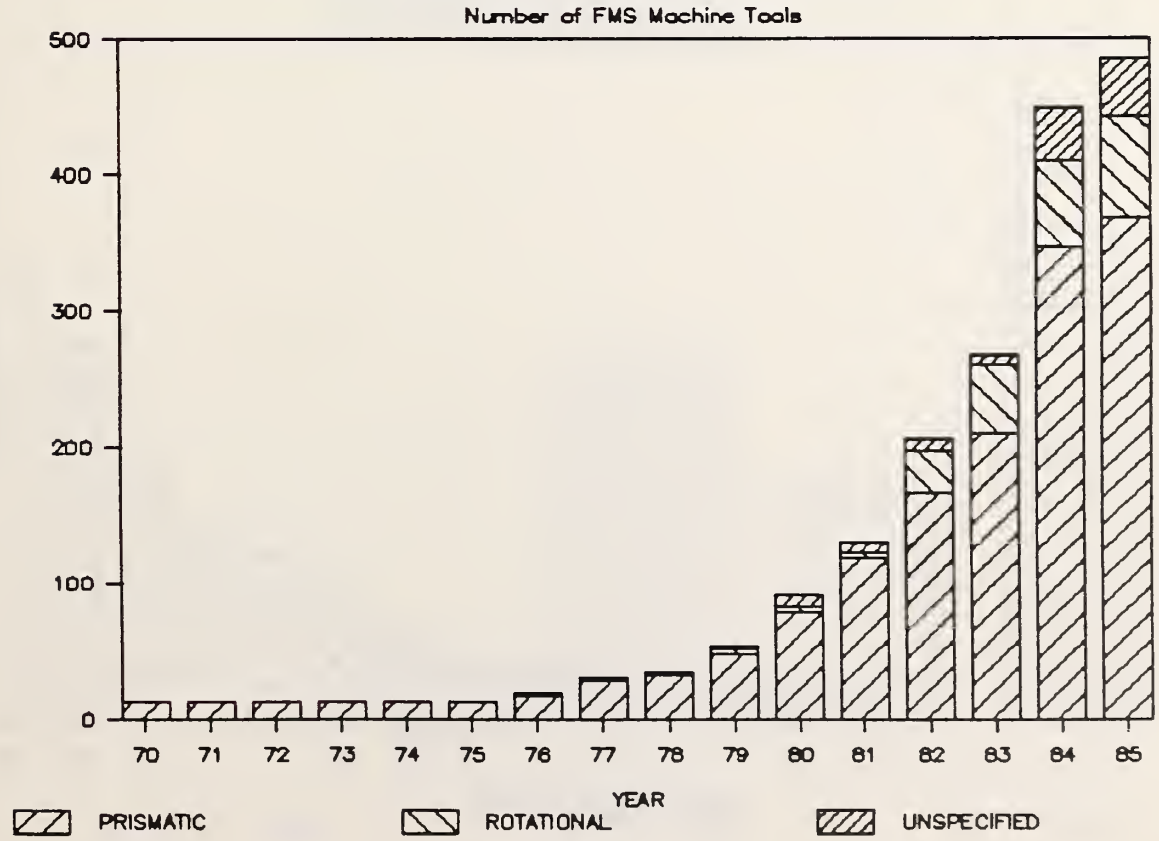


FIGURE 5. Japan

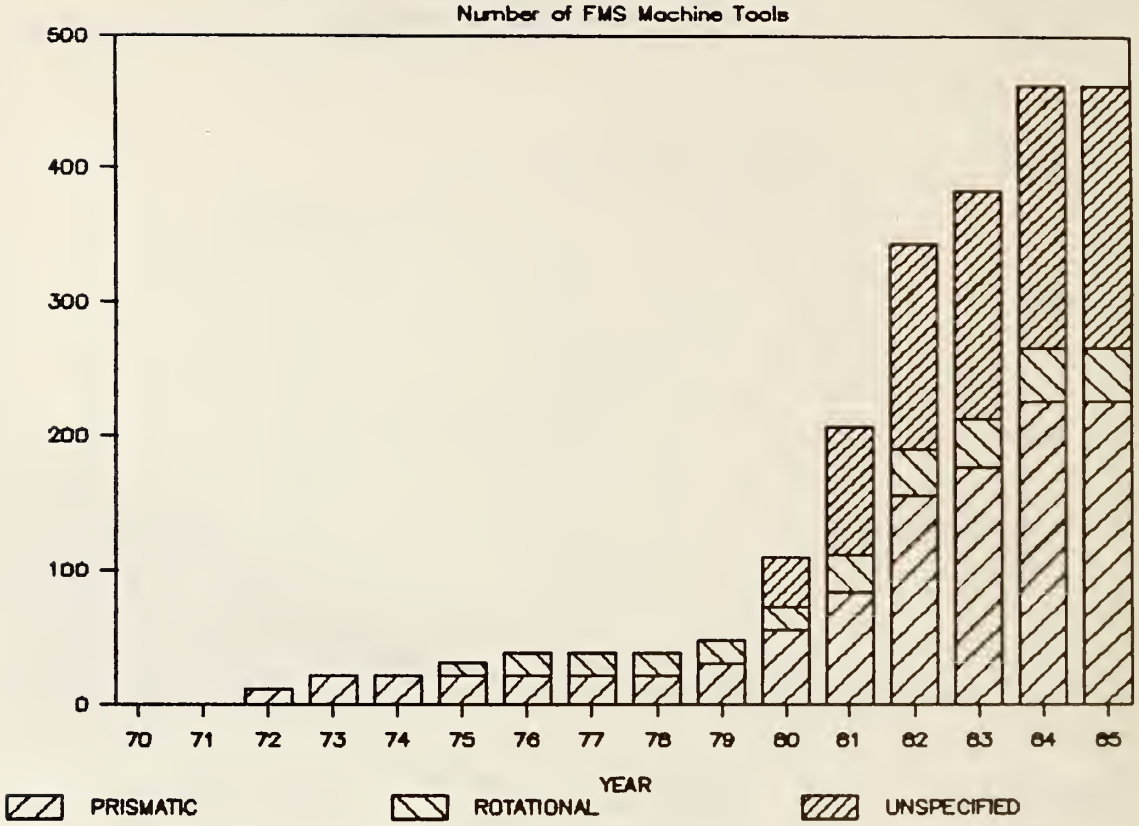


FIGURE 6. USA

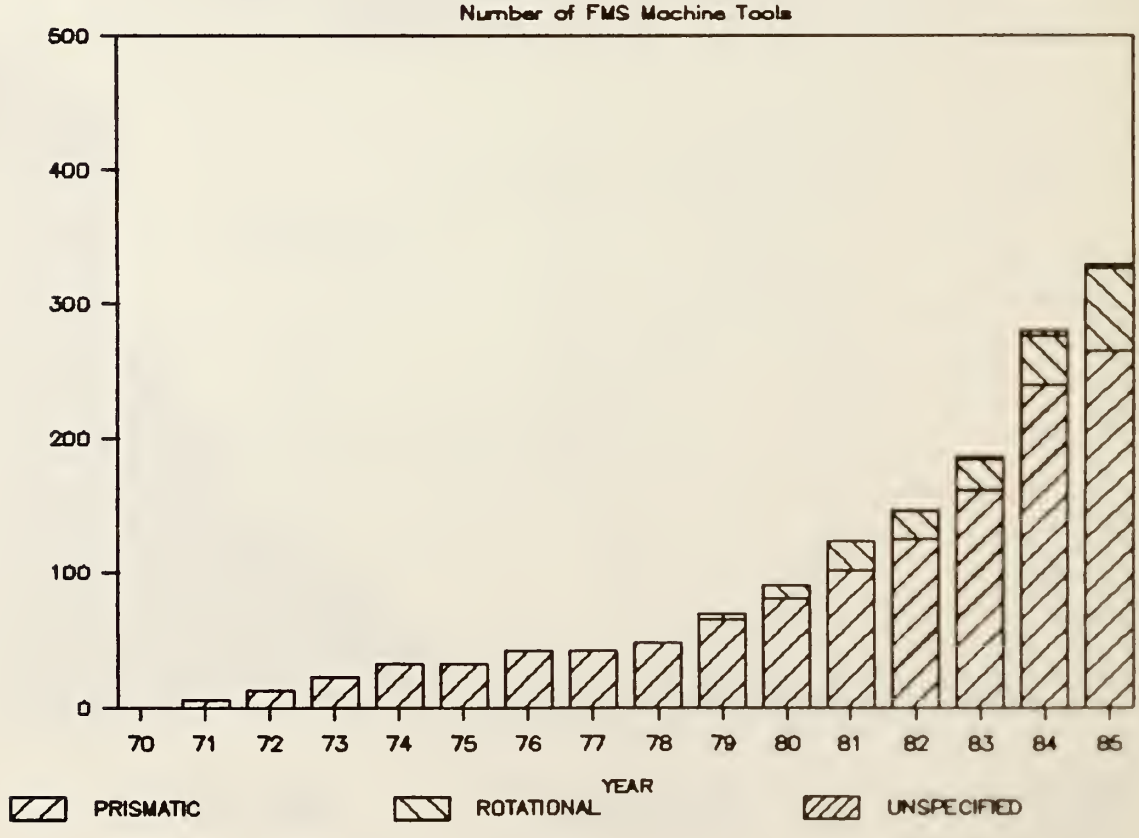


FIGURE 7. Eastern Europe

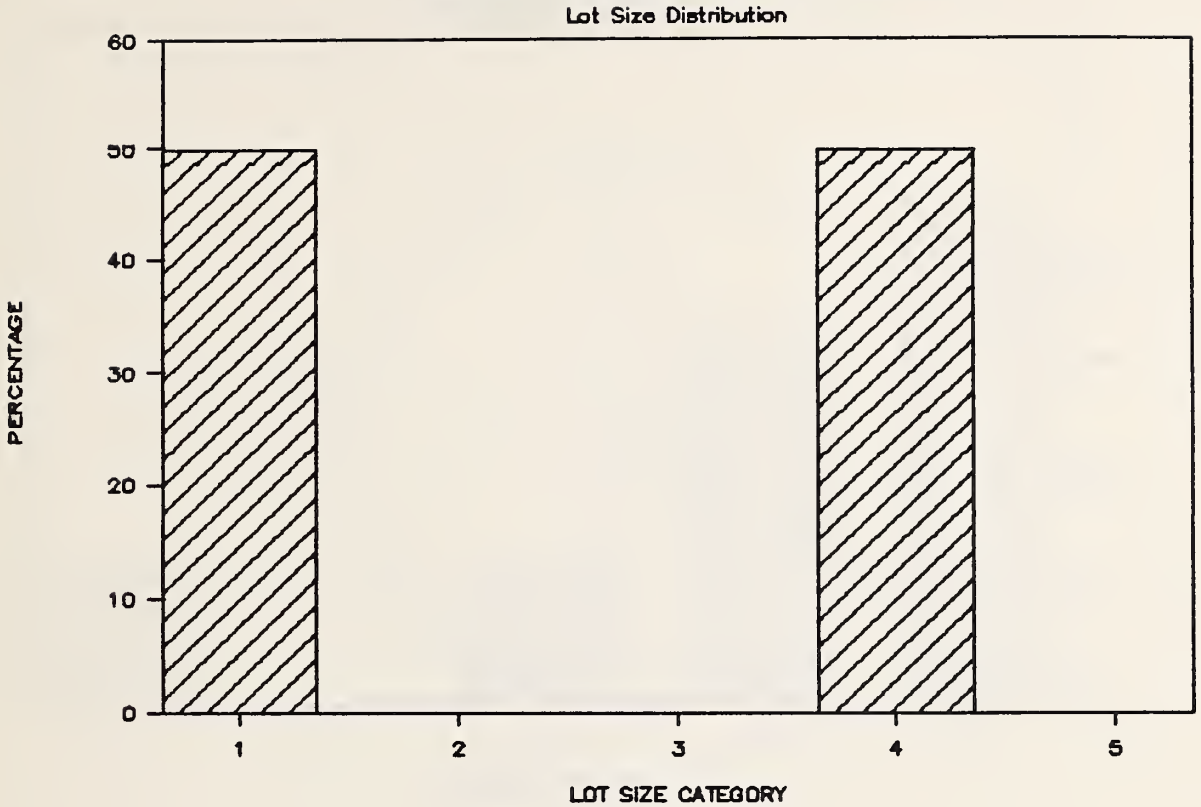


FIGURE 8. Western Europe

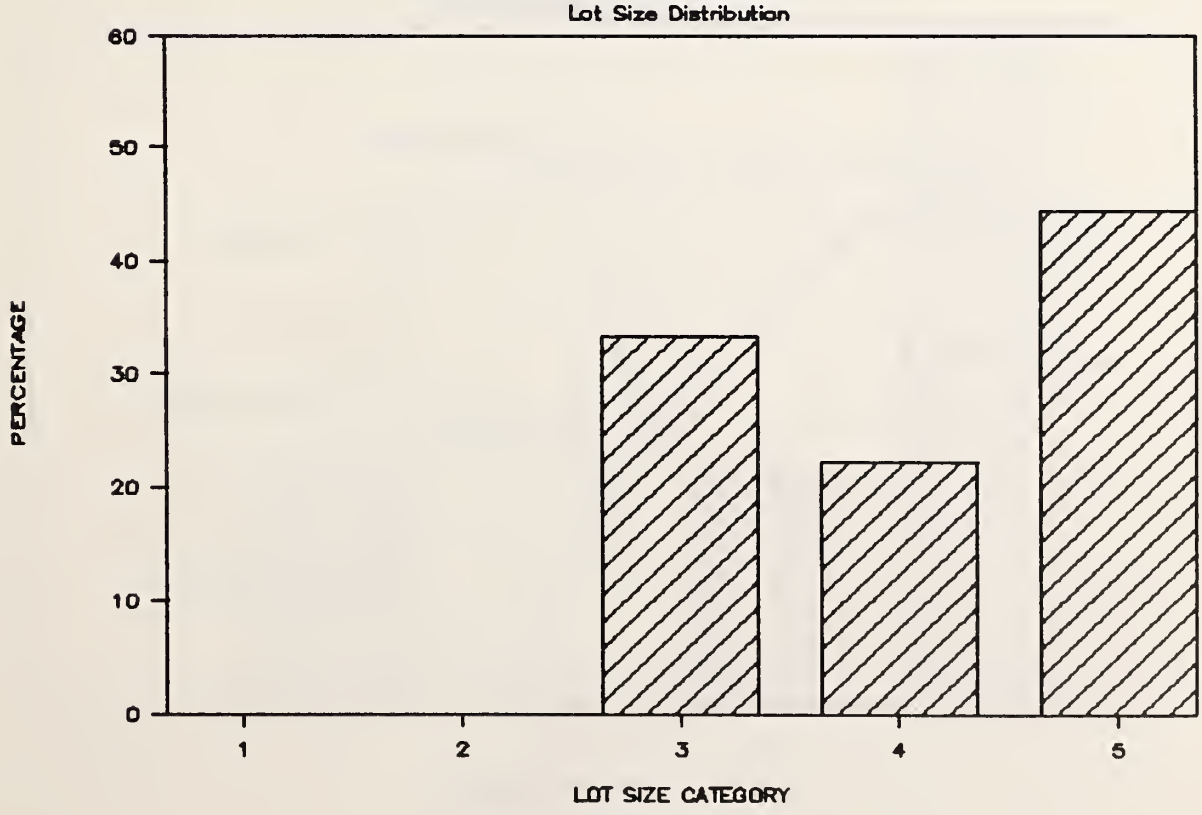


FIGURE 9. Japan

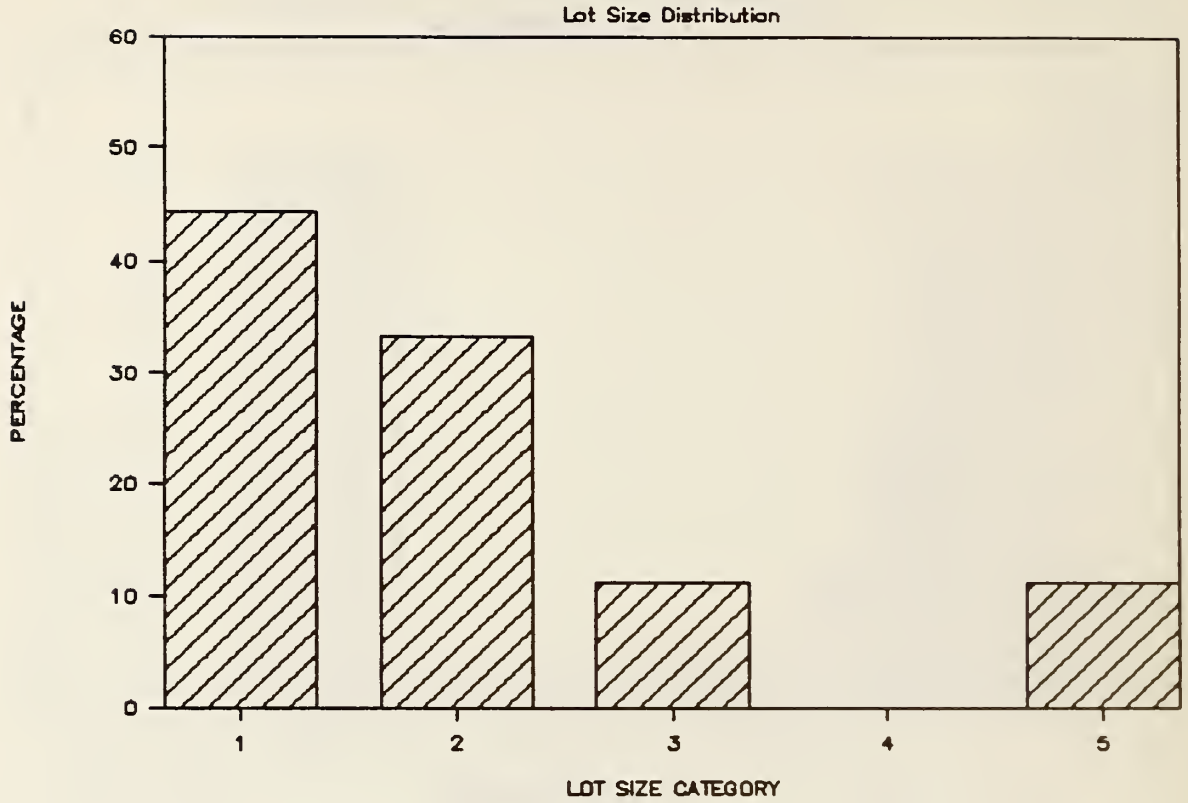


FIGURE 10. USA

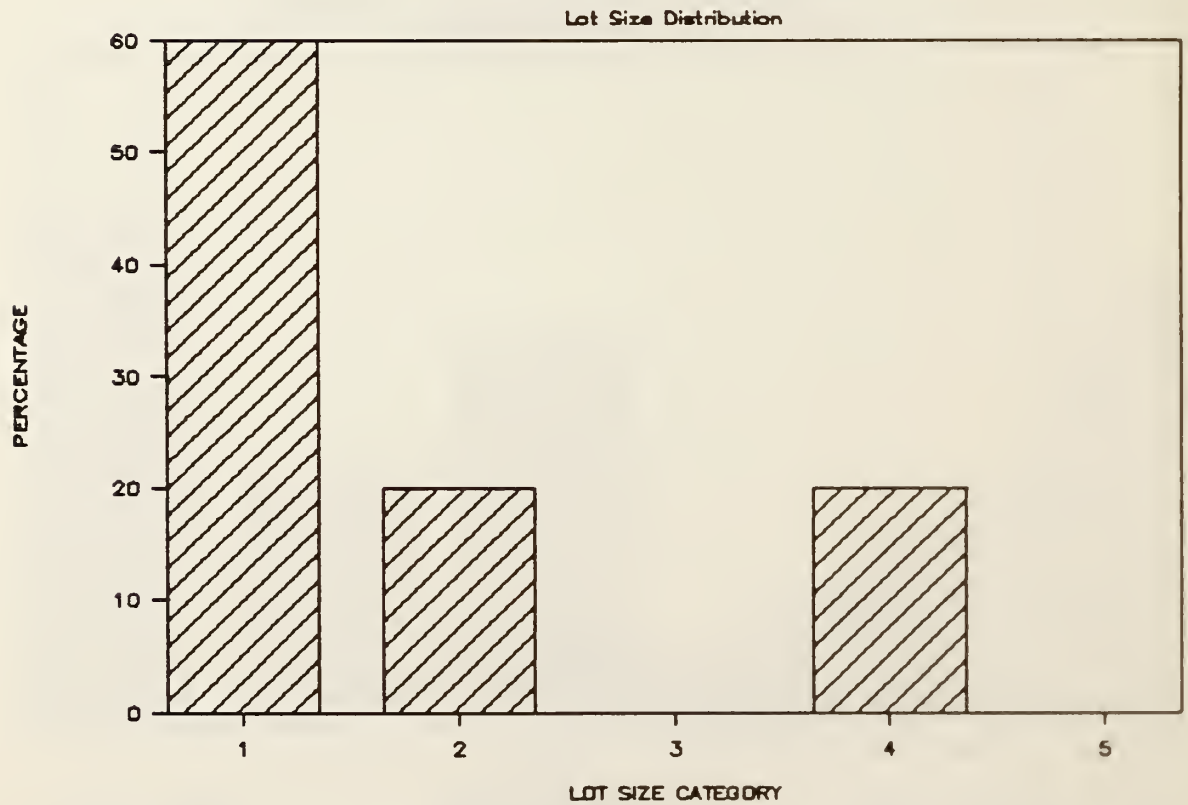


FIGURE 11. Eastern Europe

FMS Product Mix

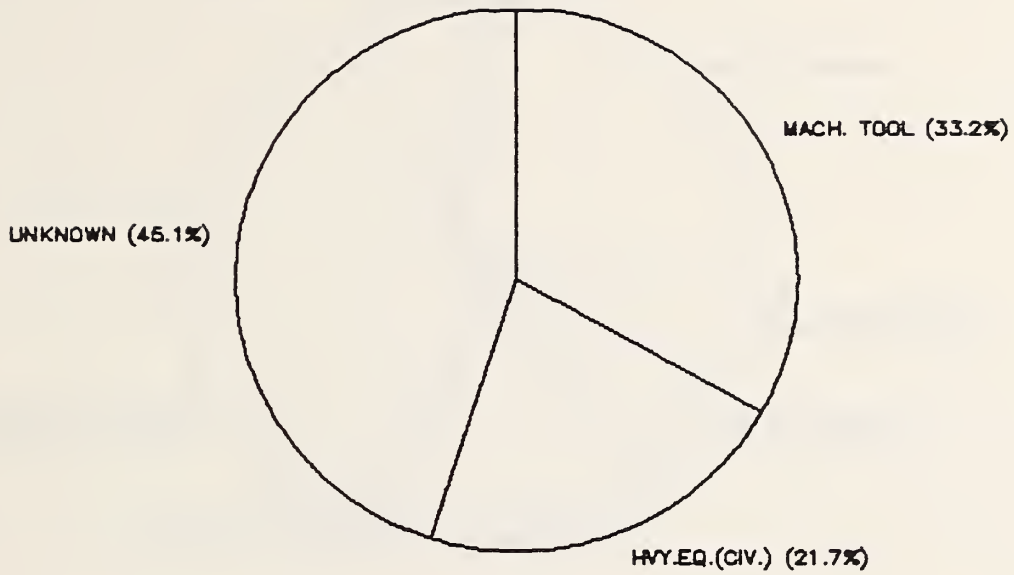


FIGURE 12. Western Europe

FMS Product Mix

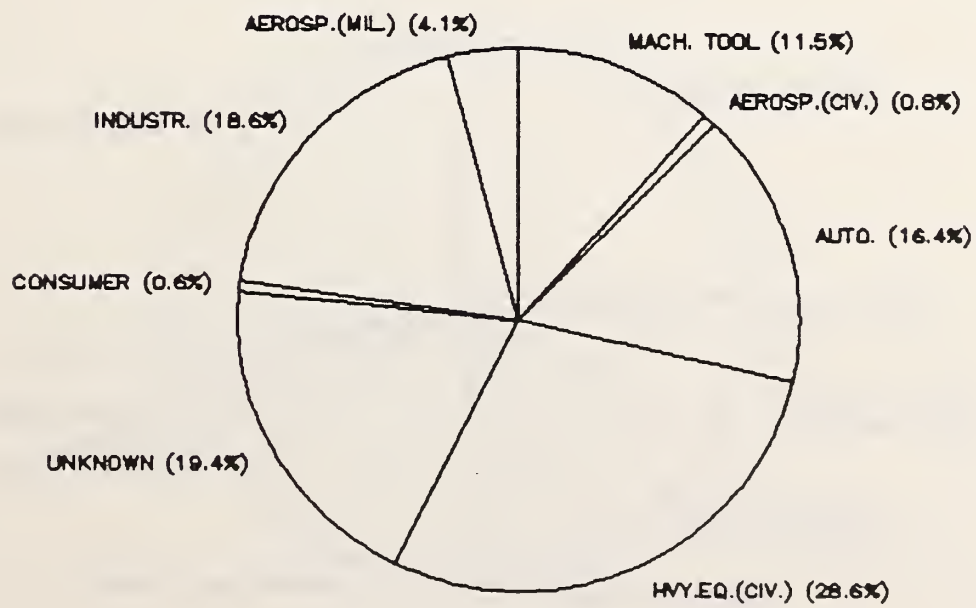


FIGURE 13. Japan

FMS Product Mix

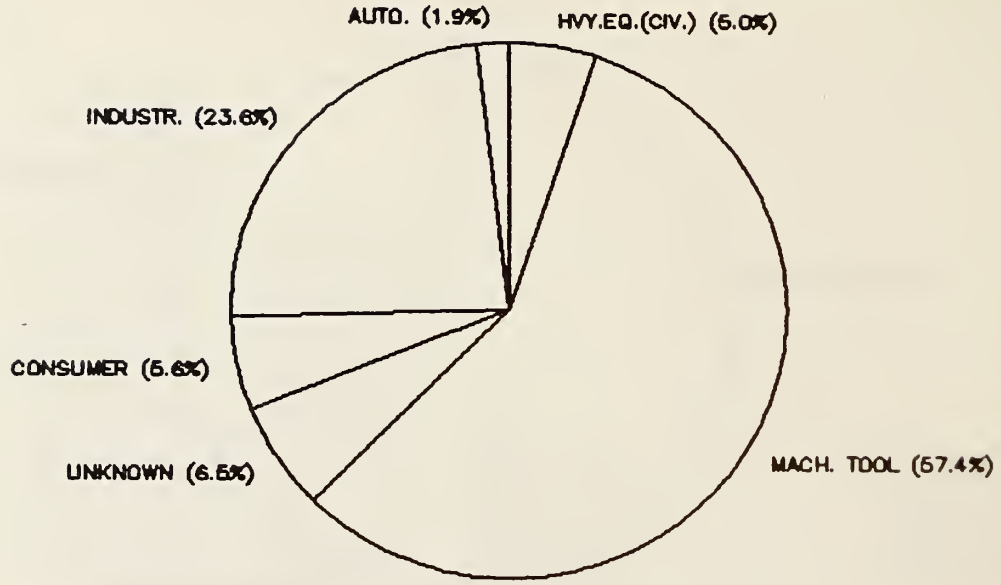


FIGURE 14. USA

FMS Product Mix

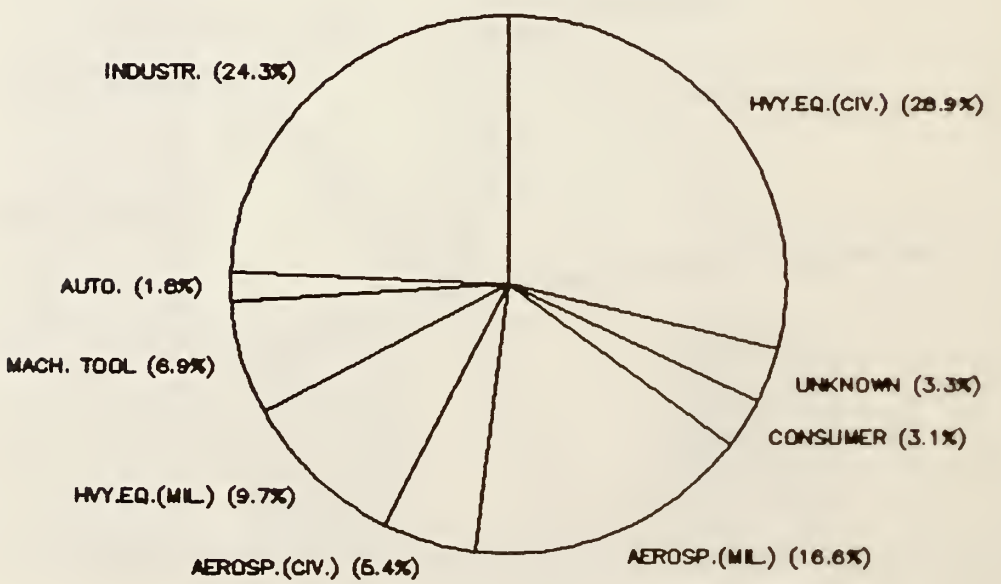


FIGURE 15. Eastern Europe

FMS Materials Usage

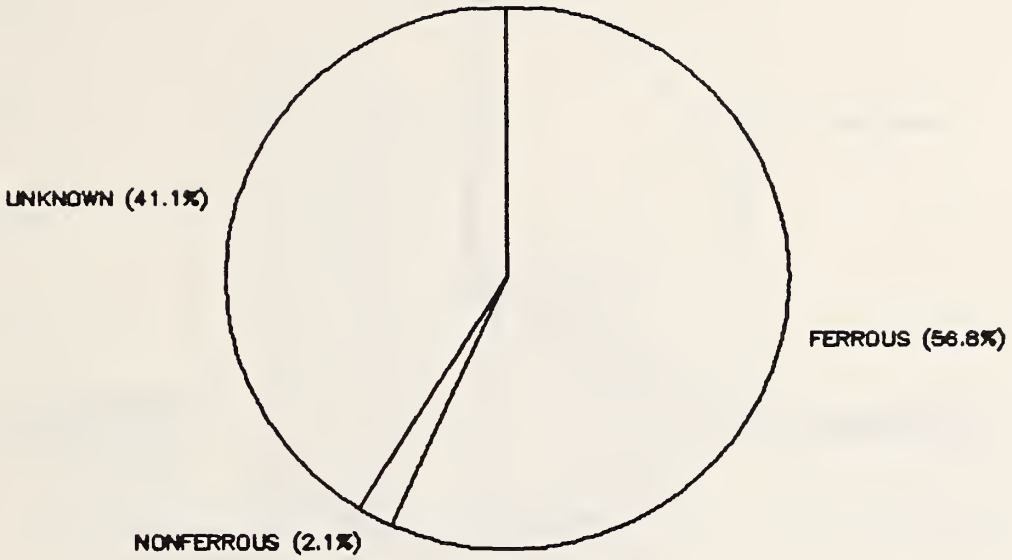


FIGURE 16. Western Europe

FMS Materials Usage

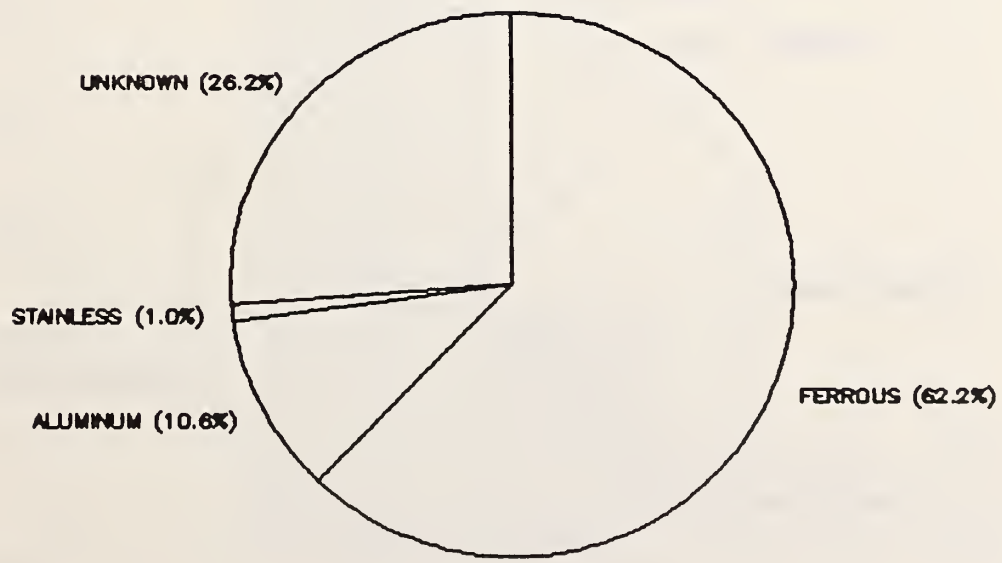


FIGURE 17. Japan

FMS Materials Usage

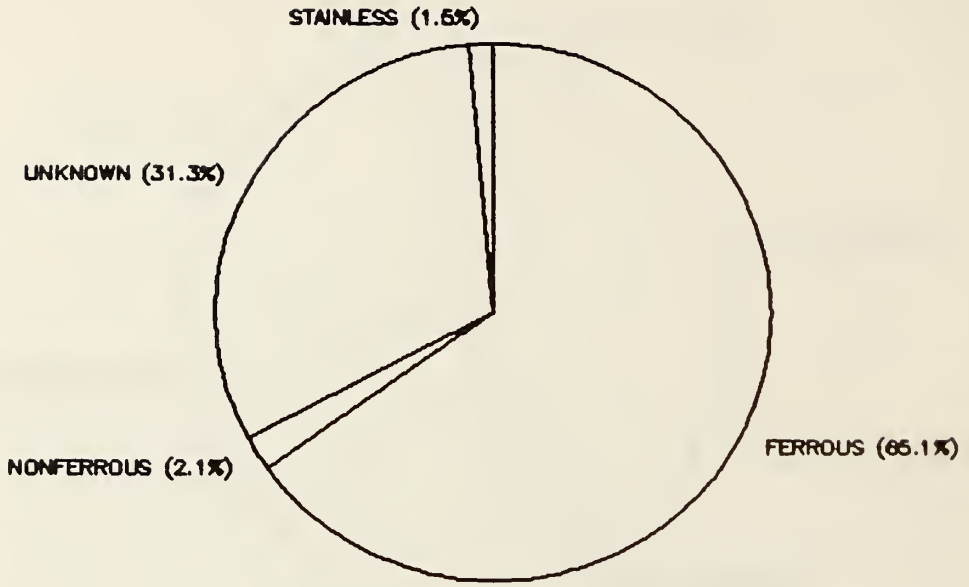


FIGURE 18. USA

FMS Materials Usage

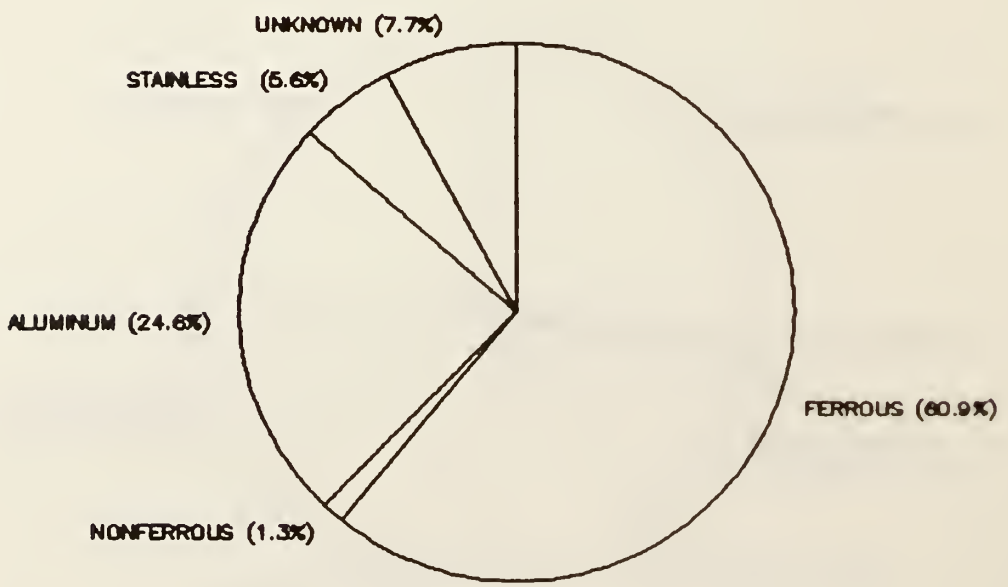


FIGURE 19. Eastern Europe

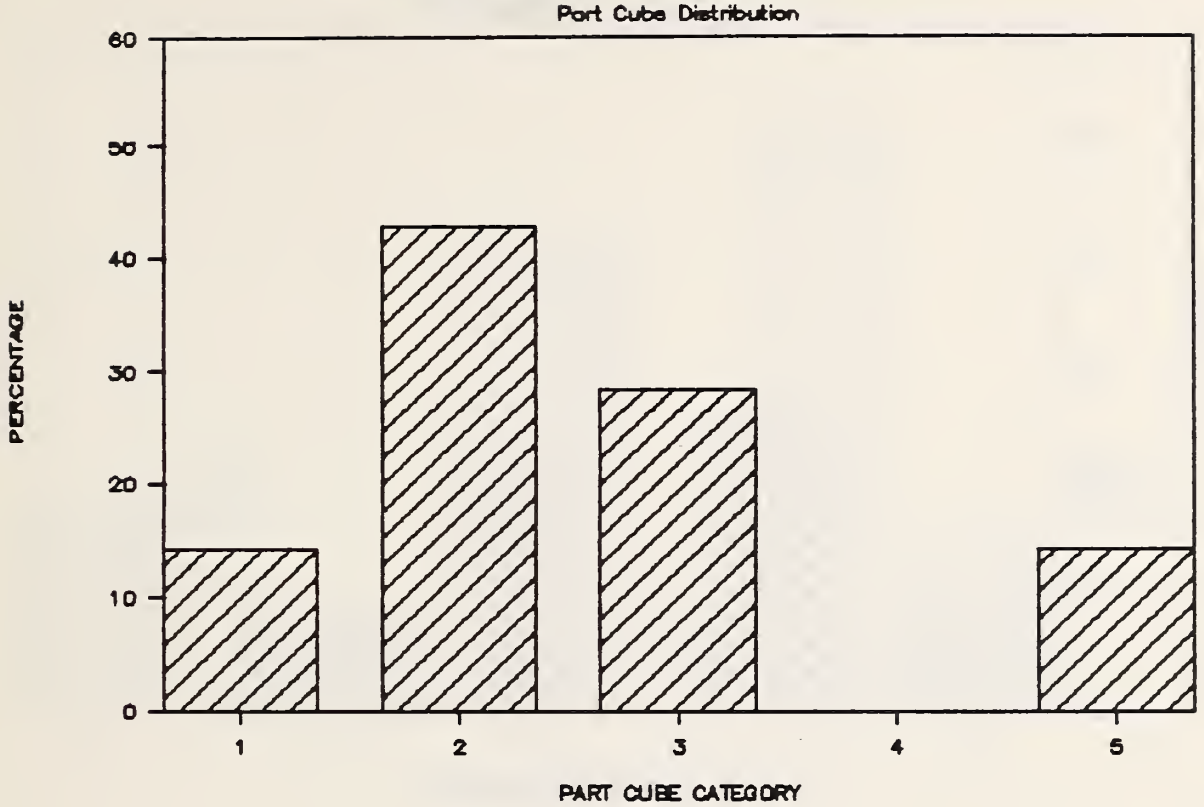


FIGURE 20. Western Europe

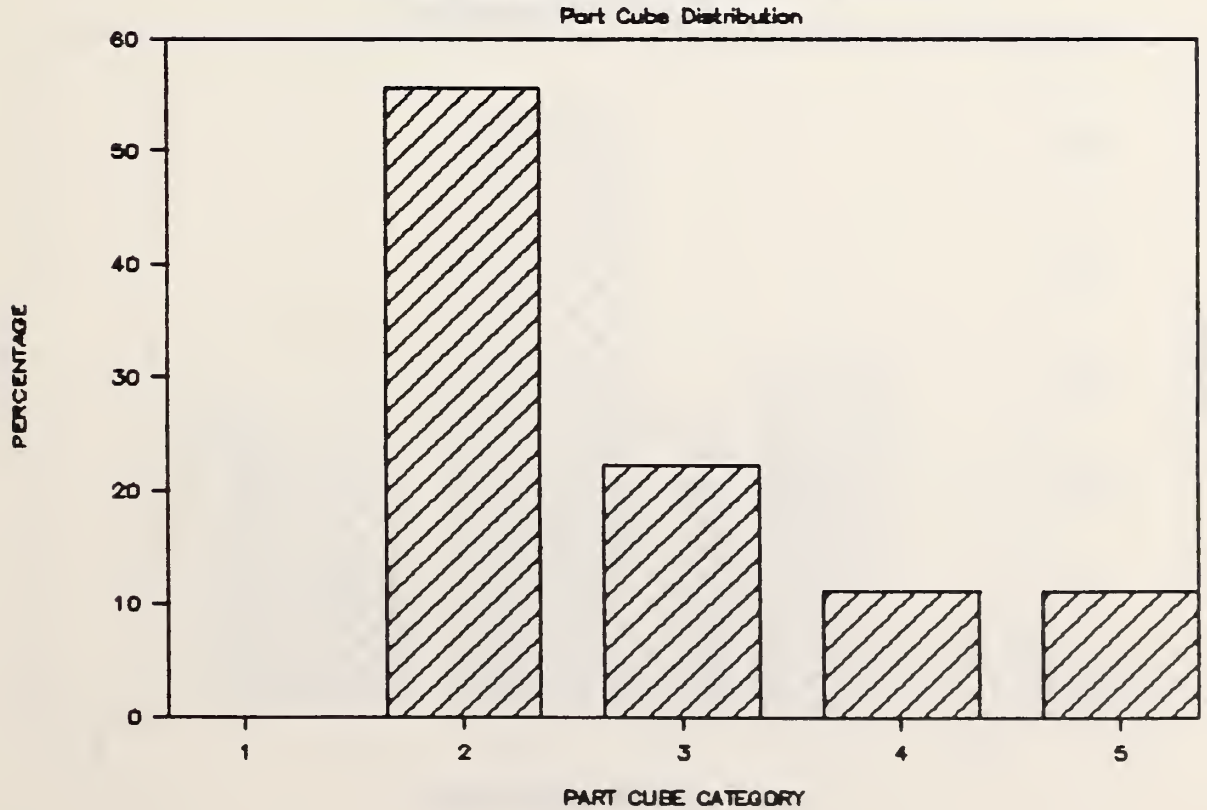


FIGURE 21. Japan

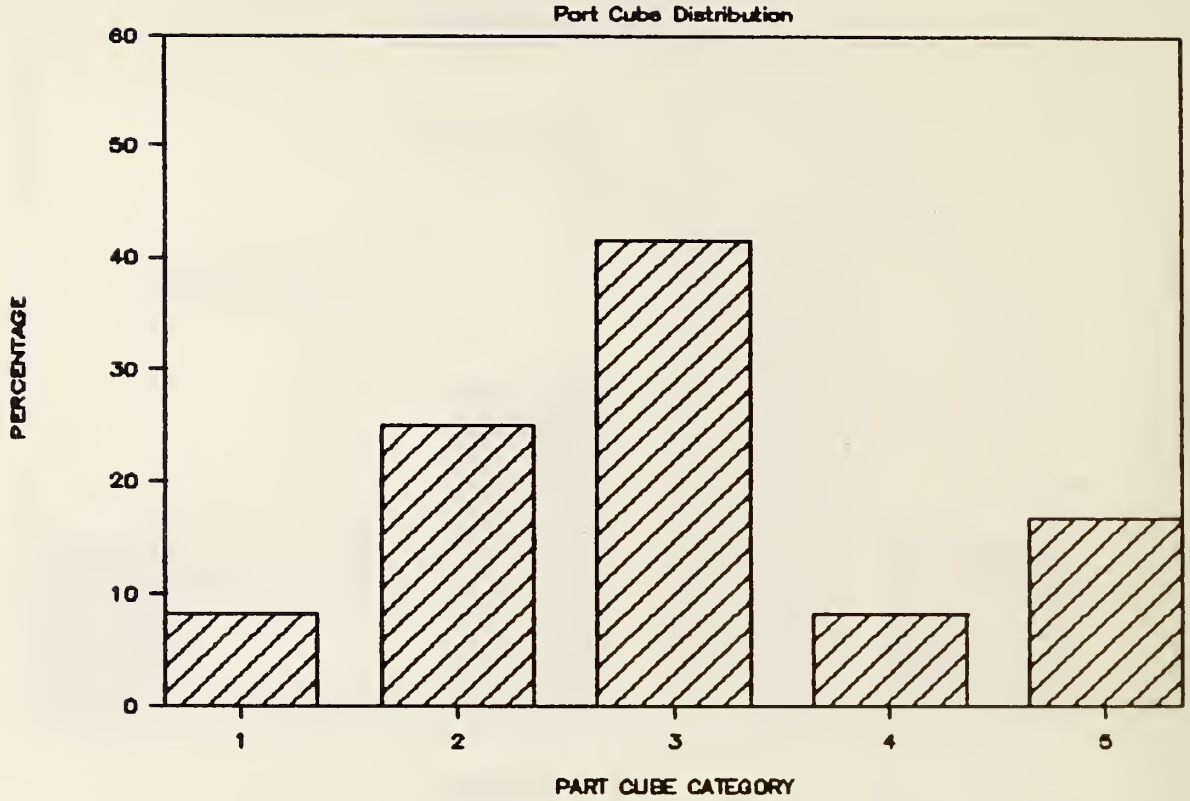


FIGURE 22. USA

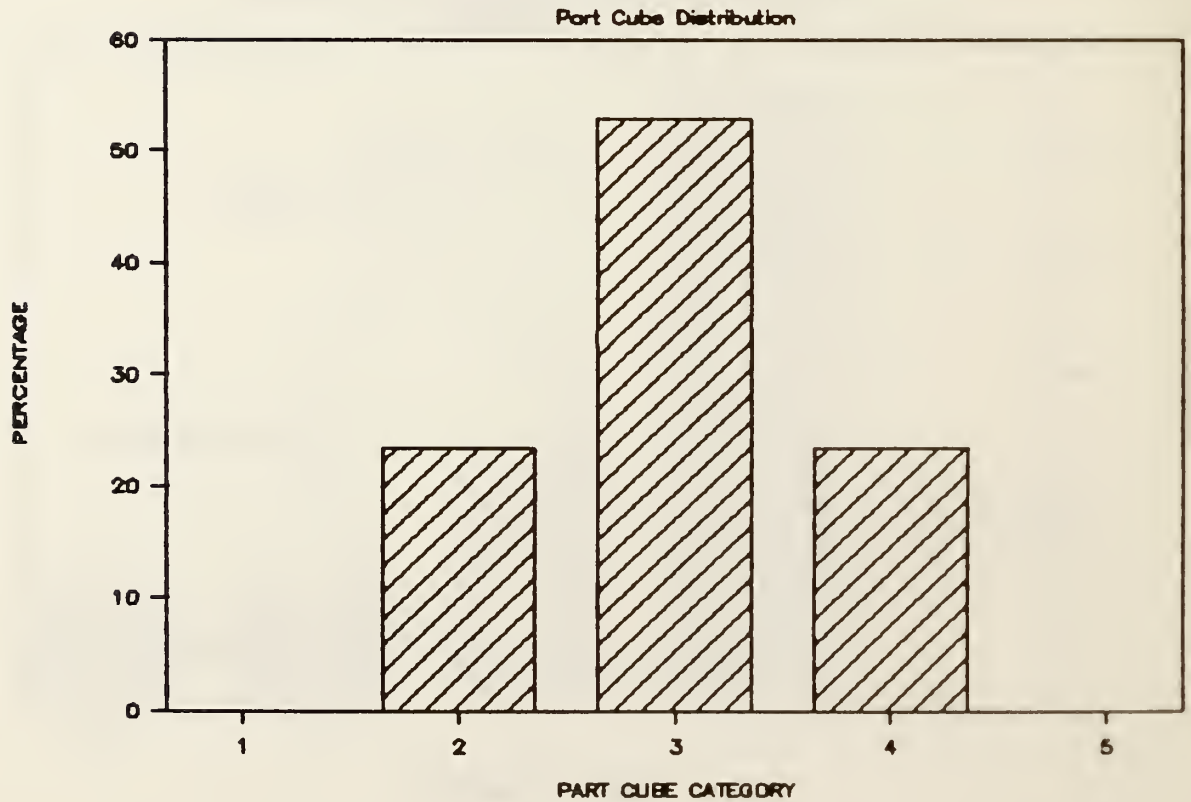


FIGURE 23. Eastern Europe

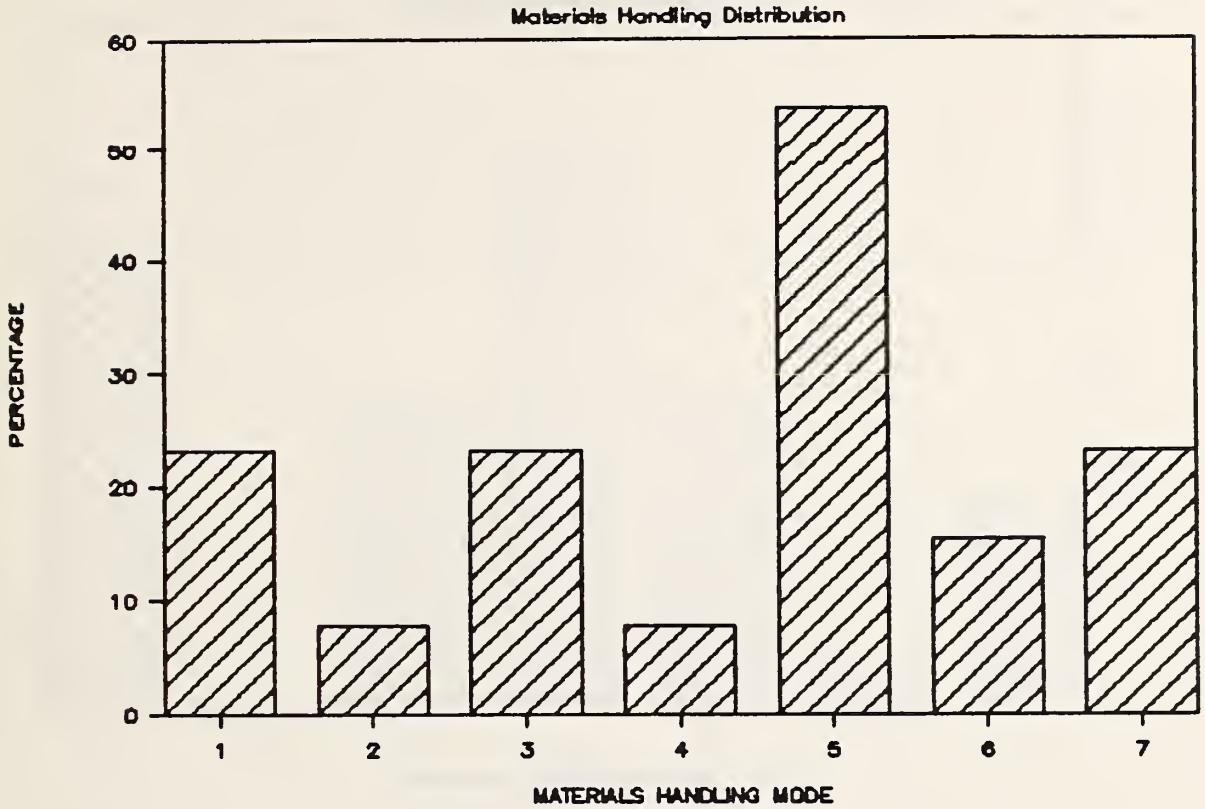


FIGURE 24. Western Europe

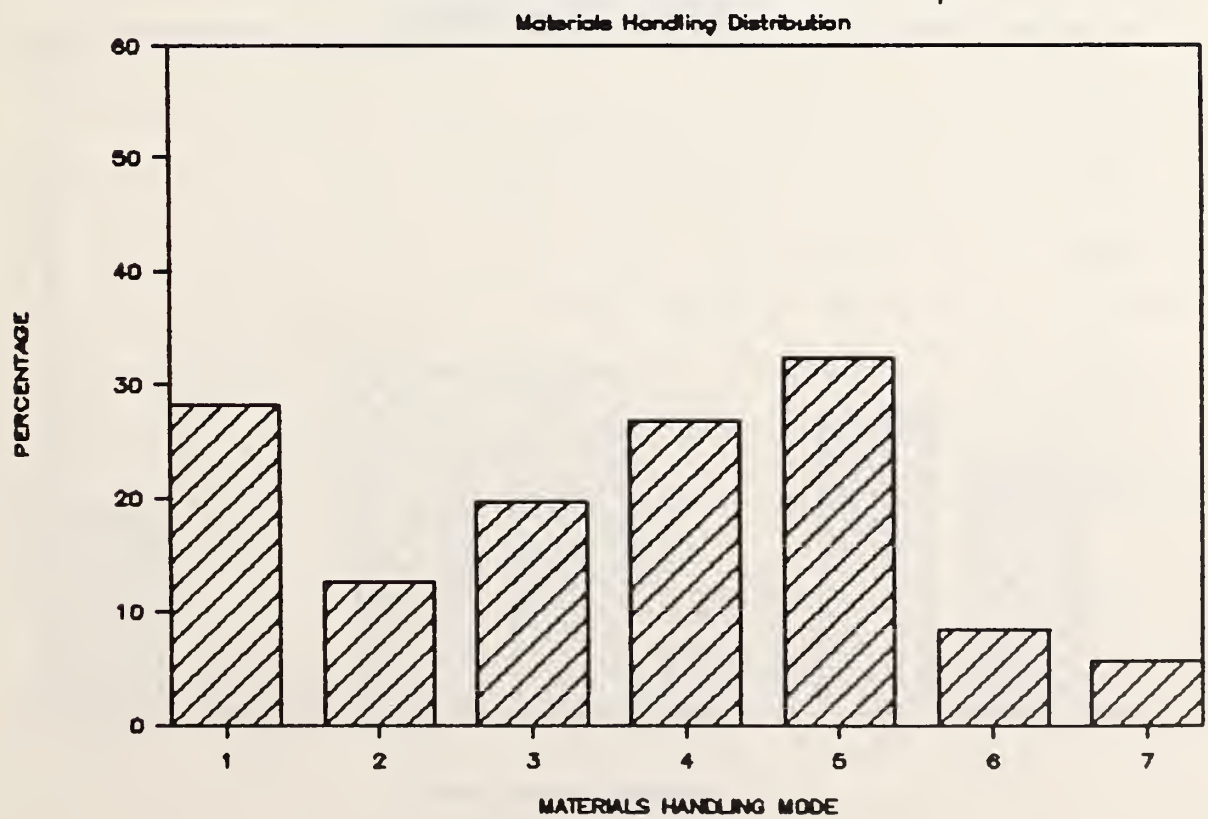


FIGURE 25. Japan

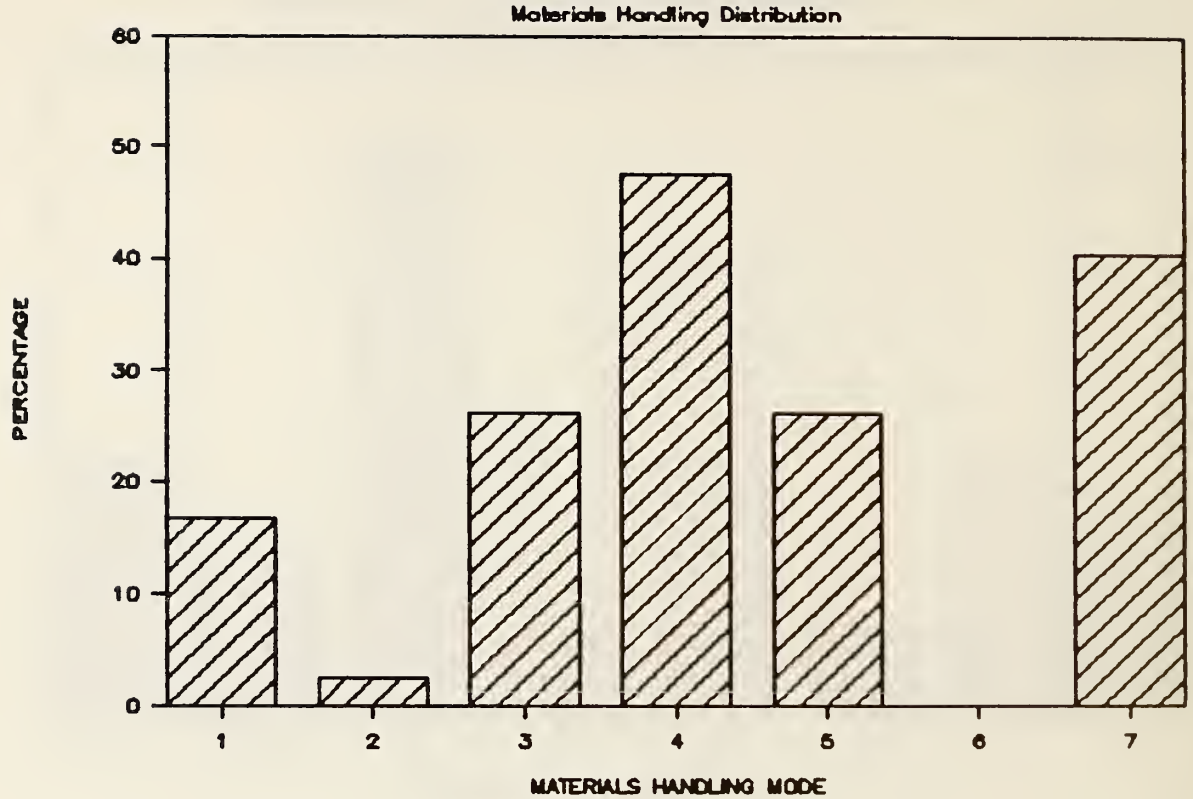
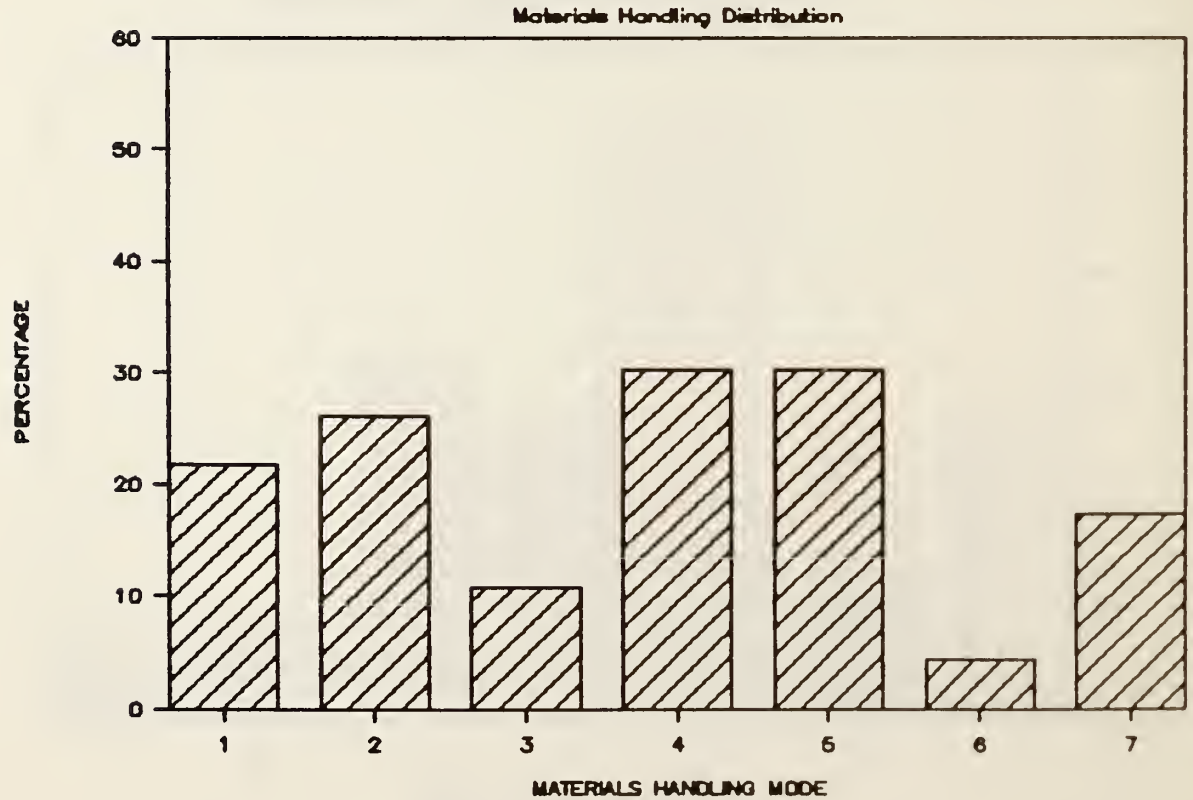


FIGURE 26. USA



SUMMARY AND CONCLUSIONS

In order to assess the state of tne art and to provide a basis for comparison, the main points from the analysis section will be summarized for each region. Overall conclusions for the report will also be given.

Eastern Europe

In Eastern Europe the numbers of systems reported are fewer than for any of the other regions studied. In addition, the growth of FMS technology appears to be linear, occurring at a slow and constant rate. This is in marked contrast to all other regions, which appear to have an exponential growth rate. However, Eastern European FMS implementations may be greatly underestimated in this report, reflecting the lack of published information on eastern block technology. One factor that suggests that the eastern block systems are being underreported is the complete lack of information on any military product applications.

The FMS systems in Eastern Europe are approximately half rotational systems, and half prismatic systems. Some evidence of the state of the art in these systems comes from the report that at least one system can economically produce a lot size of one. One available indication of the level of automation in these systems comes from the fact that slightly more than half of the implementations, which reported on their materials handling technology, use robotics. Although based upon a small sample size of 13, the use of robotics suggests a relatively nigh degree of automation.

Western Europe

Western Europe leads the other regions in terms of the number of FMS implementations and the growth rate for FMS implementations. This region has more individual firms with experience in FMS technology than any other. Although both governmental policy and economic conditions have a strong influence on the growth and diffusion of technology, Western Europe clearly has a great potential for technological growth in this area.

In terms of product mix, Western Europe has a balanced mix of traditional products with heavy equipment, industrial, and automotive products accounting for nearly 80 % of the product mix. The minimum lot size reported was 50, which may be an indication that the Western European systems have less flexibility than those found in other regions. A wide variety of materials handling technologies are used. There is some evidence that the Western European systems make less use of automation in their materials handling systems. The use of robotics is about the same as in Japan and the USA. However, the use of AGV's and ASRS is less prevalent in Western European Systems than for those surveyed in Japan or in the USA.

Japan

Japan trails the USA and Western Europe in terms of the number of implementations reported. The Japanese share of FMS technology increases when the comparison is based upon the number of machine tools, reflecting the fact that several of their FMS implementations are very large. The product mix for the Japanese systems differs markedly from the other regions in that the principal product is machine tools, which represent 64 % of all products

manufactured on FMS. This fact suggests that Japan has the potential to rapidly increase the use of FMS tecnnology, even tnough they trail both Western Europe and the USA in terms of the number of firms employing FMS.

USA

The USA has a strong position in FMS technology. However, there are at least two areas of concern. First, the growth rate of FMS technology seems to be somewhat lower than that for Western Europe or Japan. Second, the product mix differs in tnat machine tool production on FMS is lower than that for any other region. Partly offsetting this is the drive for further automation provided by defense related products.

Conclusions

The data base, graphical comparisons, analysis, and summary above presents a state of the art picture of FMS technology in terms of the major operating characteristics. The report also provides an international comparison, in terms of growth and diffusion, for the four regions studied. However, this was not the only objective of this project. Perhaps of greater importance is the potential to use this research to provide a framework for further studies. The first contribution to future research is identifying the users of FMS technology. A second contribution is providing the information in a computerized data base to facilitate further work. The data base is highly flexible, and can be expanded to include both additional implementations (records) and additional data (fields). It is hoped that this report serves to encourage further investigations into FMS implementation.

APPENDICES

APPENDIX A. DATA BASE SCHEMA AND DATA DICTIONARY

COUNTRY: User country

COMPANY: User company

LOCATION: Location of FMS installation

DIVISION: Division of user company

SUPPLIER: Principal supplier of FMS

CLASS: System classification: FMS, FTL, or MC (see FMS abbreviations)

YEAR: The reported, or estimated, year when the FMS began routine production

FIN_JUST: Financial justification information

COMPUTER: The host computer

CONTROLS: The process controls. In the Eastern European installations the FMS system nomenclature is given in this field.

PRODUCTS: The principal products produced by the FMS

MATERIALS: The materials used to produce the product. Where not specified, this was inferred from the product when obvious. For example, aluminum was given as the material for aircraft parts, cast iron and steel were given as materials for machine tool parts.

NO_PARTS: The number of different unique parts produced by the FMS

NO_FAMILYS: The number of product (or part) families produced by the FMS

PARTS_ANN: The number of parts produced annually, or the production rate

PART_CUBE: The dimensions of the part envelope

PART_SHAPE: The basic part geometry/production mode: prismatic (P), rotational (R), and unrestricted (U)

SCHEDULING: Descriptive information about the operation's scheduling

SCHEDULE2: A continuation of the SCHEDULING field

LOT_SIZE: Lot size information

CREW_SIZE: Crew size information. This is given by shift when possible.

MACH_SET: A list of the number and types of machines in the FMS (see FMS abbreviations)

MATL_HANDL: A brief description of the material handling equipment (see FMS abbreviations)

TOOLING: A brief description of the tool system used in the FMS (see FMS abbreviations)

FEATURES: A brief description of the FMS system features (see FMS abbreviations)

REFERENCES: A listing of the bibliographic reference numbers of the articles used in defining the record

APPENDIX B. LIST OF ABBREVIATIONS

Class

FMS: Flexible Manufacturing System

FTL: Flexible Transfer Line

MC: Machine Cell

Machine Tools

MC: Machining centers

NHM: NC Horizontal Mill

NVM: NC Vertical Mill

NM: NC Mill

NV: NC Vertical Lathe

NT: NC Lathe

ND: NC Drill

NB: NC Boring

NG: NC Gear Cutting

NGR: NC Grinding

WS: Wash Station

CMM: Coordinate Measuring Machine

MT: Unspecified Machine Tool

SP: Special Purpose Machine Tool

Organizational Abbreviations

DOC: Department of Commerce

NBS: National Bureau of Standards

ITA: International Trade Administration

Materials Handling:

CT: Cart with towline

AGV's: Automatic Guided Vehicle(s) (Wire Guided)

RA: Robotic Application

RG: Rail Guided Shuttle

RC: Roller Conveyor

CAR: Carrousel

ASRS: Automatic Storage & Retrieval

STK: Stacker Crane

X: Other

Features:

AC: Adaptive Control

AE: Acoustic Emission

CC: Central Coolant

SC: Self-contained Coolant

P: Probing

I: Inspection

X: Other

WS: Wash Station

Miscellaneous Abbreviations

CAM: Computer Aided Manufacturing

CIM: Computer Integrated Manufacturing

CNC: Computer Numerically Controlled (Machining)

DNC: Direct (Computer) Numerically Controlled (Machining)

Justification:

WIP: Work in process reductions

FLR: Floor space

LT: Lead time

MT: Reduction in the number of machine tools required

LAB: Reduced labor cost

PMX: Changing product mix

ROI: Return on investment

PB: Pay back period

UT: Machine utilization

PRD: Increased production

CST: Reduced manufacturing cost

Tooling:

CAR: Carrousel

HI: Head Indexer

HC: Head Changer

ATC: Automatic Tool Changing

Part Geometry:

R: Rotational

P: Prismatic

U: Unrestricted

APPENDIX C. FMS IMPLEMENTATION DATA BASE

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Austria
2. COMPANY: Steyr Puch
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Mandelli
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Belgium
2. COMPANY: Caterpillar
3. LOCATION: Gosselies
4. DIVISION:
5. SUPPLIER: Hueller Hille
6. CLASS: FMS
7. YEAR: 80
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: Siemens
11. PRODUCTS: Wheel loader lift arms
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NM, 2 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Belgium
2.	COMPANY:	Caterpillar
3.	LOCATION:	Gosselies
4.	DIVISION:	
5.	SUPPLIER:	Scharmann
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	Dual DEC PDP 11/34's
10.	CONTROLS:	Siemens
11.	PRODUCTS:	Wheel loader engine frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	2.5 hrs./part
16.	PART CUBE:	3 x 1.5 x .8 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 NM, 1 NB (vertical), 5 NB (duplex), 6 meas. sta.
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	ATC: 70 tool capacity
23.	FEATURES:	Inspection, probing, and adaptive control
24.	REFERENCES:	14

1.	COUNTRY:	Belgium
2.	COMPANY:	Caterpillar
3.	LOCATION:	Gosselies
4.	DIVISION:	
5.	SUPPLIER:	Pegard
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Siemens
11.	PRODUCTS:	Wheel loader frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NM, 3 MC
21.	MATL. HANDLING:	Pallet shuttle
22.	TOOLING:	
23.	FEATURES:	Probing, adaptive control
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Belgium
2.	COMPANY:	DAF Trucks
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Rear axle parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 ND, 1 NB, 1 MC
21.	MATL. HANDLING:	Cart with towline, robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	Bulgaria
2.	COMPANY:	ITCR
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	80
8.	FINANCIAL DATA:	4-6 fold increase in productivity, reduced WIP inventory
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	20,000 + parts per year
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Work centers are operated independently, two shift operation
19.	LOT SIZE:	
20.	MACHINE SET:	5 NT, 1 ND, 1 WS
21.	MATL. HANDLING:	AGV, ASRS, manually loaded machines
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	83

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Bulgaria
2.	COMPANY:	ITCR
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	80
8.	FINANCIAL DATA:	3-7 fold increase in productivity, less than 1% scrap
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Gear boxes for machine tools
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	12
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	1,600 per year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Two shift operation
19.	LOT SIZE:	
20.	MACHINE SET:	3 NHM, 2 NVM, 1 CMM
21.	MATL. HANDLING:	Rail guided vehicle
22.	TOOLING:	ATC: capacities of 32,48,60, and 90
23.	FEATURES:	
24.	REFERENCES:	83

1.	COUNTRY:	Bulgaria
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki, Fanuc
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	30 MC
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Bulgaria
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	SSHO System
11.	PRODUCTS:	Electric motor shafts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NGR
21.	MATL. HANDLING:	Overhead robot
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	Bulgaria
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	ZMM System, Fanuc licensed NC controls
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Bulgaria
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	76
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	ZMM System (DNC)
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NT
21.	MATL. HANDLING:	2 Robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Kovosvit Sezimovo
3.	LOCATION:	
4.	DIVISION:	ISTU, N.E.
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	IVU 320 System
11.	PRODUCTS:	Flanges and shafts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	5,000
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	120 mm round x 500 mm long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	Average of 39
20.	MACHINE SET:	22 NT, 1 NHM, 1 ND, 1 NHM (off line)
21.	MATL. HANDLING:	Stacker crane
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	41

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Pvazke-Strojirney Works
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	IVU 200 System
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	200 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NHM, 1 NVM, 1 CMM, 1 WS
21.	MATL. HANDLING:	Stacker crane, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	41, 69

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Sezimovo Usti
3.	LOCATION:	Kosovit Plant
4.	DIVISION:	
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	IVU 320 System
11.	PRODUCTS:	Flanges and shafts
12.	MATERIALS:	Carbon steel
13.	NUMBER OF PARTS:	5,500
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	Shafts: 120 mm round x 500 mm long, flanges 50-320 mm rd.
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Crew of 13
19.	LOT SIZE:	Average of 39, minimum of 10
20.	MACHINE SET:	22 NT, 2 NVM, 1 ND
21.	MATL. HANDLING:	Stacker crane
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	41

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Tos Kurim
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	IVU 800 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	800 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	25 maximum
20.	MACHINE SET:	1 NM, 2 MC, 1 NB
21.	MATL. HANDLING:	Stacker crane, 2 carts
22.	TOOLING:	ATC
23.	FEATURES:	
24.	REFERENCES:	41

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Tos Kurim
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	IVU 1250 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1250 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	25 maximum
20.	MACHINE SET:	1 NM, 1 NB, 2 NHM, 1 MC, 2 CMM
21.	MATL. HANDLING:	Stacker crane, 2 carts
22.	TOOLING:	Manual
23.	FEATURES:	
24.	REFERENCES:	41

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Tos Olomonc
3.	LOCATION:	Olomonc
4.	DIVISION:	
5.	SUPPLIER:	Vusco Research Institute
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	ADT 4500 (Czech.)
10.	CONTROLS:	PVS 400 System, NS Series 750, 850, and 920 controls
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	40
14.	PART FAMILIES:	8
15.	PRODUCTION RATE:	52 parts/24 hours
16.	PART CUBE:	400 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Random flow of parts. One manned shift,24 hour operation. Parallel machine centers.
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 2 CMM, 2 WS
21.	MATL. HANDLING:	Stacker crane, ASRS
22.	TOOLING:	ATC: tool magazines linked by automatic tool transfer
23.	FEATURES:	Adaptive control
24.	REFERENCES:	41, 78

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Unknown
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	SKODA
6.	CLASS:	MC
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	SKODA-NC-N System
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	3.5 x 2.24 x 2 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	Vuste Research Institute
3.	LOCATION:	Prague
4.	DIVISION:	
5.	SUPPLIER:	Vuste Research Institute
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	Steel, cast iron, and non-ferrous metals
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	.25 m cube (prismatic), .16 m rd. x .38 m l (rotational)
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	Computer scheduling of work and material transport. Central computer downloads NC programs.
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 2 NT
21.	MATL. HANDLING:	rail guided cart, robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	23

1.	COUNTRY:	Czechoslovakia
2.	COMPANY:	ZPS Gottwaldow
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Tos Kurim
6.	CLASS:	MC
7.	YEAR:	75
8.	FINANCIAL DATA:	15 jobs eliminated, 90% machine utilization acheived
9.	COMPUTER:	
10.	CONTROLS:	IVU 400 System
11.	PRODUCTS:	Machine tool and shoe machinery parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	20,000
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	630 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	Average of 50, range of 10 to 100
20.	MACHINE SET:	10 MC
21.	MATL. HANDLING:	Stacker Crane
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	41

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	7 October
3.	LOCATION:	
4.	DIVISION:	Niles Group
5.	SUPPLIER:	7 October
6.	CLASS:	MC
7.	YEAR:	71
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Rota F125 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	400
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	135,000/year
16.	PART CUBE:	125 mm diameter
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Batch computer schedules with revisions by operator
19.	LOT SIZE:	
20.	MACHINE SET:	1 NT (rough), 3 NT, 2 NM/D, 1 NGR
21.	MATL. HANDLING:	Overhead carousel (270 part capacity), manual load/unload
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	37, 38

1.	COUNTRY:	East Germany
2.	COMPANY:	7 October
3.	LOCATION:	Zerbst
4.	DIVISION:	
5.	SUPPLIER:	7 October
6.	CLASS:	FMS
7.	YEAR:	73
8.	FINANCIAL DATA:	4-5 year payback, 270% increase in productivity
9.	COMPUTER:	Robatron 4000
10.	CONTROLS:	Rota FZ200 System
11.	PRODUCTS:	Gears for machine tools
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	2,000
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	310,000 parts/year
16.	PART CUBE:	60-200 mm diameter
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Batch computer schedules with revisions by operator
19.	LOT SIZE:	Range 10 to 500
20.	MACHINE SET:	16 work stations: 3 NV, 1 NT, 2 NM, + ...
21.	MATL. HANDLING:	Stacker crane, robots for machine loading
22.	TOOLING:	Manual, local to each machine
23.	FEATURES:	Gear hardening equipment planned for 1978
24.	REFERENCES:	14, 37, 38, 39

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	Fritz Heckert
3.	LOCATION:	Gruenbach
4.	DIVISION:	
5.	SUPPLIER:	Fritz Heckert
6.	CLASS:	MC
7.	YEAR:	71
8.	FINANCIAL DATA:	62.8 % cost reduction in sample of 21 parts
9.	COMPUTER:	KRS 4200
10.	CONTROLS:	Prisma 1 System
11.	PRODUCTS:	Machine tool components
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	250 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed sequence of operations for each part
19.	LOT SIZE:	
20.	MACHINE SET:	1 NHM, 1 NVM
21.	MATL. HANDLING:	Carosel at center of cell
22.	TOOLING:	40 per machine tool
23.	FEATURES:	
24.	REFERENCES:	14, 37, 38

1.	COUNTRY:	East Germany
2.	COMPANY:	Fritz Heckert
3.	LOCATION:	Auerbach
4.	DIVISION:	Karl-Marx-Stadt
5.	SUPPLIER:	Fritz Heckert
6.	CLASS:	FMS
7.	YEAR:	72
8.	FINANCIAL DATA:	5 year payback, 75 % machine utilization
9.	COMPUTER:	
10.	CONTROLS:	Prisma 2 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	12
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	8,000 parts/year
16.	PART CUBE:	1 x 1 x 1.5 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Multiple routings with alternate operations generated by computer to balance the work load, crew of 11
19.	LOT SIZE:	
20.	MACHINE SET:	1 NM (rough), 2 NVM, 3 MC, 2 CMM, 2 WS
21.	MATL. HANDLING:	Air cushion conveyor positions pallet to w/i 3 um
22.	TOOLING:	Local to MT, up to 138/MT
23.	FEATURES:	Adaptive control: tool wear, casting dim., plt. position
24.	REFERENCES:	14, 37, 38, 39

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	Herbert Warnke
3.	LOCATION:	Erfurt
4.	DIVISION:	
5.	SUPPLIER:	Fritz Heckert
6.	CLASS:	MC
7.	YEAR:	78
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	PC 1 System
11.	PRODUCTS:	Very large parts for metal forming machines
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NVM (200 mm spindle), 1 NVM (250 mm spindle)
21.	MATL. HANDLING:	Overhead crane
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	39

1.	COUNTRY:	East Germany
2.	COMPANY:	Herbert Warnke
3.	LOCATION:	Erfurt
4.	DIVISION:	
5.	SUPPLIER:	Fritz Heckert, Svoda
6.	CLASS:	FMS
7.	YEAR:	77
8.	FINANCIAL DATA:	Labor savings of 55,000 man-hrs./year, 66% MT utilization
9.	COMPUTER:	Robatron 4000
10.	CONTROLS:	PC 3 System
11.	PRODUCTS:	Large parts for metal presses & brakes
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	120
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	625 parts/ year
16.	PART CUBE:	4 - 7 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Works to a monthly plan, infrequent changes made by the operator, simulation is used in developing the schedule
19.	LOT SIZE:	
20.	MACHINE SET:	5 NVM (250 mm & 160 mm spindles)
21.	MATL. HANDLING:	Rail guided cart with 57 m track and 14 stations
22.	TOOLING:	ATC for each machine
23.	FEATURES:	
24.	REFERENCES:	23, 38, 39

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	Hermann Matern
3.	LOCATION:	Zerbst
4.	DIVISION:	
5.	SUPPLIER:	7 October
6.	CLASS:	FMS
7.	YEAR:	73
8.	FINANCIAL DATA:	
9.	COMPUTER:	2 - KRS 4201's
10.	CONTROLS:	FZ 200 System
11.	PRODUCTS:	Spur gears for lathes
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	200
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	180,000 parts/year
16.	PART CUBE:	60-200 mm round
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	400 maximum
20.	MACHINE SET:	5 NT, 3 NGR, 1 Broaching MT, 9 NG, 1 Burnishing MT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	East Germany
2.	COMPANY:	Saalfeld
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	MAPK 500 System
11.	PRODUCTS:	Drill gearbox, spindle, and base
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	1 Rail guided cart, 2 carousels
22.	TOOLING:	Head changer
23.	FEATURES:	
24.	REFERENCES:	39

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	USSR Import
3.	LOCATION:	
4.	DIVISION:	VEB Rawema
5.	SUPPLIER:	Fritz Heckert
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	FMS 1000 System
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1000 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	19 MT
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	24

1.	COUNTRY:	East Germany
2.	COMPANY:	Umformtechnik
3.	LOCATION:	Erfurt
4.	DIVISION:	
5.	SUPPLIER:	Forschungszentrum
6.	CLASS:	FMS
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	PC 3 System
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1000 mm, 24000 kps
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 NVM
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	
3.	LOCATION:	Dresden
4.	DIVISION:	Agricultural Machinery
5.	SUPPLIER:	Fritz Heckert
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	480 % increase in productivity
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Gear boxes
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 1 WS
21.	MATL. HANDLING:	Rail guided cart, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	24

1.	COUNTRY:	East Germany
2.	COMPANY:	Veb Robur
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	East Germany
2.	COMPANY:	Werkzeugmaschinenkombinat
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	7 October
6.	CLASS:	FMS
7.	YEAR:	73
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	Rotational
17.	PART SHAPE:	
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NV, 1 NT, 2 NM
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	France
2.	COMPANY:	Alsthom Atlantique
3.	LOCATION:	Saint Nazaire
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Diesel engine parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 1 MT, plus 2 auxilliary modules
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 20

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Alsthom Unelec
3.	LOCATION:	Orleans
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/24
10.	CONTROLS:	
11.	PRODUCTS:	AC electric motor parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	12
14.	PART FAMILIES:	4
15.	PRODUCTION RATE:	7,000 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Crew of 2
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 WS
21.	MATL. HANDLING:	1 rail guided cart
22.	TOOLING:	ATC 60 tool capacity
23.	FEATURES:	Probing
24.	REFERENCES:	14, 15, 20

1.	COUNTRY:	France
2.	COMPANY:	Caterpillar
3.	LOCATION:	Grenoble
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Track links
12.	MATERIALS:	Cast steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	2 rototraversing units
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 18

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Caterpillar
3.	LOCATION:	Grenoble
4.	DIVISION:	
5.	SUPPLIER:	Renault/Mandelli
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Renault/Mandelli
11.	PRODUCTS:	Track roller frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Pallet transfer
22.	TOOLING:	
23.	FEATURES:	Probing, adaptive control
24.	REFERENCES:	14

1.	COUNTRY:	France
2.	COMPANY:	Caterpillar
3.	LOCATION:	Grenoble
4.	DIVISION:	
5.	SUPPLIER:	Wotan/Line
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Bosh, Bendix
11.	PRODUCTS:	Track type loader frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Caterpillar
3.	LOCATION:	Grenoble
4.	DIVISION:	
5.	SUPPLIER:	Pegard
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Siemens
11.	PRODUCTS:	Track type case & frame
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	Cart with tow line
22.	TOOLING:	
23.	FEATURES:	Probing, adaptive control
24.	REFERENCES:	14, 18

1.	COUNTRY:	France
2.	COMPANY:	Citroen
3.	LOCATION:	Meudon
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	3.1 year payback period
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Cylinder heads, transmission & differential housings
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	3
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC (five axis), 1 CMM, 1 WS
21.	MATL. HANDLING:	4 AGV's
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Citroen
3.	LOCATION:	Meudon
4.	DIVISION:	
5.	SUPPLIER:	Automatique Industriel
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	Machine utilization 75-80 %
9.	COMPUTER:	Thompson (French Mfg.)
10.	CONTROLS:	
11.	PRODUCTS:	Automobile engine parts
12.	MATERIALS:	Cast iron, steel, aluminum
13.	NUMBER OF PARTS:	80
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	24 hour operation, parts may be processed in random order
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC (5 axis), surface treatment station, 1 CMM, 1 WS
21.	MATL. HANDLING:	AGV
22.	TOOLING:	ATC, central magazine with 600 tools
23.	FEATURES:	
24.	REFERENCES:	65, 66

1.	COUNTRY:	France
2.	COMPANY:	Citroen Construction Mechanique
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Automatique Industriel
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Labor savings, 20 workers vs. 73
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Cylinder heads, gear, differential, and clutch housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	24 hour operation, third shift has 1 worker (10 hrs.), random processing capability, crew size of 9, 8, and 1
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 WS, 1 CMM, 1 surface treating station
21.	MATL. HANDLING:	5 AGV's
22.	TOOLING:	ATC, central magazine with 600 tools
23.	FEATURES:	
24.	REFERENCES:	66

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Iveco
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Berardi S.P.A.
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	France
2.	COMPANY:	Renault
3.	LOCATION:	Saint Priest
4.	DIVISION:	Vehicles Industriels
5.	SUPPLIER:	Renault
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 work stations
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 18

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	France
2.	COMPANY:	Renault
3.	LOCATION:	Le Mans
4.	DIVISION:	Renault Materiel Agricole
5.	SUPPLIER:	Renault
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Agricultural machinery parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MT
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 18

1.	COUNTRY:	France
2.	COMPANY:	Renault Machines Outils
3.	LOCATION:	Boutheon
4.	DIVISION:	Renault Vehicles Industriels
5.	SUPPLIER:	Renault/Graffenstaden
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	Reduced WIP
9.	COMPUTER:	Solar 16.4
10.	CONTROLS:	Renault (SMC)
11.	PRODUCTS:	Gear boxes for trucks
12.	MATERIALS:	Cast iron, aluminum
13.	NUMBER OF PARTS:	3
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	300/day
16.	PART CUBE:	600 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Alternate routings for machine failure in real time
19.	LOT SIZE:	100
20.	MACHINE SET:	4 MC (4-axis), 1 NM, 1 WS
21.	MATL. HANDLING:	8 AGV's
22.	TOOLING:	2 Head changers
23.	FEATURES:	Adaptive control: tool wear adjustment
24.	REFERENCES:	18, 19

1. COUNTRY: France
2. COMPANY: Unic
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Engine base
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 special machines
21. MATL. HANDLING: Cart with towline, robots
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

1. COUNTRY: Hungary
2. COMPANY: Budapest Technical University
3. LOCATION: Budapest
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: CONY 16 System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic & rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC, 4 NT, 1 CMM
21. MATL. HANDLING: 2 Robots
22. TOOLING:
23. FEATURES:
24. REFERENCES: 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Hungary
2.	COMPANY:	Csepel Machine Tool Company
3.	LOCATION:	Budapest
4.	DIVISION:	
5.	SUPPLIER:	Csepel
6.	CLASS:	MC
7.	YEAR:	78
8.	FINANCIAL DATA:	
9.	COMPUTER:	KFKI (Hungarian)
10.	CONTROLS:	CONY 16 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	33
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Alternate routings
19.	LOT SIZE:	
20.	MACHINE SET:	1 WS, 1 CMM, 2 NHM, 1 NVM, 1 NM
21.	MATL. HANDLING:	Rail guided cart, 30 queue buffer, ASRS (400 part cap.)
22.	TOOLING:	ATC
23.	FEATURES:	
24.	REFERENCES:	67, 86

1.	COUNTRY:	Hungary
2.	COMPANY:	EVIG
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Electric motor housings
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	Hungary
2.	COMPANY:	HAFE
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	HAFE
6.	CLASS:	MC
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Gear boxes
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	Hungary
2.	COMPANY:	Szim
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Hungary
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 78
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: BME System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Hungary
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 81
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: Diagon 500 System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Hungary
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 73
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: DNC-73 System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Hungary
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 79
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: FIG System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Hungary
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 80
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: IGYR 630 System
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Italy
2. COMPANY: Bonfiglioli
3. LOCATION: Bologna
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Vehicle parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV
21. MATL. HANDLING: Cart with towline, robot
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Italy
2.	COMPANY:	Cessna
3.	LOCATION:	Treviglio
4.	DIVISION:	
5.	SUPPLIER:	Olivetti
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Plasma
11.	PRODUCTS:	Engine Heads
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	100,000 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 NB, 1 WS
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	Adaptive control, automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	Italy
2.	COMPANY:	Ferrari
3.	LOCATION:	Maranello
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Plasma
11.	PRODUCTS:	Automobile engine components
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	29
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	13 engines/day
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 MC, 2 WS
21.	MATL. HANDLING:	2 rail guided carts, 2 carousels (14 pallets each)
22.	TOOLING:	ATC
23.	FEATURES:	
24.	REFERENCES:	14, 20

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Italy
2.	COMPANY:	Fiat
3.	LOCATION:	Brescia
4.	DIVISION:	Iveco Truck Plant
5.	SUPPLIER:	Jobs
6.	CLASS:	MC
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Drive Shafts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	15 parts/hour
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 SP, 1 NB
21.	MATL. HANDLING:	Robot
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 20

1.	COUNTRY:	Italy
2.	COMPANY:	Fiat
3.	LOCATION:	Turin
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Wheel hubs
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NV
21.	MATL. HANDLING:	Robot
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Italy
2.	COMPANY:	Fiat
3.	LOCATION:	Turin
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Universal joints
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 NV
21.	MATL. HANDLING:	Robots, cart with towline
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	Italy
2.	COMPANY:	Fiat Trattori
3.	LOCATION:	Modena
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Transmission housing
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Italy
2. COMPANY: Goldoni
3. LOCATION: Capri
4. DIVISION:
5. SUPPLIER: Berardi
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Tractor body parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 9 parts/3.5 hours
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING: Roller conveyor
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Italy
2. COMPANY: IBM Italia
3. LOCATION: Milan
4. DIVISION:
5. SUPPLIER: Mandelli
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Terminal parts
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1.	COUNTRY:	Italy
2.	COMPANY:	Iveco Brescia
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Covers and gear boxes
12.	MATERIALS:	Aluminum, cast iron
13.	NUMBER OF PARTS:	7
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	220 parts/15 hours
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	10 MT, 1 WS
21.	MATL. HANDLING:	Robots
22.	TOOLING:	Head changer
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 70

1.	COUNTRY:	Italy
2.	COMPANY:	Lamborghini
3.	LOCATION:	Pieve di Centro
4.	DIVISION:	
5.	SUPPLIER:	Berardi
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Engine parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	44
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Italy
2.	COMPANY:	Mandelli
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/23,24,34
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	62
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1.85 x 1.2 x .45 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Two shifts with crew of 4, one shift unmanned
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC, 1 WS, 1 CMM
21.	MATL. HANDLING:	1 rail guided cart, carousel with 20 pallet capacity
22.	TOOLING:	ATC: 120 tool capacity
23.	FEATURES:	Automated inspection
24.	REFERENCES:	20

1.	COUNTRY:	Italy
2.	COMPANY:	Maserati
3.	LOCATION:	Modena
4.	DIVISION:	
5.	SUPPLIER:	Olivetti
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Engine components
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	200 parts/day
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	10 MC, 1 WS
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Italy
2.	COMPANY:	Nuova Innocenti
3.	LOCATION:	Milan
4.	DIVISION:	
5.	SUPPLIER:	Berardi
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Engine heads
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing
24.	REFERENCES:	14

1.	COUNTRY:	Italy
2.	COMPANY:	Nuovo Pignone
3.	LOCATION:	Florence
4.	DIVISION:	
5.	SUPPLIER:	Mandelli
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Turbine impellers
12.	MATERIALS:	
13.	NUMBER OF PARTS:	17
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	1 part/3 hours
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Italy
2.	COMPANY:	OM
3.	LOCATION:	Brescia
4.	DIVISION:	
5.	SUPPLIER:	Jobs
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Beveling shaft gears
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	120 parts/hour
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 SP
21.	MATL. HANDLING:	AGV, Robot
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing
24.	REFERENCES:	14

1.	COUNTRY:	Italy
2.	COMPANY:	Piaggio Gilera
3.	LOCATION:	Genoa
4.	DIVISION:	
5.	SUPPLIER:	Berardi
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Motorcycle castings
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 WS
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	14

1. COUNTRY: Italy
2. COMPANY: Piaggio Gilera
3. LOCATION: Genoa
4. DIVISION:
5. SUPPLIER: Berardi
6. CLASS: FTL
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Engine heads
12. MATERIALS: Cast iron
13. NUMBER OF PARTS: 4
14. PART FAMILIES: 1
15. PRODUCTION RATE: 1 part/2 hours
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 8 MC
21. MATL. HANDLING: Roller conveyor
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Italy
2. COMPANY: Rockwell CVC Omevi
3. LOCATION: Cameri
4. DIVISION:
5. SUPPLIER: Mandelli
6. CLASS: FTL
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Truck differential carriers
12. MATERIALS: Cast iron
13. NUMBER OF PARTS: 2
14. PART FAMILIES: 1
15. PRODUCTION RATE: 7.6/hour
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC, 1 CMM, 1 WS
21. MATL. HANDLING: 2 rail guided carts, robots, carousel with 18 pallets
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 20

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Italy
2. COMPANY: Rockwell Iveco
3. LOCATION: Novara
4. DIVISION:
5. SUPPLIER: Mandelli
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Truck differential carriers
12. MATERIALS: Cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 15

1. COUNTRY: Italy
2. COMPANY: Rockwell Italia
3. LOCATION: Cameri
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Differential parts
12. MATERIALS: Cast Iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 62,300 parts/year
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV
21. MATL. HANDLING: Cart with towline, robot
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

1. COUNTRY: Italy
2. COMPANY: Rockwell Italia
3. LOCATION: Cameri
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Bearing boxes
12. MATERIALS: Cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 44,500 parts/year
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV
21. MATL. HANDLING: Cart with towline, robot
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

1. COUNTRY: Italy
2. COMPANY: Savio
3. LOCATION: Genoa
4. DIVISION:
5. SUPPLIER: Berardi
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC, 1 WS
21. MATL. HANDLING: Roller conveyor
22. TOOLING:
23. FEATURES: Cental coolant
24. REFERENCES: 14

1. COUNTRY: Italy
2. COMPANY:
3. LOCATION: Di Tomazo
4. DIVISION:
5. SUPPLIER: Berardi
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 8 MC
21. MATL. HANDLING: Roller conveyor, 8 robots
22. TOOLING:
23. FEATURES:
24. REFERENCES: 18

1. COUNTRY: Italy
2. COMPANY: VM
3. LOCATION: Ceto
4. DIVISION:
5. SUPPLIER: Jobs
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Drive shafts
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 4 parts/2.5 minutes
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV, 2 NM
21. MATL. HANDLING: Robots
22. TOOLING:
23. FEATURES: Automated inspection, probing
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY: Asian Kogyo
3. LOCATION: Anjyo
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 6 NC piercing machines
21. MATL. HANDLING: 2 robots
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Atsugi Jidasha Buhin
3. LOCATION: Akita
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 81
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 1 MC, 2 MT
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Brother Industries
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Toshiba
6. CLASS: FMS
7. YEAR: 80
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Typewriter, sewing machine parts
12. MATERIALS:
13. NUMBER OF PARTS: 6
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING: Crew of 2
19. LOT SIZE: 50 average
20. MACHINE SET: 22 DNC MT's
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 86

1. COUNTRY: Japan
2. COMPANY: Cannon
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Okuma
6. CLASS: MC
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Camera and VCR parts
12. MATERIALS: Aluminum
13. NUMBER OF PARTS: 40
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 6 NT (2 duplicate cells)
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 75

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY: Daifu Kiko
3. LOCATION: Osaka
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC
21. MATL. HANDLING: AGV, ASRS
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Fuji Denki Seico
3. LOCATION: Suzuka
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV, 1 MC
21. MATL. HANDLING: 3 automatic loaders
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1.	COUNTRY:	Japan
2.	COMPANY:	Fuji Xerox
3.	LOCATION:	Ebina
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Parts for copy machines
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Japan
2.	COMPANY:	Fujitsu Fanuc
3.	LOCATION:	Fuji
4.	DIVISION:	
5.	SUPPLIER:	Fuji Electric
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Robots, EDM machines, small CNC lathes
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	450
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	Unmanned night shift, crew of 4
19.	LOT SIZE:	
20.	MACHINE SET:	30 MT's, CO2 laser for hardening
21.	MATL. HANDLING:	4 AGV's, ASRS, robots, and carousels
22.	TOOLING:	
23.	FEATURES:	Probing, closed circuit TV
24.	REFERENCES:	7, 12, 14, 18, 51

1. COUNTRY: Japan
2. COMPANY: Fujutsu Fanuc
3. LOCATION: Fuji
4. DIVISION:
5. SUPPLIER: Fanuc
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA: $37 million plant, labor savings: 60 workers vs. 300
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Electric motors
12. MATERIALS:
13. NUMBER OF PARTS: 900
14. PART FAMILIES:
15. PRODUCTION RATE: 120,000 parts/year
16. PART CUBE:
17. PART SHAPE: Prismatic and rotational
18. OPERATION SCHEDULING:
19. LOT SIZE: Range of 20 to 1,000
20. MACHINE SET: 60 MT's
21. MATL. HANDLING: AGV's, 52 robots (plus 49 used in assembly), ASRS
22. TOOLING:
23. FEATURES:
24. REFERENCES: 7, 12, 69

1. COUNTRY: Japan
2. COMPANY: Fujitsu Fanuc
3. LOCATION: Oshino
4. DIVISION:
5. SUPPLIER: Fanuc
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Plastic injection molding machine parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 11 NHM (Makino), 2 NVM (Makino)
21. MATL. HANDLING: AGV's
22. TOOLING:
23. FEATURES:
24. REFERENCES: 7, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Fujitsu Fanuc
3.	LOCATION:	Oshino
4.	DIVISION:	
5.	SUPPLIER:	Fanuc
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	90 % savings in number of MT's and number of workers
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Plastic injection molding machine parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 NT, 1 GR, 1 NM, 1 SP, 1 ND
21.	MATL. HANDLING:	Robots, AGV's
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 12, 14, 18

1.	COUNTRY:	Japan
2.	COMPANY:	Fukushimo Seisakusha
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Low pressure hydraulic devices
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational and prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 NT, 1 NV, 1 NM
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Hitachi Seiki
3.	LOCATION:	Abiko
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	3.7 year payback period, jobs reduced from 9 to 4
9.	COMPUTER:	NEC MS8
10.	CONTROLS:	Fanuc 6MB CNC's
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	79
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	60 x 100 in plate
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NHM (Hitachi, # 112 line)
21.	MATL. HANDLING:	1 rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Hitachi Seiki
3.	LOCATION:	Abiko
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	4.1 year payback period, 4 MT's vs 8
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	131
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 mm x 500 mm pallets
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shift operation with 2,000 machine hours per month
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM, 2 NVM (# 113 line)
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	ATC with a robot, 528 tools in the system
23.	FEATURES:	
24.	REFERENCES:	7, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Hitachi Seiki
3.	LOCATION:	Abiko
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	3.6 year payback, 4 MT's vs. 7, jobs reduced from 12 to 5
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	468
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	1600 machine hours per month
19.	LOT SIZE:	Maximum of 20
20.	MACHINE SET:	3 NT, 1 NHM (# 114 line)
21.	MATL. HANDLING:	4 robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Hitachi Seiko
3.	LOCATION:	Ebina
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	Hitachi M1002H
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	10
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 x 500 mm pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NHM, 1 NVM
21.	MATL. HANDLING:	1 rail guided cart
22.	TOOLING:	ATC with capacities of 40 and 60
23.	FEATURES:	Machine vision, pallet ID
24.	REFERENCES:	7

1. COUNTRY: Japan
2. COMPANY: Ishikawajima Harima
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Japanese National Project
3. LOCATION: Tsukuba Science City
4. DIVISION: MITI - Agency of Science & Technology
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Gearboxes, diesel engine components
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE: 300 mm
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 3 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 77

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY: Kawakami Seisakusho
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 GR, 1 NV, 1 power press
21. MATL. HANDLING: Robot for power press
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Kawaski Heavy Industries
3. LOCATION: Nishi-Kobi
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 75
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Valve casting - radial piston engine
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 1NV, 2 NT, 3NM, 4ND
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1.	COUNTRY:	Japan
2.	COMPANY:	Kitagoe Kogyo
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Compressor parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Japan
2.	COMPANY:	Komatsu Seisakusho
3.	LOCATION:	Awazu
4.	DIVISION:	Komatsu
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	76
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Bulldozer transmission parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	106
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Crew of 6
19.	LOT SIZE:	Average of 16
20.	MACHINE SET:	1 NM, 2 NV, 4 spline hobbing machines
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Makino Milling Machine Co.
3.	LOCATION:	Atsugi
4.	DIVISION:	
5.	SUPPLIER:	Makino
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	Univac AGS2400F
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	500
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	270 parts/day
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shift operation
19.	LOT SIZE:	
20.	MACHINE SET:	10 MC (Makino)
21.	MATL. HANDLING:	5 AGV's, ASRS
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	7, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Mike Pulley
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Conveyor parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NV, 1 GR
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1. COUNTRY: Japan
2. COMPANY: Mitsubishi Electric Co.
3. LOCATION: Inagwa
4. DIVISION:
5. SUPPLIER: Mitsubishi
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Machined sheet metal parts
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Mitsubishi Heavy Industries
3. LOCATION: Kyoto
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS: 120
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 5 MC
21. MATL. HANDLING: Air cushion AGV, air cushion conveyor
22. TOOLING: ATC with capacities of 60 and 90, 100 tools in system
23. FEATURES:
24. REFERENCES: 7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Mitsubishi Heavy Industries
3.	LOCATION:	Kyoto
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	12 CNC (boring, turning, and grinding operations)
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	Mori Seiki
3.	LOCATION:	Iga
4.	DIVISION:	
5.	SUPPLIER:	Mori Seiki
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	Machine utilization 93%, 13 MT's vs. 54
9.	COMPUTER:	Hitachi E800
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	22 24-hour days are scheduled every month, 3 workers on first shift, none on second or third
19.	LOT SIZE:	
20.	MACHINE SET:	9 NVM (Mori Seiki), 4 NHM (Toyada)
21.	MATL. HANDLING:	16 AGV's, ASRS, linear 14 station queue
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Murata Machinery
3.	LOCATION:	Nihon Denki
4.	DIVISION:	Tamagwa
5.	SUPPLIER:	Murata
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Sheet metal chasis cover
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 turret presses, 2 cutting machines
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Japan
2.	COMPANY:	Murata Machinery
3.	LOCATION:	Inuyama
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	260 % increase in productivity, 20 to 30 workers vs. 100
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Textile machinery, AGV's
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	150
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	2 10-hour shifts
19.	LOT SIZE:	
20.	MACHINE SET:	3 NHM, 4 NVM
21.	MATL. HANDLING:	Robots, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Niigata Engineering
3.	LOCATION:	Niigata
4.	DIVISION:	Diesel Engine Works
5.	SUPPLIER:	Niigata Engineering
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	Hitachi
10.	CONTROLS:	
11.	PRODUCTS:	Cylinder heads
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	80
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	36 x 24 x 12 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shifts, 21 hours per day, in event of machine breakdown the computer assigns alternate operations in real time
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC
21.	MATL. HANDLING:	Roller conveyor, 1 rail guided cart
22.	TOOLING:	
23.	FEATURES:	Acoustic emmisions for adaptive control
24.	REFERENCES:	7, 14, 45

1.	COUNTRY:	Japan
2.	COMPANY:	Niigata Engineering
3.	LOCATION:	Niigata
4.	DIVISION:	Niigata Machine Tool Works
5.	SUPPLIER:	Niigata
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	70
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 NHM, 1 NM, 1 NV (all Toshiba)
21.	MATL. HANDLING:	2 AGV's, ASRS
22.	TOOLING:	ATC with capacities of 60 & 90, 700 tools in system
23.	FEATURES:	
24.	REFERENCES:	7, 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Okuma
3.	LOCATION:	Oguchi
4.	DIVISION:	
5.	SUPPLIER:	Okuma
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	1.9 year payback, 60% labor savings, 75 % utilization
9.	COMPUTER:	Campus 5000
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool headstocks, taulstocks, and saddles
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	95
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shifts with crew of 3, 1 shift unmanned
19.	LOT SIZE:	
20.	MACHINE SET:	7 MC (Okuma)
21.	MATL. HANDLING:	1 AGV
22.	TOOLING:	ATC
23.	FEATURES:	Adaptive control
24.	REFERENCES:	7, 51, 69, 75

1.	COUNTRY:	Japan
2.	COMPANY:	Osaka Kiko
3.	LOCATION:	Inuyama
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	65
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	2 shifts plus
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM, 1 NVM, (all OKK)
21.	MATL. HANDLING:	1 rail guided cart
22.	TOOLING:	ATC with capacity of 120 tools per machine
23.	FEATURES:	Acoustic emmissions monitoring for adaptive control
24.	REFERENCES:	7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Shin Nippon Koki
3.	LOCATION:	Osaka
4.	DIVISION:	Shinodayama Works
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	Mitsubishi Melcom 7030
10.	CONTROLS:	
11.	PRODUCTS:	Machine center and planner parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	250
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	28 x 28 x 20 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shifts, with unmanned night shift
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM, 2 NVM, 1 CMM, (all SNK)
21.	MATL. HANDLING:	1 rail guided cart, ASRS
22.	TOOLING:	
23.	FEATURES:	Acoustic emmissions monitoring for adaptive control
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	Shinmeiwa Kogyo
3.	LOCATION:	Takarazuka
4.	DIVISION:	
5.	SUPPLIER:	Shinmeiwa
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Robot and machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Unmanned night shift
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 51

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Shinmeiwa Kogyo
3.	LOCATION:	Takarazuka
4.	DIVISION:	
5.	SUPPLIER:	Shinmeiwa
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool, aircraft parts
12.	MATERIALS:	Steel, cast iron, and aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Unmanned operation at night
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Adaptive control
24.	REFERENCES:	14, 51

1.	COUNTRY:	Japan
2.	COMPANY:	Shinodayama
3.	LOCATION:	Osaka
4.	DIVISION:	
5.	SUPPLIER:	Shi Nippon Koki
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Melcon 70/30
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Rail guided cart, ASRS
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY:
3. LOCATION: China
4. DIVISION:
5. SUPPLIER: Sunitomo Jyuki Kogyo
6. CLASS: FMS
7. YEAR: 79
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Power shovel parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES: 1 welding robot
24. REFERENCES: 14

1. COUNTRY: Japan
2. COMPANY: Takisawa Machine Tool
3. LOCATION: Okayama
4. DIVISION:
5. SUPPLIER: Takisawa
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER: IBM System 38
10. CONTROLS: IBM S-1 Process Computer
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 3 MC (Takisawa)
21. MATL. HANDLING: 1 AGV
22. TOOLING:
23. FEATURES:
24. REFERENCES: 7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Takisawa Machine Tool
3.	LOCATION:	Okayama
4.	DIVISION:	
5.	SUPPLIER:	Takisawa
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	IBM System 38
10.	CONTROLS:	IBM S-1 Process Computer
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC (Takisawa)
21.	MATL. HANDLING:	1 AGV, ASRS with 570 locations
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	Tokyo Shibaura Denki
3.	LOCATION:	Fuchu
4.	DIVISION:	
5.	SUPPLIER:	Toshiba
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Switches
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC, 8 NV
21.	MATL. HANDLING:	AGV, robots, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Machine Co.
3.	LOCATION:	Fuchu
4.	DIVISION:	
5.	SUPPLIER:	Toshiba
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Labor savings: 7 workers vs. 75
9.	COMPUTER:	Toshiba
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	3,000
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC, 8 NT
21.	MATL. HANDLING:	1 AGV, 2 robots, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	69

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba
3.	LOCATION:	Numazu
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	FMS T5003
10.	CONTROLS:	Tosunuc 500
11.	PRODUCTS:	Machine tool and textile parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NHM, 1 NVM
21.	MATL. HANDLING:	ASRS, carousel (16 locations)
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 51

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Machine Company
3.	LOCATION:	Numazu
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	Toshiba
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM, 1 CMM, 1 WS, honing machine
21.	MATL. HANDLING:	ASRS
22.	TOOLING:	ATC 120 tool capacity
23.	FEATURES:	Automated inspection
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Machine Company
3.	LOCATION:	Numazu
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	630 x 630 mm pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM, 1 NVM
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Machine Tool Company
3.	LOCATION:	Numazu
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	T-5003 System
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	630 x 630 mm pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NHM
21.	MATL. HANDLING:	Carousel with 20 positions
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Machine Company
3.	LOCATION:	Numazu
4.	DIVISION:	
5.	SUPPLIER:	Toshiba Machine
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Injection molding machine parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Toshiba Tungaloy Company
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Toshiba Machine
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	6 MT vs. 50, 16 workers vs. 70, and 4 vs. 16 wk lead time
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Carbide cutting tools
12.	MATERIALS:	Carbide tool materials
13.	NUMBER OF PARTS:	3600
14.	PART FAMILIES:	10
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	Crew of 8, unmanned night shift
19.	LOT SIZE:	Average of 5
20.	MACHINE SET:	4 MC, 1 GR, 1 NV
21.	MATL. HANDLING:	No inter-machine transfer, multiple pallets on machine
22.	TOOLING:	
23.	FEATURES:	Automated inspection, tool wear monitoring
24.	REFERENCES:	14, 19, 51, 86

1.	COUNTRY:	Japan
2.	COMPANY:	Toyada Machine Works
3.	LOCATION:	Kariya
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY: Toyada Machine Works
3. LOCATION: Okazaka
4. DIVISION:
5. SUPPLIER:
6. CLASS: MC
7. YEAR: 81
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS: 1,500
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING: Crew of 12
19. LOT SIZE: Average of 5
20. MACHINE SET:
21. MATL. HANDLING: 15 DNC
22. TOOLING:
23. FEATURES:
24. REFERENCES: 7, 12, 86

1. COUNTRY: Japan
2. COMPANY: Toyota Tipros
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Toyota
6. CLASS: FMS
7. YEAR: 73
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Engine components
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 9,600 parts/year
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING: Each part stops at each spur in the conveyor
Crew of 4
19. LOT SIZE: 100
20. MACHINE SET: 1 MC, 8 MT's
21. MATL. HANDLING: Roller conveyor
22. TOOLING:
23. FEATURES:
24. REFERENCES: 35, 38

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Tsugami
3.	LOCATION:	Nagaoka
4.	DIVISION:	
5.	SUPPLIER:	Tsugami
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	200
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NHM (Tsugami)
21.	MATL. HANDLING:	Overhead conveyor
22.	TOOLING:	ATC with capacity of 164
23.	FEATURES:	
24.	REFERENCES:	7

1.	COUNTRY:	Japan
2.	COMPANY:	
3.	LOCATION:	Inuyama
4.	DIVISION:	
5.	SUPPLIER:	Osaka Kiko
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Yamatake Honeywell
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FMS
7.	YEAR:	72
8.	FINANCIAL DATA:	Job reduction from 40 to 5
9.	COMPUTER:	Fujutsu Fanuc
10.	CONTROLS:	
11.	PRODUCTS:	1.5 - 6 inch flow control valve housings
12.	MATERIALS:	Cast iron, steel, stainless steel
13.	NUMBER OF PARTS:	400
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	4,000 parts/month
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Parts designed for equal cycle times, fixed path flows
19.	LOT SIZE:	10
20.	MACHINE SET:	7 MC, 1 WS
21.	MATL. HANDLING:	Roller conveyor, ASRS
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	14, 35, 51, 86

1.	COUNTRY:	Japan
2.	COMPANY:	Yamazaki Machinery
3.	LOCATION:	Aichi
4.	DIVISION:	
5.	SUPPLIER:	Yamazaki
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	2.5 year payback
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Large MT parts for NT, MC
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	74
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	5,400 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	24 hour, 6 day schedule, with 3rd shift unmanned, crew of 3
19.	LOT SIZE:	
20.	MACHINE SET:	8 MT (A line)
21.	MATL. HANDLING:	2 AGV's
22.	TOOLING:	ATC, 2 drums per MT
23.	FEATURES:	
24.	REFERENCES:	51, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Yamazaki Machinery Works
3.	LOCATION:	Aichi
4.	DIVISION:	
5.	SUPPLIER:	Yamazaki
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	2.5 year payback
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Large machine tool parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	74
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	6,744 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	24 hour, 6 day schedule with 3rd shift unmanned, crew of 3
19.	LOT SIZE:	
20.	MACHINE SET:	10 MT's (B line)
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	51, 69

1.	COUNTRY:	Japan
2.	COMPANY:	Yamazaki Machinery Works
3.	LOCATION:	Mino-Kamo
4.	DIVISION:	
5.	SUPPLIER:	Yamazaki
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	CNC lathes
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	543
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	88 MT, 60 of which are CNC
21.	MATL. HANDLING:	30 robots, AGV's
22.	TOOLING:	
23.	FEATURES:	Adaptive control using acoustic emmissions
24.	REFERENCES:	7, 14, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Yamazaki Machinery Works
3.	LOCATION:	Oguchi
4.	DIVISION:	
5.	SUPPLIER:	Yamazaki
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	75 % reduction in the number of MT's needed
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Headstocks for MC's
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	23
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	800 parts/month
16.	PART CUBE:	40 x 40 in pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shift operation, 3rd shift unmanned, crew of 2
19.	LOT SIZE:	
20.	MACHINE SET:	8 NHM (Yamazaki)
21.	MATL. HANDLING:	Rail guided carts, robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 12, 14

1.	COUNTRY:	Japan
2.	COMPANY:	Yamazaki Machinery Works
3.	LOCATION:	Oguchi
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Beds, bases, columns for MT's
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	350
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	650 parts/month
16.	PART CUBE:	63 x 118 inch pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shift operation, crew of 4
19.	LOT SIZE:	
20.	MACHINE SET:	7 NVM, 3 NHM, (all Yamazaki)
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	7, 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Japan
2.	COMPANY:	Yanmar Diesel
3.	LOCATION:	Amagaski
4.	DIVISION:	
5.	SUPPLIER:	Hitachi Seiki
6.	CLASS:	FTL
7.	YEAR:	72
8.	FINANCIAL DATA:	Labor reduction 12 to 1, cost reduction of 23 %
9.	COMPUTER:	Fujitsu Fanuc T-0 K-0
10.	CONTROLS:	
11.	PRODUCTS:	Cylinder heads
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	8
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	10,800
16.	PART CUBE:	2 x 1.5 x 2 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed sequence determined by operator at time of loading, crew of 1
19.	LOT SIZE:	Average of 3
20.	MACHINE SET:	5 MC
21.	MATL. HANDLING:	Roller conveyor loop with spurs
22.	TOOLING:	ATC with capacity of 160
23.	FEATURES:	
24.	REFERENCES:	35, 38, 86

1.	COUNTRY:	Japan
2.	COMPANY:	Yanmar Group
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Makino
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Japan
2. COMPANY: Yanmar Group
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Norway
2. COMPANY: University of Trondheim
3. LOCATION:
4. DIVISION: SINTEF
5. SUPPLIER: University of Trondheim
6. CLASS: MC
7. YEAR: 78
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic and rotational
18. OPERATION SCHEDULING: Control computer attempts to optimize operations
19. LOT SIZE:
20. MACHINE SET: 1 MC, 1 NM, 1 NT, 1 ND
21. MATL. HANDLING: 1 robot at the center of the cell
22. TOOLING:
23. FEATURES:
24. REFERENCES: 52

1. COUNTRY: Poland
2. COMPANY: Stalowa Wola
3. LOCATION:
4. DIVISION:
5. SUPPLIER: 7 October
6. CLASS: FMS
7. YEAR: 81
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: Rota FZ200
11. PRODUCTS: Gears for trucks, construction, and agricultural uses
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 400,000 parts/year
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 52 work stations (see East German Rota FZ200 systems)
21. MATL. HANDLING: Stacker crane, roller conveyor
22. TOOLING:
23. FEATURES:
24. REFERENCES: 37, 86

1. COUNTRY: Poland
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER: CBKO (Design & Research Center for Machine Tools)
6. CLASS: MC
7. YEAR: 77
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: KOR-1 System
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 to 5 MC's
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1.	COUNTRY:	Poland
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	7 October
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Rota FZ200 System
11.	PRODUCTS:	Gears
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	(See East German Systems)
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	37

1.	COUNTRY:	Poland
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	CBKO (Design & Research Center for Machine Tools)
6.	CLASS:	MC
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	TOR-1 System
11.	PRODUCTS:	Shafts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Poland
2. COMPANY:
3. LOCATION:
4. DIVISION:
5. SUPPLIER: CBKO (Design & Research Center for Machine Tools)
6. CLASS: MC
7. YEAR: 78
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: TOR-1M System
11. PRODUCTS: Shafts
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NT
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

1. COUNTRY: Rumania
2. COMPANY: Bucharest R & D Institute for Automation
3. LOCATION: Bucharest
4. DIVISION:
5. SUPPLIER: Bucharest R & D Institute
6. CLASS: FMS
7. YEAR: 79
8. FINANCIAL DATA:
9. COMPUTER: Felix C32 (Rumanian under French license)
10. CONTROLS: AEC, GE, Cesla, and Sperry
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 7 MT
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	South Korea
2.	COMPANY:	Tongil Company
3.	LOCATION:	Kyungnam
4.	DIVISION:	
5.	SUPPLIER:	Fanuc
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Fanuc
11.	PRODUCTS:	Machine tool and automative parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	30
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	4,500 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	Probing, self contained coolant
24.	REFERENCES:	14

1.	COUNTRY:	Sweeden
2.	COMPANY:	AB Hydron
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	MC
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	50
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	175 minimum
20.	MACHINE SET:	2 NT, 2 ND, 1 WS, 1 Press
21.	MATL. HANDLING:	Robot, conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Sweeden
2.	COMPANY:	ASEA
3.	LOCATION:	Ludvika
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	23

1.	COUNTRY:	Sweeden
2.	COMPANY:	ASEA
3.	LOCATION:	Vastarras
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Electric motor parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	18
14.	PART FAMILIES:	3
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	1 manned shift, 2 unmanned shifts
19.	LOT SIZE:	200 minimum
20.	MACHINE SET:	1 NT, 1 rotary grinder, 2 turret drills
21.	MATL. HANDLING:	Conveyor with internal storage, 1 robot
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 52

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Sweeden
2. COMPANY: Alo-Maskiner
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Sweeden
2. COMPANY: Atlas-Copco
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Sweeden
2.	COMPANY:	BT (AB BYGG-och Transport)
3.	LOCATION:	Mjolby
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Materials handling, ASRS, and AGV systems
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Pallets enter system following operator request via CRT
19.	LOT SIZE:	
20.	MACHINE SET:	20 NC MT's, 23 CNC MT's
21.	MATL. HANDLING:	Stacker crane, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	3, 4, 69

1.	COUNTRY:	Sweeden
2.	COMPANY:	Benzler Production AB
3.	LOCATION:	Norrkoping
4.	DIVISION:	
5.	SUPPLIER:	Sajo, Benzler provided the systems integration
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 1 MT, 1 cutting machine
21.	MATL. HANDLING:	Benzler AGV
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Sweeden
2.	COMPANY:	Bofors
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	23

1.	COUNTRY:	Sweeden
2.	COMPANY:	Bygg & Transportekonomi DB BT
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Japanese MC's, West German NV's
6.	CLASS:	FMS
7.	YEAR:	78
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Saab
11.	PRODUCTS:	Material handling systems parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 NV
21.	MATL. HANDLING:	Roller conveyor, stacker crane
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1. COUNTRY: Sweeden
2. COMPANY: C. E. Johansson Aktiebolag FFV-CEJ
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Sweeden
2. COMPANY: Electrolux AB
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Sweeden
2.	COMPANY:	Esab AB
3.	LOCATION:	Laxa
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 2 NT, 2 NM
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	3, 4, 14

1.	COUNTRY:	Sweeden
2.	COMPANY:	Hiab Foco
3.	LOCATION:	Skelleftea
4.	DIVISION:	
5.	SUPPLIER:	SMT Machine Company
6.	CLASS:	MC
7.	YEAR:	81
8.	FINANCIAL DATA:	45 % cost reduction
9.	COMPUTER:	No host
10.	CONTROLS:	NC for each machine
11.	PRODUCTS:	Cylinder heads, pistons
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	22 parts/hour
16.	PART CUBE:	45-160 mm
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	175 minimum
20.	MACHINE SET:	2 NT, 1 ND, 1 WS, 1 CMM, 1 hydraulic press
21.	MATL. HANDLING:	Conveyor, Electrolux robots
22.	TOOLING:	
23.	FEATURES:	Press fit of bearing
24.	REFERENCES:	31

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Sweeden
2. COMPANY: Kochums Mekaniska Verkstads AB
3. LOCATION:
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Sweeden
2. COMPANY: Saab-Scania AB
3. LOCATION: Sodertalje
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA: 3 year payback
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Gearbox mainshafts
12. MATERIALS: Steel
13. NUMBER OF PARTS: 8
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE: 300-700
20. MACHINE SET: 1 NT, 2 ND, 2 NG
21. MATL. HANDLING: Conveyor system
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 31

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Sweeden
2. COMPANY: Samefa
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Niigata
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC, 1 MT, 1 cutting machine
21. MATL. HANDLING: BT AGV
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: Sweeden
2. COMPANY: Seco Tools
3. LOCATION: Arbogo
4. DIVISION:
5. SUPPLIER: Saab
6. CLASS: MC
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Special tool for external turning
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 1 MC
21. MATL. HANDLING: Rotary table, robot for deburring
22. TOOLING:
23. FEATURES: Probing
24. REFERENCES: 14

1.	COUNTRY:	Sweeden
2.	COMPANY:	Sundsvalle Verkstader
3.	LOCATION:	Orebo
4.	DIVISION:	
5.	SUPPLIER:	Japanese MT's, BT installation
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Glass making machinery
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 69

1.	COUNTRY:	Sweeden
2.	COMPANY:	Volvo
3.	LOCATION:	Koping
4.	DIVISION:	Heavy Engineering Division
5.	SUPPLIER:	Volvo
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Truck transmission parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	22 transmissions
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	Range from 200 to 600
20.	MACHINE SET:	4 MC, 1 NM, 1 multi-headed spindle MT
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Sweeden
2.	COMPANY:	Volvo
3.	LOCATION:	Skovde
4.	DIVISION:	Components Division
5.	SUPPLIER:	Japanese Firm
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Intake Manifold
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 SP, 3 MC, 1 ND, drying station
21.	MATL. HANDLING:	
22.	TOOLING:	2 head indexers
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Sweeden
2.	COMPANY:	Volvo
3.	LOCATION:	Skovde
4.	DIVISION:	Components Division
5.	SUPPLIER:	Volvo
6.	CLASS:	FTL
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11
10.	CONTROLS:	
11.	PRODUCTS:	Heavy diesel crank shafts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	2
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	2,000
20.	MACHINE SET:	3 NT, 2 NM, balancing machine (4 cells)
21.	MATL. HANDLING:	3 AGV's, 3 gantry cranes
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 47, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Switzerland
2.	COMPANY:	Bobst & Fils SA
3.	LOCATION:	Pausanne-Prilly
4.	DIVISION:	
5.	SUPPLIER:	Forest (French)
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Printing & packaging machine parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MT
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	Switzerland
2.	COMPANY:	Brown Boveri
3.	LOCATION:	Scharmann
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	Sinumeric 8MC
11.	PRODUCTS:	Turbocharger parts
12.	MATERIALS:	Cast iron, aluminum
13.	NUMBER OF PARTS:	100
14.	PART FAMILIES:	5
15.	PRODUCTION RATE:	
16.	PART CUBE:	1 x 1 x 1.2 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	3 shift operation, 1 man crew
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 1 WS
21.	MATL. HANDLING:	2 AGV
22.	TOOLING:	ATC with capacity of 80
23.	FEATURES:	
24.	REFERENCES:	14, 79

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Switzerland
2. COMPANY: Sulzer Brothers
3. LOCATION: Zuchwil
4. DIVISION:
5. SUPPLIER: Fischer, Burkhardt & Weber
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: High speed weaving machine parts
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 12 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 69

1. COUNTRY: Taiwan
2. COMPANY: Lian Feng Machine
3. LOCATION: Feng Yuan
4. DIVISION:
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: Fanuc
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING: Rail guided cart
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: Taiwan
2. COMPANY: Mechanical Industries Research Laboratory
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Mechanical Industries Research Laboratory
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS: Allen Bradley
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NHM
21. MATL. HANDLING: AGV
22. TOOLING:
23. FEATURES: Probing, automated inspection, part washing
24. REFERENCES: 14

1. COUNTRY: Taiwan
2. COMPANY: ORC Speicer
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Speicer
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING: 2 carriers
22. TOOLING:
23. FEATURES: Probing
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	Taiwan
2.	COMPANY:	Taichung Precision Machinery
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	87
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NT, 2 NVM, 1 NHM
21.	MATL. HANDLING:	1 robot, conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	UK
2.	COMPANY:	Anderson Strathclyde PLC
3.	LOCATION:	Motherwell, Scotland
4.	DIVISION:	
5.	SUPPLIER:	Giddings & Lewis, Fraser
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Coal cutters
12.	MATERIALS:	Steel castings
13.	NUMBER OF PARTS:	14
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	4 x 6 ft pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	AGV
22.	TOOLING:	ATC with capacity of 100
23.	FEATURES:	
24.	REFERENCES:	14, 58, 60

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: UK
2. COMPANY: Babcock Bristol
3. LOCATION: Croydon
4. DIVISION:
5. SUPPLIER: Yamazaki
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Signature transmitter parts
12. MATERIALS:
13. NUMBER OF PARTS: 100
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 1 NV, 1 MC
21. MATL. HANDLING: Robot, conveyor, carousel
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 58

1. COUNTRY: UK
2. COMPANY: Black & Decker
3. LOCATION: Spennymoor, County Durham
4. DIVISION:
5. SUPPLIER: Fairey Automation
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	UK
2.	COMPANY:	British United Shoe Company
3.	LOCATION:	Leicester
4.	DIVISION:	
5.	SUPPLIER:	KTM
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Siemens
11.	PRODUCTS:	Shoe machinery parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	4-5,000
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 58

1.	COUNTRY:	UK
2.	COMPANY:	Caterpillar
3.	LOCATION:	Glasgow
4.	DIVISION:	
5.	SUPPLIER:	Scharmann
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Tractor gearbox parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	9
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: UK
2. COMPANY: Caterpillar
3. LOCATION: Glasgow
4. DIVISION:
5. SUPPLIER: Scharmann
6. CLASS: FMS
7. YEAR: 83
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Large tractor parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS: 8
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 58

1. COUNTRY: UK
2. COMPANY: Caterpillar
3. LOCATION: Glasgow
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Tractor track parts
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 specially designed MT's
21. MATL. HANDLING: Robot, cart with towline
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

1. COUNTRY: UK
2. COMPANY: Cessna
3. LOCATION: Glenrothes, Scotland
4. DIVISION: Fluid Power
5. SUPPLIER: Olivetti
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Pump gear housing
12. MATERIALS:
13. NUMBER OF PARTS: 18
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 3 MC
21. MATL. HANDLING: 2 robots
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14, 58

1. COUNTRY: UK
2. COMPANY: Cincinnati Milicron
3. LOCATION: Birmingham
4. DIVISION:
5. SUPPLIER: Cincinnati Milicron
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Machine tool parts
12. MATERIALS: Steel, cast iron
13. NUMBER OF PARTS: 13
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING: AGV
22. TOOLING:
23. FEATURES: Probing, adaptive control, part washing
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	UK
2.	COMPANY:	Colechester Lathe
3.	LOCATION:	Colechester
4.	DIVISION:	600 Group
5.	SUPPLIER:	Scamp Systems Limited
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Leadtime reduced from 3 months to 3 days
9.	COMPUTER:	Dual DEC PDP 11/60's
10.	CONTROLS:	5000E
11.	PRODUCTS:	Shafts, discs, and gears for machine tools
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	46
14.	PART FAMILIES:	3
15.	PRODUCTION RATE:	
16.	PART CUBE:	220 mm round x 420 mm long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Computer assisted scheduling
19.	LOT SIZE:	25-100
20.	MACHINE SET:	4 NT, 3 NG, 1 NGR, 1 SP
21.	MATL. HANDLING:	8 Fanuc robots, roller conveyor
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 57, 68, 69

1.	COUNTRY:	UK
2.	COMPANY:	Deep Sea Seals
3.	LOCATION:	Havant
4.	DIVISION:	
5.	SUPPLIER:	TI Matrix
6.	CLASS:	MC
7.	YEAR:	84
8.	FINANCIAL DATA:	60 % reduction in machining time
9.	COMPUTER:	DEC PDP 11/23
10.	CONTROLS:	Fanuc 6MB, Fanuc 6T
11.	PRODUCTS:	Ship propeller shaft seals
12.	MATERIALS:	Gunmetal bronze
13.	NUMBER OF PARTS:	Custom designs
14.	PART FAMILIES:	20
15.	PRODUCTION RATE:	
16.	PART CUBE:	1.5 m round
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	16 hours per day
19.	LOT SIZE:	
20.	MACHINE SET:	1 NVM (Matrix V50LR), 1 NV (Web. & Ben.)
21.	MATL. HANDLING:	AGV - Babcock FATA
22.	TOOLING:	ATC for NVM with 30 tool magazine
23.	FEATURES:	
24.	REFERENCES:	85

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	UK
2.	COMPANY:	Dowty Mining Equipment
3.	LOCATION:	Tewkesbury
4.	DIVISION:	
5.	SUPPLIER:	K & T
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Hydraulic valve manifolds
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	30
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	Automatic inspection, probing, and adaptive control
24.	REFERENCES:	14, 58

1.	COUNTRY:	UK
2.	COMPANY:	Ford Motor Company
3.	LOCATION:	Halewood
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Cluster gear for automobile transportation
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	9
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 NT, 2 ND
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 58

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: UK
2. COMPANY: J. C. Bamford
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Scharmann
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: UK
2. COMPANY: L. Gardner & Sons
3. LOCATION: Barton Hall
4. DIVISION: Engine Works
5. SUPPLIER: KTM
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Diesel engine blocks
12. MATERIALS: Cast iron
13. NUMBER OF PARTS: 4
14. PART FAMILIES: 1
15. PRODUCTION RATE: 3parts/hour
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 16

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	UK
2.	COMPANY:	Leyland Bus
3.	LOCATION:	Farington
4.	DIVISION:	
5.	SUPPLIER:	KTM
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/24
10.	CONTROLS:	
11.	PRODUCTS:	Hydraulic transmissions
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	28
14.	PART FAMILIES:	2
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NHM (KTM)
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 63

1.	COUNTRY:	UK
2.	COMPANY:	Lucas Electrical
3.	LOCATION:	Telford
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Automotive electrical parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	130
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	130,000 parts/year
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	7 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Probing, adaptive control
24.	REFERENCES:	14, 75

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	UK
2.	COMPANY:	Normalair Garret
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	KTM
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft components
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 16, 86

1.	COUNTRY:	UK
2.	COMPANY:	Rolls Royce
3.	LOCATION:	Derby
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Jet engine parts
12.	MATERIALS:	Nickle alloys, stainless steels
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	49

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Allis Chalmers
3.	LOCATION:	Milwaukee, WI
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	71
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Inter Data, Bendix
11.	PRODUCTS:	Tractor parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	48
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	23,600
16.	PART CUBE:	3 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Computer dynamically assigns work stations, product mix changed significantly during implementation, crew of 9
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC, 1 NM
21.	MATL. HANDLING:	23 carts with towline, complex network
22.	TOOLING:	4 duplex multi-spindle head indexers, 864 tools, 73 heads
23.	FEATURES:	
24.	REFERENCES:	18, 38, 52, 61

1.	COUNTRY:	USA
2.	COMPANY:	Allison-Detroit Diesel
3.	LOCATION:	Hamtrack, MI
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Omni
11.	PRODUCTS:	Large transmission housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	40
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	14, 22

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Avco Lycoming
3.	LOCATION:	Stratford, Conn
4.	DIVISION:	Lycoming
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	2 Interdata 8/16E
10.	CONTROLS:	Allen Bradley 7320's
11.	PRODUCTS:	XM-1 Tank engine parts
12.	MATERIALS:	Stainless steel castings
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	2 shifts, 3 shifts planned in late 85
19.	LOT SIZE:	
20.	MACHINE SET:	7 MC, 3 NV, 4 more MC's planned
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	ATC with 70 tool magazines, 1,000 + tools in system
23.	FEATURES:	Probing
24.	REFERENCES:	14, 46, 49

1.	COUNTRY:	USA
2.	COMPANY:	Avco Lycoming
3.	LOCATION:	Williamsport, PA
4.	DIVISION:	Lycoming
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	76
8.	FINANCIAL DATA:	9 MC's replaced 67 MT's
9.	COMPUTER:	2 Microdata Model 70's
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft engine crank cases
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	6
14.	PART FAMILIES:	2
15.	PRODUCTION RATE:	2,000 parts/month
16.	PART CUBE:	4 ft square pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Computer dynamically assigns work stations, each operation has alternates, crew of 9
19.	LOT SIZE:	
20.	MACHINE SET:	9 MC
21.	MATL. HANDLING:	Cart with towline, simple loop with short spurs
22.	TOOLING:	2 simplex & 1 duplex multispindle head changers
23.	FEATURES:	Probing
24.	REFERENCES:	14, 38, 52, 61, 17, 43, 45

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Boeing Aerospace
3.	LOCATION:	Kent, WA
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	61 % reduction in machine hours
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	Omni Microswinc M23
11.	PRODUCTS:	Housings, covers, fittings, and links for airframes
12.	MATERIALS:	Aluminum (6061-T6), stainless steel 15-5ph, 13-8mo
13.	NUMBER OF PARTS:	15
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	6,000 parts/year
16.	PART CUBE:	30 x 20 x 22 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Crew of 1
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 WS
21.	MATL. HANDLING:	195 ft roller conveyor with 5 pallet transfer units
22.	TOOLING:	ATC with capacity of 48
23.	FEATURES:	
24.	REFERENCES:	14, 59

1.	COUNTRY:	USA
2.	COMPANY:	Boeing Aerospace
3.	LOCATION:	Seattle, WA
4.	DIVISION:	
5.	SUPPLIER:	Shin Nippon Koki
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	
11.	PRODUCTS:	Airframe parts
12.	MATERIALS:	Aluminum (6061-T6), stainless steel 15-5ph, 13-8mo
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Borg-Warner
3.	LOCATION:	York, PA
4.	DIVISION:	
5.	SUPPLIER:	Comau
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	Replaced 14 MT's
9.	COMPUTER:	Dual DEC PDP 11/44's
10.	CONTROLS:	Allan Bradley
11.	PRODUCTS:	Air conditioner compressor parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	85
14.	PART FAMILIES:	7
15.	PRODUCTION RATE:	38,500 parts/year
16.	PART CUBE:	1300 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Random sequencing possible
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 NV
21.	MATL. HANDLING:	Roller conveyor, ASRS, stacker crane
22.	TOOLING:	ATC 2 tool magazines with 70 tools, 572 tools in system
23.	FEATURES:	Robotic wash station, adaptive control
24.	REFERENCES:	14, 70, 71, 75

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	Aurora, IL
4.	DIVISION:	
5.	SUPPLIER:	Giddings & Lewis
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	Labor reduction from 18.7 to 6.4 hours per piece
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	3 tractor loader frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	3
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 NM, 4 ND
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	Head indexer
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	Aurora, IL
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Milicron
11.	PRODUCTS:	Excavator sticks & booms
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing, and adaptive control
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	Davenport, IO
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Milicron
11.	PRODUCTS:	Tracked loader frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	100 machining steps
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 NB
21.	MATL. HANDLING:	
22.	TOOLING:	Head indexer
23.	FEATURES:	Adaptive control, part washing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	Decatur, IL
4.	DIVISION:	
5.	SUPPLIER:	Dearborn
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Allen Bradley
11.	PRODUCTS:	Truck axle banjo housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NB, 5 MC, 1 ND, 1 NM
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	East Peoria, IL
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FTL
7.	YEAR:	74
8.	FINANCIAL DATA:	Labor reduced from 13 to 7, machine utilization doubled
9.	COMPUTER:	
10.	CONTROLS:	Omnicontrol DNC
11.	PRODUCTS:	Case & cover for tractor transmissions
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	6
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	1,200 parts/year
16.	PART CUBE:	3 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed sequence, worked to monthly master schedule, crew of 7
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC, 2 NV, 1 CMM, 3 ND
21.	MATL. HANDLING:	2 rail guided carts
22.	TOOLING:	350 tools in system
23.	FEATURES:	
24.	REFERENCES:	18, 38, 52, 61, 84

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	East Peoria, IL
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Omnicontrol DNC
11.	PRODUCTS:	Transmission cases & covers
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 2 NV, 1 WS, 1 CMM
21.	MATL. HANDLING:	Shuttle car
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing
24.	REFERENCES:	14, 84

1.	COUNTRY:	USA
2.	COMPANY:	Caterpillar
3.	LOCATION:	Peoria, IL
4.	DIVISION:	
5.	SUPPLIER:	Mazak (Yamazaki's US subsidiary)
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Mazak
11.	PRODUCTS:	Sprocket segments
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 1 SP
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection, probing, and part washing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Cincinnati Milicron
3.	LOCATION:	Cincinnati, OH
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	Leadtime 20 days to 1 day
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	
11.	PRODUCTS:	Plastic injection molding machine parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	3,500
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	3 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	1 possible
20.	MACHINE SET:	4 MC, 1 CMM
21.	MATL. HANDLING:	3 Eaton AGV's
22.	TOOLING:	
23.	FEATURES:	Part washing
24.	REFERENCES:	14, 62, 75

1.	COUNTRY:	USA
2.	COMPANY:	Cummins Engine
3.	LOCATION:	Columbus, IL
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	DEC, Gemini
11.	PRODUCTS:	Brake parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	Probing, adaptive control
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Department of Commerce
3.	LOCATION:	Gaithersburg, MD
4.	DIVISION:	National Bureau of Standards
5.	SUPPLIER:	Integration by NBS
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Reaseach facility
9.	COMPUTER:	DEC VAX
10.	CONTROLS:	Hewlett Packard, Allen Bradley, GE
11.	PRODUCTS:	
12.	MATERIALS:	Aluminum, brass, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	Real time scheduling of machines, robots, and AGV
19.	LOT SIZE:	
20.	MACHINE SET:	1 NHM, 1 NVM, 1 NT, 1 CMM
21.	MATL. HANDLING:	AGV, robot, gantry robot
22.	TOOLING:	ATC
23.	FEATURES:	Robotic deburring station
24.	REFERENCES:	1, 25, 33

1.	COUNTRY:	USA
2.	COMPANY:	FMC
3.	LOCATION:	Aiken, SC
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	Leadtime reduced from 90 to 5 days
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	Acramatic 900
11.	PRODUCTS:	Gear housings for the IFV drive train
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	16
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	15 parts/week
16.	PART CUBE:	30 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Crew of 5
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 CMM
21.	MATL. HANDLING:	3 AGV's (Eaton Kenway), 2 10-position carousels
22.	TOOLING:	ATC with capacity of 90
23.	FEATURES:	
24.	REFERENCES:	14, 75, 80

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: USA
2. COMPANY: FMC
3. LOCATION: San Jose, CA
4. DIVISION: Ordinance
5. SUPPLIER: Cincinnati Milicron
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER: DEC PDP 11/24
10. CONTROLS:
11. PRODUCTS: Infantry Fighting Vehicle drive train & chasis parts
12. MATERIALS: Steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC, 1 CMM
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 13, 14

1. COUNTRY: USA
2. COMPANY: GMC
3. LOCATION: Hamtrack, MI
4. DIVISION: Chevrolet Gear & Axle Plant
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Dif. housing, suspension tubes, cylinder heads, manifolds
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: 70 parts/15 hours
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 3 MC, 1 WS
21. MATL. HANDLING: Roller conveyor, robots
22. TOOLING:
23. FEATURES: Automated inspection, part washing
24. REFERENCES: 12, 14, 70

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY:	USA
2. COMPANY:	GMC
3. LOCATION:	Indianapolis, IN
4. DIVISION:	Allison Gas Turbine
5. SUPPLIER:	
6. CLASS:	FMS
7. YEAR:	87
8. FINANCIAL DATA:	
9. COMPUTER:	
10. CONTROLS:	MAP system
11. PRODUCTS:	Precision gears
12. MATERIALS:	Steel
13. NUMBER OF PARTS:	30
14. PART FAMILIES:	
15. PRODUCTION RATE:	
16. PART CUBE:	3 - 14.5 in round
17. PART SHAPE:	Rotational
18. OPERATION SCHEDULING:	
19. LOT SIZE:	
20. MACHINE SET:	10 NT, 1 MC, 11 NGR, 8 NG, 1 Broaching MT
21. MATL. HANDLING:	
22. TOOLING:	
23. FEATURES:	
24. REFERENCES:	2

1. COUNTRY:	USA
2. COMPANY:	GMC
3. LOCATION:	Indianapolis, IN
4. DIVISION:	Detroit Diesel Allison
5. SUPPLIER:	White Sunstrand
6. CLASS:	FMS
7. YEAR:	80
8. FINANCIAL DATA:	Replaced 35 MT's
9. COMPUTER:	
10. CONTROLS:	Omnicontrol DNC
11. PRODUCTS:	Diesel transmissions
12. MATERIALS:	Cast iron
13. NUMBER OF PARTS:	44
14. PART FAMILIES:	
15. PRODUCTION RATE:	
16. PART CUBE:	40 x 30 x 18 in
17. PART SHAPE:	Prismatic
18. OPERATION SCHEDULING:	Supervisory computer receives input at load/unload sta. 3 shift operation, crew of 5
19. LOT SIZE:	
20. MACHINE SET:	4 NHM, 4 NVM, 1 CMM
21. MATL. HANDLING:	2 rail guided carts, 240 ft track, 15 stations
22. TOOLING:	
23. FEATURES:	
24. REFERENCES:	43, 52, 61, 84

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	Fort Worth, TX
4.	DIVISION:	
5.	SUPPLIER:	Westinghouse/Devlieg
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	AGV, robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	Fort Worth, TX
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft & missle parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	Power shuttle
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	Lynburg, CA
4.	DIVISION:	Convair
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Allen Bradley
11.	PRODUCTS:	Aircraft & missle parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Probing
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	Lynburg, CA
4.	DIVISION:	Convair
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Allen Bradley
11.	PRODUCTS:	Aircraft & missle parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Part washing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	Lynburg, CA
4.	DIVISION:	Convair
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Allen Bradley
11.	PRODUCTS:	Aircraft & missle parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Part washing
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	General Dynamics
3.	LOCATION:	
4.	DIVISION:	Convair
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft & missle parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	4 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	52

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	General Electric
3.	LOCATION:	Erie, PA
4.	DIVISION:	Erie Works
5.	SUPPLIER:	Giddings & Lewis
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Leadtime from 16 to 1 day
9.	COMPUTER:	Dual DEC PDP 11/44's
10.	CONTROLS:	GE 1050 CNC
11.	PRODUCTS:	Locomotive motor frames and gear boxes
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	6
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	1 part/hour, 5,500 parts/year
16.	PART CUBE:	4 x 4 x 5 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Computer schedules in real time, can reschedule around down unit, crew of 2
19.	LOT SIZE:	1
20.	MACHINE SET:	2 NVM, 4 NB, 3 NHM, 1 SP
21.	MATL. HANDLING:	Cart with towline, robot, ASRS
22.	TOOLING:	ATC
23.	FEATURES:	Automated inspection, probing
24.	REFERENCES:	8, 12, 14, 49, 69

1.	COUNTRY:	USA
2.	COMPANY:	General Electric
3.	LOCATION:	Evandale, OH
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NT
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: USA
2. COMPANY: General Electric
3. LOCATION: Pittsfield, MA
4. DIVISION: Ordinance Systems
5. SUPPLIER: Ex-Cell-O
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Infantry Fighting Vehicle turret stabilization system
12. MATERIALS: Steel
13. NUMBER OF PARTS: 11
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 5 MC
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 22, 52, 53

1. COUNTRY: USA
2. COMPANY: Georgetown Manufacturing
3. LOCATION: Georgetown, KY
4. DIVISION:
5. SUPPLIER: KT
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER: DEC
10. CONTROLS: Gemini
11. PRODUCTS: Manifolds, spindles, housings
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS: 150
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 6 MC
21. MATL. HANDLING: Stacker crane
22. TOOLING:
23. FEATURES: Adaptive control, probing
24. REFERENCES: 14, 53

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Harris Press
3.	LOCATION:	Fort Worth, TX
4.	DIVISION:	
5.	SUPPLIER:	Harris Press
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	Cost reduction of from 25 - 57 %
9.	COMPUTER:	DEC
10.	CONTROLS:	
11.	PRODUCTS:	Precision printing press cylinder parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	700
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	
16.	PART CUBE:	1.5 - 8 in round x 120 in long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	NC saw, 2MC, 2NT, 1 MC, 2NGR, balancing , straightening
21.	MATL. HANDLING:	3 robots, roller conveyor
22.	TOOLING:	
23.	FEATURES:	Automated inspection, part washing, inertial welding sta.
24.	REFERENCES:	14, 55, 69

1.	COUNTRY:	USA
2.	COMPANY:	Hughes Aircraft
3.	LOCATION:	El Segundo, CA
4.	DIVISION:	Electro-Optical & Data Systems Group
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	9 MT's vs. 25, 87 % labor savings
9.	COMPUTER:	Dual DEC PDP 11/44's
10.	CONTROLS:	KT, Gemini DNC
11.	PRODUCTS:	Housings for laser range finder
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	5
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	1,200 + parts/year
16.	PART CUBE:	24 x 24 in pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Crew of 3
19.	LOT SIZE:	
20.	MACHINE SET:	9 MC, 1 CMM
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	
23.	FEATURES:	Automatic inspection, adaptive control, and probing
24.	REFERENCES:	14, 29, 44, 50, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Ingersol Rand
3.	LOCATION:	Roanoke, VA
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	72
8.	FINANCIAL DATA:	Labor savings of 50 %, cost savings of 70 %
9.	COMPUTER:	IBM 360/30
10.	CONTROLS:	Omnicontrol DNC
11.	PRODUCTS:	Housings for industrial hoists
12.	MATERIALS:	Cast iron, steel, aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	3 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed sequence within system, multiple alternate routings, 4 man crew, foreman dispatches jobs
19.	LOT SIZE:	
20.	MACHINE SET:	5MC, 2ND
21.	MATL. HANDLING:	Roller conveyor with buffer at each MT
22.	TOOLING:	360 tools in system
23.	FEATURES:	
24.	REFERENCES:	38, 61, 84

1.	COUNTRY:	USA
2.	COMPANY:	Ingersoll Milling Machine
3.	LOCATION:	Rockford, IL
4.	DIVISION:	
5.	SUPPLIER:	Ingersoll Milling
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Eliminated 17 MT's
9.	COMPUTER:	DEC VAX 750
10.	CONTROLS:	Allan Bradley 8200
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	25,000 parts/year
16.	PART CUBE:	1 m
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	1 (75 % of the time)
20.	MACHINE SET:	5 MC, 1 WS, 2 CMM
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	Automated inspection, part washing
24.	REFERENCES:	14, 32, 42

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Ingersoll Milling Machine
3.	LOCATION:	Rockford, IL
4.	DIVISION:	
5.	SUPPLIER:	Ingersoll Milling
6.	CLASS:	FMS
7.	YEAR:	87
8.	FINANCIAL DATA:	
9.	COMPUTER:	VAX 750
10.	CONTROLS:	Allen Bradley 8200
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Ingersoll Milling Machine
3.	LOCATION:	Rockford, IL
4.	DIVISION:	
5.	SUPPLIER:	Ingersoll Milling
6.	CLASS:	FMS
7.	YEAR:	87
8.	FINANCIAL DATA:	
9.	COMPUTER:	VAX 750
10.	CONTROLS:	Alen Bradley 8200
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 NV
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	J. I. Case
3.	LOCATION:	Racine, WI
4.	DIVISION:	Components
5.	SUPPLIER:	Imgersoll Milling
6.	CLASS:	FTL
7.	YEAR:	78
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Agricultural tractor transmission cases
12.	MATERIALS:	Gray iron castings
13.	NUMBER OF PARTS:	2
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed path sequencing
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 1 NM, 1 NB
21.	MATL. HANDLING:	Roller conveyor, cart with towline for heads
22.	TOOLING:	2 head changers, 22 heads in system
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 43, 45

1.	COUNTRY:	USA
2.	COMPANY:	John Deere & Company
3.	LOCATION:	Moline, IL
4.	DIVISION:	
5.	SUPPLIER:	Masch. Diedesheim
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	DNC network
10.	CONTROLS:	Allan Bradley
11.	PRODUCTS:	Farm tractor parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	3 NT, 2 MC (WCI)
21.	MATL. HANDLING:	2 Unimate robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	54

1.	COUNTRY:	USA
2.	COMPANY:	John Deere & Company
3.	LOCATION:	Waterloo, IO
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	DEC, KT, CNC
11.	PRODUCTS:	Transmission & clutch housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	8
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	11 MC
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	5 Head indexers
23.	FEATURES:	Part washing
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	John Deere & Company
3.	LOCATION:	Waterloo, IO
4.	DIVISION:	
5.	SUPPLIER:	Burkhardt & Weber
6.	CLASS:	FMS
7.	YEAR:	78
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Agricultural machinery parts
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	Head changer
23.	FEATURES:	
24.	REFERENCES:	14, 53

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	John Deere & Company
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Burkhardt & Weber
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	LTV
3.	LOCATION:	Dallas, TX
4.	DIVISION:	Vought Aero Products
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	3 year return on investment
9.	COMPUTER:	DEC PDP 11/70,44,24
10.	CONTROLS:	Acramatic 900, DEC, Allen Bradley
11.	PRODUCTS:	B1 bomber airframe components
12.	MATERIALS:	95 % aluminum, 5% steel
13.	NUMBER OF PARTS:	540
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	30 x 32 x 36 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Simulation used to aid in computerized scheduling Average crew size of 5.6
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 1 WS, 2 CMM
21.	MATL. HANDLING:	4 AGV's, ASRS, 2 carousels with 10 stations each
22.	TOOLING:	ATC with capacity of 45
23.	FEATURES:	Automatic inspection, probing, and part washing
24.	REFERENCES:	14, 21, 45, 75

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Mack Truck
3.	LOCATION:	Haggerstown, MD
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	Labor reduction from 20 to 5
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Truck transmission castings
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	7
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 NB
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	2 head changers
23.	FEATURES:	Adaptive control, probing, auto. insp., part washing
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Massey Ferguson
3.	LOCATION:	Detroit, MI
4.	DIVISION:	Transmission & Axle Plant
5.	SUPPLIER:	Massey Ferguson and Unimate
6.	CLASS:	MC
7.	YEAR:	79
8.	FINANCIAL DATA:	1.5 year payback, 25 % increase in productivity
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Planetary pinion gears
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	4 sizes
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	3.5 - 7 in round
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Alternate part programs for MT's and robots, graceful degradation in the event of MT failure
19.	LOT SIZE:	
20.	MACHINE SET:	2 NV, 6 NG
21.	MATL. HANDLING:	3 Unimate robots, custom design conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	45, 52, 54, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	McDonnel Douglas
3.	LOCATION:	Saint Charles, MO
4.	DIVISION:	Astronautics
5.	SUPPLIER:	Giddings & Lewis
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	60 % reduction in machining costs
9.	COMPUTER:	DEC VAX 11/780
10.	CONTROLS:	G & L CNC 8000
11.	PRODUCTS:	Missle body sections
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	72
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	34,800 parts/year
16.	PART CUBE:	33 in round x 60 in long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Real time scheduling & control, average crew size of 2.5
19.	LOT SIZE:	
20.	MACHINE SET:	3 MC, 2 NV, 2 NH, 1 CMM, 1 WS
21.	MATL. HANDLING:	AGV, robots, 3 deburring stations, ASRS
22.	TOOLING:	ATC with 80 tool magazines
23.	FEATURES:	Auto. insp., probing, adaptive control, part washing
24.	REFERENCES:	14, 27

1.	COUNTRY:	USA
2.	COMPANY:	Mercury Marine
3.	LOCATION:	Fond Du Lac, WI
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Outboard marine engine block, and crank case parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	6
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 MC, 1 NB
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	Head indexer
23.	FEATURES:	Adaptive control, probing
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	New York Air Brake
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Cincinnati Milicron
6.	CLASS:	FMS
7.	YEAR:	86
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	North American Rockwell
3.	LOCATION:	Newark, OH
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	73
8.	FINANCIAL DATA:	Reduced WIP and setup costs
9.	COMPUTER:	
10.	CONTROLS:	Bendix
11.	PRODUCTS:	Truck differential housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	33
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	24,000 parts/year
16.	PART CUBE:	1.5 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Computer dynamically assigns work stations
19.	LOT SIZE:	10 - 50
20.	MACHINE SET:	8 MC, 1 NV, 1 WS, 1 CMM
21.	MATL. HANDLING:	Cart with towline
22.	TOOLING:	Local to MT's
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 18, 38, 61

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Onan
3.	LOCATION:	Minneapolis, MN
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	KT, CNC
11.	PRODUCTS:	Generator frames
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	12
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NV, 1 MC
21.	MATL. HANDLING:	AGV planned for 88
22.	TOOLING:	
23.	FEATURES:	Adaptive control, probing
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Rigid tool
3.	LOCATION:	Elyria, OH
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Pipe fitting hand tools
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	75

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: USA
2. COMPANY: Rock Island Arsenal
3. LOCATION:
4. DIVISION:
5. SUPPLIER: (Proposal)
6. CLASS: FMS
7. YEAR: (Proposal)
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 22

1. COUNTRY: USA
2. COMPANY: Rockwell Motch
3. LOCATION: New Castle, PA
4. DIVISION:
5. SUPPLIER: Oerlikon/Motch
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Steering knuckles
12. MATERIALS: Steel
13. NUMBER OF PARTS: 22
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 NV, 1 ND
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES: Automated inspection
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Smith Tool
3.	LOCATION:	Irvine, CA
4.	DIVISION:	
5.	SUPPLIER:	Okuma
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	Okuma
10.	CONTROLS:	Okuma
11.	PRODUCTS:	Oil fiels parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	54
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 2 NT
21.	MATL. HANDLING:	2 robots, conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	75

1.	COUNTRY:	USA
2.	COMPANY:	Sunstrand Aviation
3.	LOCATION:	Rockford, IL
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	67
8.	FINANCIAL DATA:	Alternative was 100 MT's
9.	COMPUTER:	
10.	CONTROLS:	Omnicontrol DNC
11.	PRODUCTS:	Pump & aircraft parts
12.	MATERIALS:	Aluminum, Magnesium
13.	NUMBER OF PARTS:	70
14.	PART FAMILIES:	2
15.	PRODUCTION RATE:	24,000 parts/year
16.	PART CUBE:	16 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	Fixed sequence, unidirectional flow, crew of 8
19.	LOT SIZE:	Range of 25 to 300
20.	MACHINE SET:	8 MC, 2 ND, 1 WS, 1 CMM
21.	MATL. HANDLING:	Roller conveyor, ASRS
22.	TOOLING:	Local to MC, 39 max
23.	FEATURES:	
24.	REFERENCES:	38, 61, 84

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Sunstrand Aviation
3.	LOCATION:	Rockford, IL
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Aircraft parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	
23.	FEATURES:	Automated Inspection, probing, and adaptive control
24.	REFERENCES:	14

1.	COUNTRY:	USA
2.	COMPANY:	Union Special
3.	LOCATION:	Huntley, IL
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Sewing machine parts
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	75

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Vickers
3.	LOCATION:	Omaha, NE
4.	DIVISION:	
5.	SUPPLIER:	Acme Cleveland
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	Replaced a transfer line
9.	COMPUTER:	
10.	CONTROLS:	Westinghouse
11.	PRODUCTS:	Pump blocks
12.	MATERIALS:	Cast iron, steel
13.	NUMBER OF PARTS:	25-30
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	35-135 parts/hour
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC, 3 NT, 2 vertical broaching machines
21.	MATL. HANDLING:	Roller conveyor, 11 ASEA robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 82

1.	COUNTRY:	USA
2.	COMPANY:	Warner Ishi
3.	LOCATION:	Shelbyville, IL
4.	DIVISION:	
5.	SUPPLIER:	KT
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC
10.	CONTROLS:	Gemini
11.	PRODUCTS:	Turbo charger housings
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC, 2 NT
21.	MATL. HANDLING:	Robots
22.	TOOLING:	
23.	FEATURES:	Automated inspection, adaptive control
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Watervliet Arsenal
3.	LOCATION:	Watervliet, NY
4.	DIVISION:	
5.	SUPPLIER:	White Sunstrand
6.	CLASS:	FMS
7.	YEAR:	85
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Omnicontrol DNC
11.	PRODUCTS:	Gun tubes
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	6
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 2 NV, 2 CMM, 1 WS
21.	MATL. HANDLING:	AGV
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 84

1.	COUNTRY:	USA
2.	COMPANY:	Westinghouse
3.	LOCATION:	Cheswick, PA
4.	DIVISION:	Electro-Mechanical
5.	SUPPLIER:	White Consolidated
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Nuclear pump parts
12.	MATERIALS:	Stainless steel, inconnel
13.	NUMBER OF PARTS:	63
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	
16.	PART CUBE:	1.5 ft round x 1.5 ft long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	JIT, real time scheduling & inventory control
19.	LOT SIZE:	
20.	MACHINE SET:	1 MC, 2 NT, 1 CMM
21.	MATL. HANDLING:	1 gantry robot, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	5

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USA
2.	COMPANY:	Xerox
3.	LOCATION:	Rochester, NY
4.	DIVISION:	
5.	SUPPLIER:	Unimate
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Unimate, central control to robots
11.	PRODUCTS:	Fuser rolls for copy machines
12.	MATERIALS:	Copper
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	1
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Frequent model changes
19.	LOT SIZE:	
20.	MACHINE SET:	3 NT, 1 brazing station, 1 NGR, 1 broaching MT
21.	MATL. HANDLING:	3 robots, conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	52

1.	COUNTRY:	USA
2.	COMPANY:	Yamazaki Machinery Works (Mazak)
3.	LOCATION:	Florence, KY
4.	DIVISION:	Mazak
5.	SUPPLIER:	Yamazaki
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool frames & beds
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	AGV
22.	TOOLING:	ATC
23.	FEATURES:	Probing
24.	REFERENCES:	12, 14, 49, 69

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: USA
2. COMPANY: Yamazaki Machinery Works (Mazak)
3. LOCATION: Florence, KY
4. DIVISION: Mazak
5. SUPPLIER: Yamazaki
6. CLASS: FMS
7. YEAR: 81
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Gear boxes and small MT parts
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic and rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 4 MC, 1 NM, 1 NV, 1 NT
21. MATL. HANDLING: AGV
22. TOOLING:
23. FEATURES: Probing
24. REFERENCES: 14, 49

1. COUNTRY: USSR
2. COMPANY: Ceboksary
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Comau
6. CLASS: FMS
7. YEAR: 78
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS: Farm tractor cases and frames
12. MATERIALS: Cast iron, steel
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE: Plant produces 5,000 tractors per year
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 SP, 1 CMM
21. MATL. HANDLING: Cart with towline, robot
22. TOOLING: 1 head changer
23. FEATURES:
24. REFERENCES: 14, 53

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: USSR
2. COMPANY: Ceboksary
3. LOCATION:
4. DIVISION:
5. SUPPLIER: COMAU
6. CLASS: FMS
7. YEAR: 82
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: USSR
2. COMPANY: ENIMS (United R & D Center for Machine Tools)
3. LOCATION: Regional Centers
4. DIVISION:
5. SUPPLIER: ENIMS
6. CLASS: MC
7. YEAR: 76
8. FINANCIAL DATA: Productivity increase of 3-4 times
9. COMPUTER: CNC, PC's
10. CONTROLS: ASK 1, ASK 2, and ASK 3, Systems
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE: 250 - 1600 mm
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING: Manual part handling, ASRS
22. TOOLING:
23. FEATURES: Adaptive control
24. REFERENCES: 86

1.	COUNTRY:	USSR
2.	COMPANY:	ENIMS (United R & D Institute for Machine Tools)
3.	LOCATION:	Moscow
4.	DIVISION:	
5.	SUPPLIER:	ENIMS
6.	CLASS:	MC
7.	YEAR:	71
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	AU-1 System
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	USSR
2.	COMPANY:	
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	USSR manufacture
10.	CONTROLS:	ACB-20 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	250 mm round x 750 mm long
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	Parts may enter the system in random order, 24 hour operation
19.	LOT SIZE:	as small as 10, about 150 half of the time
20.	MACHINE SET:	6 NT, 3 NVD, 1 NVM, 1 NHM, 1 CMM
21.	MATL. HANDLING:	Gantry cranes, conveyors, robots, AGV's
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	81

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	USSR
2.	COMPANY:	Strankokonstruktsiya
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	ENIMS (United R & D Institute for Machine Tools)
6.	CLASS:	MC
7.	YEAR:	76
8.	FINANCIAL DATA:	
9.	COMPUTER:	M6000, Minsk 32
10.	CONTROLS:	ASV-20 System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 NT, 3 ND, 1 NVM, 1 NHM, 1 CMM
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

1.	COUNTRY:	USSR
2.	COMPANY:	Strankostroenie
3.	LOCATION:	Moscow
4.	DIVISION:	
5.	SUPPLIER:	ENIMS (United R & D Institute for Machine Tools)
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	APl System
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	500 mm
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	6 MC, 1 CMM
21.	MATL. HANDLING:	Automated materials handling, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	23, 69, 86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: West Germany
2. COMPANY: Brown Boveri
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Trumph
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: West Germany
2. COMPANY: Brown Boveri
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Trumph
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Eberhard Bauer
3.	LOCATION:	Esslingen
4.	DIVISION:	
5.	SUPPLIER:	Fritz Werner
6.	CLASS:	FMS
7.	YEAR:	79
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Fritz Werner
11.	PRODUCTS:	195 electric geared motors
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 NVM
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	Part washing
24.	REFERENCES:	14, 36

1.	COUNTRY:	West Germany
2.	COMPANY:	Friedrich Deckel AG
3.	LOCATION:	Munich
4.	DIVISION:	
5.	SUPPLIER:	Friedrich Deckel
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	5
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	16 hours with operator, 5.5 unmanned hours, Crew of 15
19.	LOT SIZE:	100
20.	MACHINE SET:	8 MC
21.	MATL. HANDLING:	2 AGV's
22.	TOOLING:	ATC with capacity of 80
23.	FEATURES:	
24.	REFERENCES:	14, 73

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Gebr. Heller Maschinenfabrik
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Heller
6.	CLASS:	FMS
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	1.5 x 2 x 3 ft
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Stacker crane, roller conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 36, 38

1.	COUNTRY:	West Germany
2.	COMPANY:	Hieldelberger Druckmaschinenfabrik
3.	LOCATION:	Hiedelberg
4.	DIVISION:	
5.	SUPPLIER:	Hieldelberger Druckmaschinenfabrik, U. of Stuttgart
6.	CLASS:	FMS
7.	YEAR:	69
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Printing press precision parts
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	13 MC, 1 WS
21.	MATL. HANDLING:	Stacker crane, roller conveyor
22.	TOOLING:	Automated tool flow
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 36, 38, 52

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1. COUNTRY: West Germany
2. COMPANY: Holder
3. LOCATION:
4. DIVISION: Friedrich Deckel
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: West Germany
2. COMPANY: Kloeckner Humboldt Deutz AG
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Burkhardt & Weber
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER: Siemens 300
10. CONTROLS: Sinumeric 8
11. PRODUCTS: Crank case, differential, clutch, and trans. housings
12. MATERIALS: Cast iron
13. NUMBER OF PARTS:
14. PART FAMILIES: 4
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic
18. OPERATION SCHEDULING: Crew of 5
19. LOT SIZE:
20. MACHINE SET: 4 MC, 1 WS
21. MATL. HANDLING: Rail guided cart
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14, 72

1. COUNTRY: West Germany
2. COMPANY: Linde Aschaffenburg
3. LOCATION:
4. DIVISION:
5. SUPPLIER: Scharmann
6. CLASS: FMS
7. YEAR: 84
8. FINANCIAL DATA:
9. COMPUTER:
10. CONTROLS:
11. PRODUCTS:
12. MATERIALS:
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE:
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET:
21. MATL. HANDLING:
22. TOOLING:
23. FEATURES:
24. REFERENCES: 14

1. COUNTRY: West Germany
2. COMPANY: Messerschmitt Boelkow Blohm
3. LOCATION: Augsburg
4. DIVISION: Military Aircraft
5. SUPPLIER:
6. CLASS: FMS
7. YEAR: 85
8. FINANCIAL DATA:
9. COMPUTER: DFU Nabern
10. CONTROLS:
11. PRODUCTS: Aircraft parts
12. MATERIALS: Aluminum
13. NUMBER OF PARTS:
14. PART FAMILIES:
15. PRODUCTION RATE:
16. PART CUBE:
17. PART SHAPE: Prismatic and rotational
18. OPERATION SCHEDULING:
19. LOT SIZE:
20. MACHINE SET: 2 MC, 2 NT
21. MATL. HANDLING: AGV's, ASRS
22. TOOLING:
23. FEATURES:
24. REFERENCES: 9

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Messerschmitt Boelkow Blohm
3.	LOCATION:	Augsburg
4.	DIVISION:	Military Aircraft
5.	SUPPLIER:	Burkhardt & Weber
6.	CLASS:	MC
7.	YEAR:	80
8.	FINANCIAL DATA:	52.6 % reduction in MT's and labor
9.	COMPUTER:	Siemens 330, 3 DEC PDP 11/34's
10.	CONTROLS:	
11.	PRODUCTS:	Aircraft parts
12.	MATERIALS:	Titanium
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 MC, 1 NM
21.	MATL. HANDLING:	AGV, ASRS
22.	TOOLING:	Overhead conveyor & ASRS for tools on pallets
23.	FEATURES:	
24.	REFERENCES:	26, 30, 36, 38, 69

1.	COUNTRY:	West Germany
2.	COMPANY:	Moteren Turbinen Union (MTU)
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Cylinder heads
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	4
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	5 MC
21.	MATL. HANDLING:	Stacker crane, 4 roller conveyors
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Oberkochen
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Carl Zeiss
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/24
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	West Germany
2.	COMPANY:	Robert Bosch
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Steinel
6.	CLASS:	MC
7.	YEAR:	82
8.	FINANCIAL DATA:	Labor reduced from 18 to 5, cost 20 %, LT from 6wks to 1
9.	COMPUTER:	
10.	CONTROLS:	4 Bosch CNC Micro # 8
11.	PRODUCTS:	Power tool gearboxes, housings for hand tools
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	4
15.	PRODUCTION RATE:	300,000 parts/year
16.	PART CUBE:	12 x 8 x 8 in
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	4 independent CNC machines in parallel, crew of 2
19.	LOT SIZE:	Small & medium
20.	MACHINE SET:	4 CNC
21.	MATL. HANDLING:	4 robots, 2 conveyor belts (50 ft each)
22.	TOOLING:	ATC with capacity of 60
23.	FEATURES:	
24.	REFERENCES:	48

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Robert Bosch
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Steinel
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	Bosch CNC Micro # 8
11.	PRODUCTS:	ABS anti-skid system
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	400 x 250 mm pallet
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	Medium & large
20.	MACHINE SET:	8 MC, 1 CMM
21.	MATL. HANDLING:	Belt conveyor, 8 Bosch robots
22.	TOOLING:	ATC with capacity of 30
23.	FEATURES:	Pallet coding with pin system
24.	REFERENCES:	48

1.	COUNTRY:	West Germany
2.	COMPANY:	SEW
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Friedrich Deckel
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Scharmann GmbH & Co.
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Scharmann
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	West Germany
2.	COMPANY:	Trumph
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Friedrich Deckel
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machined sheet metal products
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	2 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Automated inspection, part washing
24.	REFERENCES:	34

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	University of Berlin
3.	LOCATION:	Berlin
4.	DIVISION:	
5.	SUPPLIER:	University of Berlin
6.	CLASS:	FMS
7.	YEAR:	76
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NT, 1 NM
21.	MATL. HANDLING:	Roller conveyor, overhead conveyor, 2 robots
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	36, 38, 52

1.	COUNTRY:	West Germany
2.	COMPANY:	University of Stuttgart
3.	LOCATION:	Stuttgart
4.	DIVISION:	
5.	SUPPLIER:	University of Stuttgart
6.	CLASS:	FMS
7.	YEAR:	76
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	University of Stuttgart
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	4 MC, 1 CMM
21.	MATL. HANDLING:	2 stacker cranes, rack at each MC
22.	TOOLING:	Tooling under computer control
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14, 36, 38, 52, 72

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	
3.	LOCATION:	Bauer Plant
4.	DIVISION:	
5.	SUPPLIER:	Burkhardt & Weber
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	9 MC
21.	MATL. HANDLING:	Roller conveyor
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	18

1.	COUNTRY:	West Germany
2.	COMPANY:	VFW - Fokker
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Toranado aircraft parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC
21.	MATL. HANDLING:	Rail guided cart
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	18, 69, 86

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Vereinigte Flugtechnische Werke
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Heller and Heyligenst.
6.	CLASS:	FMS
7.	YEAR:	77
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Airframe parts
12.	MATERIALS:	Aluminum
13.	NUMBER OF PARTS:	9
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC, 1 WS
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	Automated inspection
24.	REFERENCES:	14

1.	COUNTRY:	West Germany
2.	COMPANY:	Volkswagen
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Burkhardt & Weber
6.	CLASS:	FMS
7.	YEAR:	80
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Transmission and rear axle housings
12.	MATERIALS:	Cast iron
13.	NUMBER OF PARTS:	7
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	8 MC
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	14, 53

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Werkzeugmaschinenlabor
3.	LOCATION:	Aachen
4.	DIVISION:	
5.	SUPPLIER:	
6.	CLASS:	FMS
7.	YEAR:	83
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	
12.	MATERIALS:	
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	50 - 250 mm round
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 MC, 2 NT
21.	MATL. HANDLING:	1 robot in an orbital layout
22.	TOOLING:	ATC with 20 tool magazine on MC
23.	FEATURES:	
24.	REFERENCES:	14

1.	COUNTRY:	West Germany
2.	COMPANY:	Westfalia Separator
3.	LOCATION:	Oelde
4.	DIVISION:	
5.	SUPPLIER:	Dixi (Swiss)
6.	CLASS:	FMS
7.	YEAR:	84
8.	FINANCIAL DATA:	
9.	COMPUTER:	
10.	CONTROLS:	
11.	PRODUCTS:	Machine tool parts
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	MC's
21.	MATL. HANDLING:	AGV's, ASRS
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	45

APPENDIX C. FMS IMPLEMENTATION DATA BASE

1.	COUNTRY:	West Germany
2.	COMPANY:	Zahnradfabrik Friedrichshafen
3.	LOCATION:	
4.	DIVISION:	
5.	SUPPLIER:	Zahnradfabrik Friedrichshafen
6.	CLASS:	FMS
7.	YEAR:	82
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/44
10.	CONTROLS:	7 of 13 NC MT's DNC
11.	PRODUCTS:	Gears
12.	MATERIALS:	Steel
13.	NUMBER OF PARTS:	100 +
14.	PART FAMILIES:	4
15.	PRODUCTION RATE:	16,000 parts/month
16.	PART CUBE:	280 mm round x 80 mm thick
17.	PART SHAPE:	Rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	Range of 50 to 500
20.	MACHINE SET:	1 NC, 4 NT, 3 SP, 5 NG
21.	MATL. HANDLING:	Robots, gantry crane
22.	TOOLING:	
23.	FEATURES:	Automated inspection, part washing
24.	REFERENCES:	14, 34, 86

1.	COUNTRY:	Yugoslavia
2.	COMPANY:	Ljublana University
3.	LOCATION:	Ljublana
4.	DIVISION:	
5.	SUPPLIER:	Ljublana University
6.	CLASS:	FMS
7.	YEAR:	81
8.	FINANCIAL DATA:	
9.	COMPUTER:	DEC PDP 11/70
10.	CONTROLS:	
11.	PRODUCTS:	Miscellaneous parts for local industry
12.	MATERIALS:	Steel, cast iron
13.	NUMBER OF PARTS:	
14.	PART FAMILIES:	
15.	PRODUCTION RATE:	
16.	PART CUBE:	
17.	PART SHAPE:	Prismatic and rotational
18.	OPERATION SCHEDULING:	
19.	LOT SIZE:	
20.	MACHINE SET:	1 NT, 1 MC (3 additional MT's planned by 82)
21.	MATL. HANDLING:	
22.	TOOLING:	
23.	FEATURES:	
24.	REFERENCES:	86

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This report presents descriptive data on three hundred manufacturing facilities that are using computer integrated manufacturing (CIM) techniques to machine component parts for commercial, industrial, and military products. Of these 258 were categorized as Flexible Manufacturing Systems (FMS). Key descriptive statistics were gathered for each system. The data is organized into records by the user's country, company, and geographic location. Each record is made up of 24 fields that describe the facility, the product, and the operating parameters, as well as providing a reference to the source(s) of information. In many instances the information has proven to be sparse. Nevertheless, taken in aggregate, a picture of the state of the art for FMS has emerged from the study. This picture is reflected in the graphical summaries of the data, which are presented by region for Eastern Europe, Western Europe, Japan, and the United States. An analysis of trends in FMS implementation, product and material characteristics, and materials handling technology is made for each of the above regions.

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