

CS
338.454

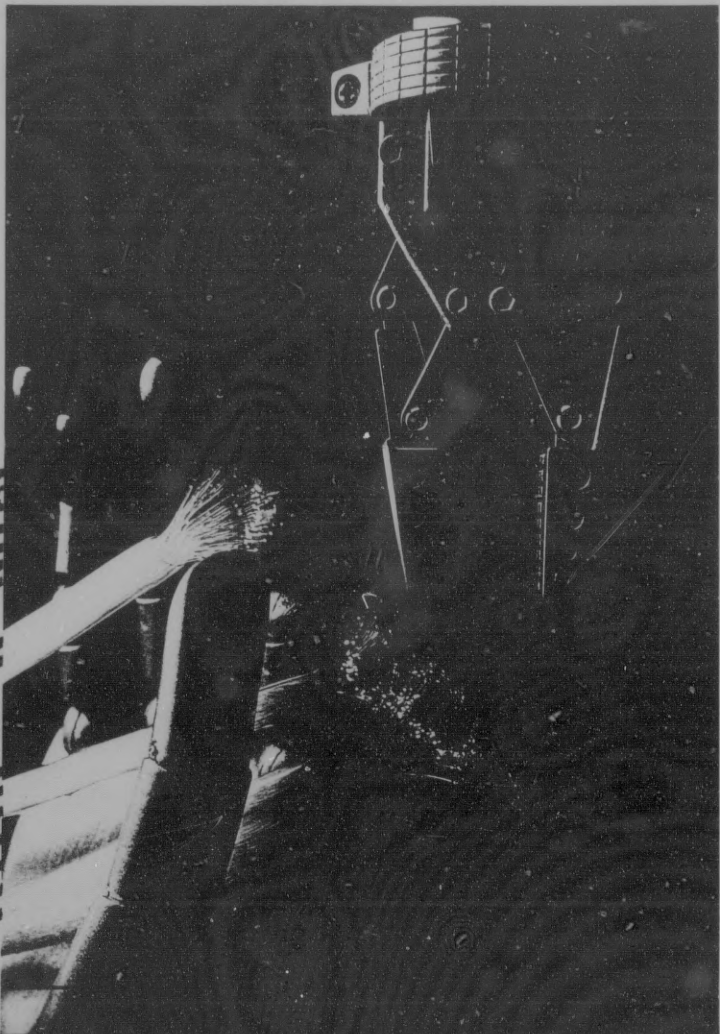
AVS



**Australian
Bureau of
Statistics**

Manufacturing Technology Statistics Australia

31 December 1991



Catalogue No. 8123.0

EMBARGOED UNTIL 11:30 A.M. 22 FEBRUARY 1993

MANUFACTURING TECHNOLOGY STATISTICS

AUSTRALIA

31 DECEMBER 1991



IAN CASTLES
Australian Statistician

AUSTRALIAN BUREAU OF STATISTICS

CATALOGUE No. 8123.0

CONTENTS

TABLE	DESCRIPTION	PAGE
	Main Features	4
	Special Notes	6
1	Manufacturing establishments with advanced technology: Technology type by industry subdivision, Australia, December 1991.	8
2	Manufacturing establishments: Number of establishments with employment of 10 or more and proportion with advanced technology by industry subdivision, Australia, June 1988 and December 1991.	10
3	Manufacturing establishments with advanced technology: Broad technology category by industry subdivision, Australia, December 1991.	12
4	Manufacturing establishments with advanced technology: Broad technology category by industry subdivision, Australia, June 1988.	12
5	Manufacturing establishments: Planned acquisition of advanced technology by type of establishment, Australia, December 1991.	12
6	Manufacturing establishments: Planned acquisition of advanced technology by technology type, Australia, December 1991.	14
7	Manufacturing establishments with advanced technology: Number of dedicated work-stations or items of equipment and source of technology by technology type, Australia, December 1991.	16
8	Manufacturing establishments: Proportion with advanced technology and contribution to industry turnover by industry subdivision, Australia, December 1991.	16
9	Manufacturing establishments with advanced technology: Employment size by industry subdivision, Australia, December 1991.	18
10	Manufacturing establishments with advanced technology: Employment size by industry subdivision, Australia, June 1988.	18
11	Manufacturing establishments with advanced technology: Employment size, Australia, June 1988 and December 1991.	18
12	Manufacturing Establishments: Number of establishments with employment of 10 or more and proportion with advanced technology, States and Territories, June 1988 and December 1991.	20

TABLE	DESCRIPTION	PAGE
13	Manufacturing establishments with advanced technology by industry subdivision, States and Territories, December 1991.	20
14	Manufacturing establishments with advanced technology: Reasons for introducing technologies by industry subdivision, Australia, December 1991.	22
15	Manufacturing establishments with advanced technology: Reasons for introducing technologies, Australia, June 1988 and December 1991.	22
16	Manufacturing establishments: Planned expenditure on advanced technology by industry subdivision, Australia, 1991.	24
17	Manufacturing establishments: Planned expenditure on advanced technology by industry subdivision, Australia, 1988.	24
18	Manufacturing establishments: Planned expenditure on advanced technology by type of establishment, Australia, 1988 and 1991.	24
19	Manufacturing establishments with advanced technology: Difficulty getting staff skilled in the normal operation or maintenance of technologies, Australia, December 1991.	26
20	Manufacturing establishments with advanced technology: Strategies used to ensure staff are skilled in the normal operation or maintenance of technologies, Australia, June 1988 and December 1991.	26
21	Manufacturing establishments: Use and planned use of advanced management techniques by industry subdivision, Australia, December 1991.	28
22	Manufacturing establishments: Use and planned use of advanced management techniques, Australia, June 1988 and December 1991.	28
	Explanatory Notes	30
	Glossary	33

Inquiries

For further information regarding the statistics in this publication and the availability of related unpublished statistics contact Mr. Eddie Koszela or the Economics Statistics Unit on Melbourne (03) 615 7000.

For information regarding other ABS statistics and services please contact Information Services Section on Melbourne (03) 615 7000 or any ABS State office.

MAIN FEATURES

- The 1991 Manufacturing Technology Survey was essentially a repeat of a similar survey conducted by the ABS in 1988. This publication outlines the broad findings from both surveys.

- More detailed information from the 1988 and 1991 collections is available on request from the ABS.

Use of technology increases

- There were an estimated 14,200 manufacturing establishments with 10 or more employees at 31 December 1991. Of these, 41 per cent had already acquired at least one of the surveyed advanced manufacturing technologies. Corresponding figures at 30 June 1988 were 16,000 establishments of which 33 per cent were using technology.

... but the proportion not using technology is still high

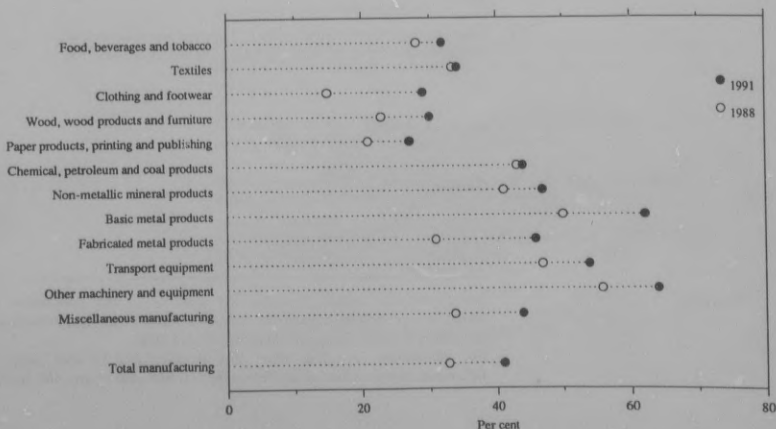
- Significantly, 50 per cent of manufacturing establishments had neither acquired any of the surveyed technologies nor had plans to acquire any within 5 years.

- While only 41 per cent of manufacturing establishments had any of the advanced technologies, they contributed 80 per cent of manufacturing turnover for the year ended 30 June 1991.

... nearly all industries show increase

- All industries except textiles increased use of advanced technology between 1988 and 1991.

USE OF ADVANCED TECHNOLOGY BY INDUSTRY SUBDIVISION



- The major uses of advanced technologies in the manufacturing sector were in design and engineering, fabrication and machining, and communication and control. Each of these activities accounted for more than 20 per cent of establishments reporting at least one of the surveyed technologies. In contrast, only 5 per cent reported having any of the technologies associated with automated material handling.

Advanced technologies commonly used

- The most common advanced technology acquired was computer aided design and/or engineering, with 18 per cent of manufacturing establishments using this technology at 31 December 1991. The next most common technologies acquired were standalone numerically controlled/computer numerically controlled (NC/CNC) machines and programmable logic controllers with 17 per cent of establishments having each technology respectively.

Source of technology

- More than half of manufacturing establishments with advanced technologies (with the exception of Filament winding, Reaction Injection Moulding (RIM), Pultrusion, and or casting) acquired them primarily from overseas sources.

Difficulty in obtaining skilled staff

- Manufacturers continue to have difficulty in getting staff skilled in the normal operation or maintenance of advanced technologies. In 1991, 30 per cent of those who had acquired such technologies reported having difficulty. This was slightly down on the 35 per cent in 1988.

Use of advanced management techniques

- There was a significant increase in the proportion of establishments using advanced management techniques. The proportion of establishments using Total Quality Control/Management increased from 15 per cent at 30 June 1988 to 24 per cent at 31 December 1991. Similarly, the proportion of establishments using Just-in-time increased from 15 per cent to 22 per cent.

Previous issue

- * This publication was last produced for the reference period 30 June 1988 and released on 8 November 1989.

Changes in this issue

- * An additional three technologies were added to the list of surveyed technologies. This had virtually no effect when comparing the data obtained for 1991 with the 1988 survey at the broad technology level.
- * An additional advanced management technique was added to the list of surveyed techniques and provision was made for the establishment to report on any additional techniques, other than those listed, which was in use or planning to be introduced by the establishment.
- * The combining of railway workshop locations (primary to ASIC class 3243) with rail transport locations (primary to ASIC class 5200) to form establishments primary to Division G: Transport and Storage (i. e. out of scope of this collection) may effect comparability of statistics for Subdivision 32 with previous data in some States.

Statistical unit

- * The unit for which statistics are reported in the Manufacturing Technology Survey 1991 is the establishment. The establishment is the smallest accounting unit of a business, within a State or Territory, controlling its productive activities and maintaining a specified range of detailed data enabling value added to be calculated. In general, an establishment covers all operations at a physical location, but may consist of a group of locations provided they are within the same State or Territory. The majority of establishments operate at one location only.
- * The standard units definitions employed in the system of integrated economic statistics were revised in 1988-89. Prior to this, an establishment covered, in general, all operations carried on under the ownership of one enterprise (business) at a single physical location. This change in units definitions has had some effect on the ratios for the 1991 survey.

Scope and coverage

- * All data for this survey relates to manufacturing establishments with employment of 10 or more.
- * Reference, within this publication, to establishments having technology is defined as establishments having one or more of the surveyed technologies (as shown on pages 33 and 34) in place.

Standard errors

- * Standard errors on the proportions of establishments with one or more technologies in each industry subdivision vary from 1.4 per cent for food, beverages and tobacco to 3.6 per cent for clothing and footwear.

STANDARD ERRORS OF PROPORTIONS OF ESTABLISHMENTS
WITH ADVANCED TECHNOLOGY,
AUSTRALIA, 1991

ASIC code	Industry subdivision	Establishments with one or more technologies (Per cent)	Standard error (Percentage points)
21	Food, beverages and tobacco	32	1.4
23	Textiles	34	3.2
24	Clothing and footwear	29	3.6
25	Wood, wood products and furniture	30	2.8
26	Paper, paper products, printing and publishing	27	2.6
27	Chemical, petroleum and coal products	44	2.6
28	Non-metallic mineral products	47	2.4
29	Basic metal products	62	3.1
31	Fabricated metal products	46	2.4
32	Transport equipment	54	3.1
33	Other machinery and equipment	64	2.2
34	Miscellaneous manufacturing	44	2.4
21-34	Total manufacturing	41	0.8

- * An example of how to interpret these standard errors is shown on page 31 under the heading "Reliability of the estimates".

- * Standard errors for other estimates presented in this publication are not separately provided but can be made available on request. Standard errors on the proportions for total manufacturing are in most cases less than two percentage points.



TABLE 1: ESTABLISHMENTS WITH TECHNOLOGY BY TECHNOLOGY TYPE
AND INDUSTRY, AUSTRALIA, 1991
(Per cent)

Detailed technology type	Industry Subdivision												Total manufacturing
	Food, beverages and tobacco	Textiles	Clothing and footwear	Wood, wood products and furniture	Paper and printing	Chemical, petroleum and coal products	Non-metallic mineral products	Basic metal products	Fabricated metal products	Transport equipment	Other machinery and equipment	Miscellaneous manufacturing	
Design and engineering													
Computer-aided design (CAD) and/or engineering (CAE)	6	10	13	14	13	17	11	25	18	24	40	20	18
CAD output used to control manufacturing machine(s) (CAD/CAM)	2	6	6	7	4	2	3	10	9	11	18	7	8
Digital representation of CAD output used in procurement activities	2	2	4	6	3	5	2	5	6	10	13	4	6
Fabrication, machining and assembly													
Standalone NC/CNC machines	5	9	11	16	6	5	10	33	23	26	33	16	17
Flexible manufacturing cell(s) or system(s)	5	4	2	1	1	6	6	7	1	5	4	4	3
Materials working laser(s)	-	-	-	-	1	-	1	3	1	3	2	1	1
Advanced cutting technologies apart from lasers	5	2	3	1	-	4	2	11	14	20	14	3	7
Advanced joining and coating technologies apart from lasers	-	-	-	1	-	-	-	2	-	3	1	2	1
Advanced heat-treatment(s) apart from lasers	-	-	-	-	-	-	-	3	2	3	1	1	1
Filament winding, Reaction Injection Moulding (RIM), Pultrusion, and/or casting	-	-	1	-	-	-	1	1	-	1	1	2	1
Simple pick and place robot(s)	1	1	1	-	1	3	4	6	2	6	4	5	2
Other more complex robots - those used for spot or arc welding	-	-	-	-	-	-	-	1	4	9	3	-	2
Other more complex robots - those used for assembly, finishing or other applications	-	-	1	-	-	-	1	2	-	4	1	-	1
Automated material handling													
Automated storage and retrieval system(s)	9	3	1	3	1	7	14	11	1	3	3	5	4
Automated guided vehicle system(s)	1	1	2	1	-	1	4	1	1	1	-	1	1
Automated inspection and/or testing equipment													
Performed on incoming materials or in process	4	2	-	2	1	5	4	5	1	3	2	4	2
Performed on final product	6	5	1	3	1	6	5	5	1	6	5	5	4
Communications and control													
Local area computer network (LAN) for technical data	4	3	3	3	6	13	5	13	7	10	13	3	7
Local area computer network (LAN) for factory use	10	9	2	1	6	16	7	17	7	14	12	6	8
Programmable logic controllers	27	22	3	7	8	38	32	36	11	22	16	18	16
Intercompany computer network (EDI) linking plant to subcontractors, suppliers and/or customers	5	7	4	3	3	9	5	14	4	17	5	4	5
Computers used for control on the factory floor	10	8	3	4	4	21	14	22	8	17	14	8	9
Proportion having one or more technologies	32	34	29	30	27	44	47	62	46	54	64	44	41

Technology details

* The advanced technology most widely used in manufacturing is computer-aided design and/or engineering (CAD/CAE). It is used in 18 per cent of establishments. This technology is used fairly extensively with at least 10 per cent of establishments in all industries except food, beverages and tobacco having this technology at 31 December 1991. Industries with the highest proportion of establishments using CAD/CAE were the other machinery and equipment industry with 40 per cent, basic metal products with 25 per cent and transport equipment with 24 per cent.

* Standalone NC/CNC machines are also extensively used within manufacturing industry with 17 per cent of establishments reporting having this technology. These machines are used mainly in the metals industries with the largest users being the basic metal products industry with 33 per cent of establishments, other machinery and equipment with 33 per cent, transport equipment with 26 per cent, and fabricated metal products with 23 per cent.

* The metals industries are also extensive users of advanced cutting technologies apart from lasers, with the transport equipment industry being the largest user with 20 per cent of establishments having this technology.

* In the communication and control field, programmable logic controllers was the most commonly acquired technology, being used by 16 per cent of establishments. This technology is used in a wide range of industries, with the most extensive users being the chemical, petroleum and coal products industry with 38 per cent of establishments, basic metal products with 36 per cent and non-metallic mineral products with 32 per cent.

* Computers used for control on the factory floor are most prevalent in the basic metal products industry with 22 per cent of establishments having this advanced technology. They are also used fairly extensively in the chemical, petroleum and coal products industry with 21 per cent of establishments and the transport equipment industry with 17 per cent.

TABLE 2 : NUMBER OF ESTABLISHMENTS WITH EMPLOYMENT OF 10 OR MORE AND PROPORTION WITH TECHNOLOGY
BY INDUSTRY,
AUSTRALIA, 1988 AND 1991

ASIC code	Industry subdivision	Number of manufacturing establishments (number)		Proportion of manufacturing establishments having one or more technologies (per cent)	
		1988	1991	1988	1991
21	Food, beverages and tobacco	2,185	1,888	28	32
23	Textiles	447	386	34	34
24	Clothing and footwear	1,400	974	15	29
25	Wood, wood products and furniture	2,080	1,908	23	30
26	Paper, paper products, printing and publishing	1,710	1,603	21	27
27	Chemical, petroleum and coal products	624	593	43	44
28	Non-metallic mineral products	613	569	41	47
29	Basic metal products	380	388	50	62
31	Fabricated metal products	2,385	2,161	31	46
32	Transport equipment	766	712	47	54
33	Other machinery and equipment	2,084	1,906	56	64
34	Miscellaneous manufacturing	1,302	1,125	34	44
21-34	Total manufacturing	15,976	14,214	33	41

Industry details

- There were 14,214 manufacturing establishments with employment of 10 or more at 31 December 1991. Of these, 41 per cent had already acquired at least one of the surveyed advanced manufacturing technologies. Corresponding figures at 30 June 1988 were 15,976 establishments of which 33 per cent were using technology.
- The clothing and footwear industry showed the greatest increase between 1988 and 1991 in the proportion of establishments acquiring advanced technology. At 30 June 1988, 15 per cent of establishments had acquired one of the surveyed technologies. This rose to 29 per cent at 31 December 1991. However, it should be noted that there was a significant decrease in the number of establishments in this industry between the two reference periods.
- Other industries with significant increases in the acquisition of at least one advanced technology included fabricated metal products (31 per cent to 46 per cent) and wood, wood products and furniture (23 per cent to 30 per cent).
- The other machinery and equipment industry continued to have the highest proportion of establishments having advanced technology with 64 per cent of establishments in this industry using one or more of the technologies at 31 December 1991.

TABLE 3: ESTABLISHMENTS WITH TECHNOLOGY BY BROAD TECHNOLOGY CATEGORY
AND INDUSTRY, AUSTRALIA,
1991
(Per cent)

ASIC code	Industry subdivision	Broad technology category				
		Design and engineering	Fabrication, machining and assembly	Automated material handling	Automated inspection and/or testing equipment	Communications and control
21	Food, beverages and tobacco	8	13	9	7	29
23	Textiles	12	15	4	7	26
24	Clothing and footwear	15	17	3	1	8
25	Wood, wood products and furniture	17	18	3	3	13
26	Paper, paper products, printing and publishing	16	8	2	2	15
27	Chemical, petroleum and coal products	19	14	8	8	43
28	Non-metallic mineral products	12	20	15	7	36
29	Basic metal products	28	45	12	8	44
31	Fabricated metal products	23	34	2	1	21
32	Transport equipment	28	44	3	7	34
33	Other machinery and equipment	44	43	3	5	34
34	Miscellaneous manufacturing	23	25	5	7	24
21-34	Total manufacturing	21	24	5	4	24

TABLE 4: ESTABLISHMENTS WITH TECHNOLOGY BY BROAD TECHNOLOGY CATEGORY
AND INDUSTRY, AUSTRALIA,
1988
(Per cent)

ASIC code	Industry subdivision	Broad technology category				
		Design and engineering	Fabrication, machining and assembly	Automated material handling	Automated inspection and/or testing equipment	Communications and control
21	Food, beverages and tobacco	5	8	5	9	24
23	Textiles	11	14	3	8	22
24	Clothing and footwear	7	8	1	1	10
25	Wood, wood products and furniture	9	13	2	2	9
26	Paper, paper products, printing and publishing	9	8	2	4	10
27	Chemical, petroleum and coal products	15	7	5	6	41
28	Non-metallic mineral products	9	13	9	7	31
29	Basic metal products	16	33	5	11	41
31	Fabricated metal products	10	20	-	2	11
32	Transport equipment	20	38	2	8	25
33	Other machinery and equipment	27	42	1	5	25
34	Miscellaneous manufacturing	11	15	2	5	18
21-34	Total manufacturing	12	18	2	5	18

TABLE 5: PLANNED ACQUISITION OF ADVANCED TECHNOLOGY
BY TYPE OF ESTABLISHMENT, AUSTRALIA, 1991
(Per cent)

Type of establishment	Planning to acquire within the next 2 years	Planning to acquire within the next 2 - 5 years	No plans to acquire (a)
Establishments with one or more technologies	23	13	64
Establishments without one or more technologies	8	6	86

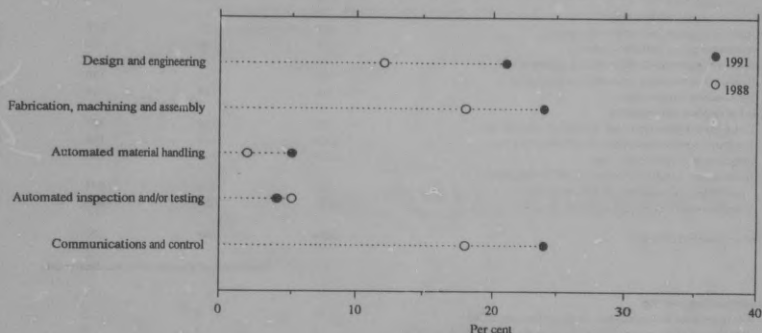
(a) No plans to acquire includes "not applicable to this type of operation" and "do not know".

Use of technology for design and engineering increases

* The major uses of advanced technology by manufacturers in 1991 continue to be in fabrication, machining and assembly and communications and control. About 24 per cent of manufacturers reported using at least one of the surveyed technologies in these broad categories.

* However, there was a significant increase from 1988 in the proportion of establishments using advanced technology for design and engineering. The proportion of manufacturers using advanced technology for design and engineering increased from 12 per cent in 1988 to 21 per cent in 1991.

USE OF ADVANCED TECHNOLOGY BY BROAD CATEGORY



* For each of the surveyed technologies, manufacturing establishments were asked to report if they had acquired the technology and, if not, whether they had any plans to acquire it. An establishment could not report having both acquired a particular technology and having plans to acquire the same technology (for example, to upgrade existing equipment). This could have an impact on the data relating to acquisition plans for technology.

Manufacturers with technology are more likely to acquire technology in the future

There is a marked difference in the acquisition plans between manufacturers with technology and those without. While manufacturers with technology could only report on acquisition plans for additional types of technology (as distinct from upgrade/replacement technology) about 36 per cent of these indicated they planned to do so within the next 5 years. On the other hand, only 14 per cent of manufacturers without technology planned to acquire any of the surveyed technologies within 5 years.

TABLE 6 : PLANNED ACQUISITION OF ADVANCED TECHNOLOGY
BY TECHNOLOGY TYPE, AUSTRALIA, 1991

Detailed technology type	Technology acquired	Planning to acquire within the next 2 years	Planning to acquire within the next 2 - 5 years	No plans to acquire (a)
Number of manufacturing establishments				
Design and engineering				
Computer-aided design (CAD) and/or engineering (CAE)	2,585	538	441	10,651
CAD output used to control manufacturing machine(s) (CAD/CAM)	1,090	232	362	12,530
Digital representation of CAD output used in procurement activities	791	291	401	12,731
Fabrication, machining and assembly				
Standalone NC/CNC machines	2,359	161	218	11,476
Flexible manufacturing cell(s) or system(s)	444	131	221	13,418
Materials working laser(s)	117	117	209	13,772
Advanced cutting technologies apart from lasers	998	130	116	12,970
Advanced joining and coating technologies apart from lasers	101	18	31	14,064
Advanced heat treatment(s) apart from lasers	115	15	34	14,049
Filament winding, Reaction Injection Moulding (RIM), Pultrusion, and/or casting	84	31	35	14,064
Simple pick and place robot(s)	340	168	301	13,405
Other more complex robots - those used for spot or arc welding	228	66	107	13,813
Other more complex robots - those used for assembly, finishing or other applications	88	43	137	13,946
Automated material handling				
Automated storage and retrieval system(s)	601	127	259	13,226
Automated guided vehicle system(s)	121	30	91	13,972
Automated inspection and/or testing equipment				
Performed on incoming materials or in process	330	114	230	13,541
Performed on final product	514	129	249	13,322
Communications and control				
Local area computer network (LAN) for technical data	939	369	363	12,543
Local area computer network (LAN) for factory use	1,108	443	466	12,197
Programmable logic controllers	2,330	190	166	11,528
Intercompany computer network (EDI) linking plant to subcontractors, suppliers and/or customers	741	534	391	12,548
Computers used for control on the factory floor	1,321	330	365	12,197
One or more technologies	5,894	660	532	7,128
Percentage of manufacturing establishments				
Design and engineering				
Computer-aided design (CAD) and/or engineering (CAE)	18	4	3	75
CAD output used to control manufacturing machine(s) (CAD/CAM)	8	2	3	88
Digital representation of CAD output used in procurement activities	6	2	3	90
Fabrication, machining and assembly				
Standalone NC/CNC machines	17	1	2	81
Flexible manufacturing cell(s) or system(s)	3	1	2	94
Materials working laser(s)	1	1	1	97
Advanced cutting technologies apart from lasers	7	1	1	91
Advanced joining and coating technologies apart from lasers	1	-	-	99
Advanced heat treatment(s) apart from lasers	1	-	-	99
Filament winding, Reaction Injection Moulding (RIM), Pultrusion, and/or casting	1	-	-	99
Simple pick and place robot(s)	2	1	2	94
Other more complex robots - those used for spot or arc welding	2	-	1	97
Other more complex robots - those used for assembly, finishing or other applications	1	-	1	98
Automated material handling				
Automated storage and retrieval system(s)	4	1	2	93
Automated guided vehicle system(s)	1	-	1	98
Automated inspection and/or testing equipment				
Performed on incoming materials or in process	2	1	2	95
Performed on final product	4	1	2	94
Communications and control				
Local area computer network (LAN) for technical data	7	3	3	88
Local area computer network (LAN) for factory use	8	3	3	86
Programmable logic controllers	16	1	1	81
Intercompany computer network (EDI) linking plant to subcontractors, suppliers and/or customers	5	4	3	88
Computers used for control on the factory floor	9	2	3	86
One or more technologies	41	5	4	50

(a) No plans to acquire includes "not applicable to this type of operation" and "do not know".

*Few manufacturers
intend to utilise
advanced technology*

* Only a small proportion of manufacturing establishments not having a particular type of advanced technology in place at 31 December 1991 had plans to acquire that technology within 5 years.

* A very substantial proportion of manufacturing establishments (50 per cent) had neither acquired any of the surveyed technologies nor had plans to acquire any such technologies within 5 years.

* Even for the most common technology acquired (computer aided design and/or engineering), where 18 per cent of manufacturers have it in place, only a further 7 per cent plan to acquire it within the next 5 years.

* Since 1988, the use of advanced technology has increased by 8 percentage points to 41 per cent. If expectations for future use are met, the proportion using advanced technologies by the end of 1993 will be 46 per cent and 50 per cent by the end of 1996.

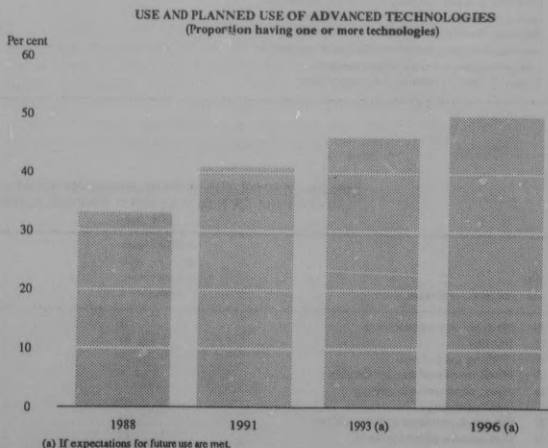


TABLE 7: NUMBER OF DEDICATED WORKSTATIONS
AND SOURCE OF TECHNOLOGY, AUSTRALIA, 1991

Detailed technology type	Number	Average number	Source of technology (per cent)	
			Primarily Australian	Primarily overseas
Design and engineering				
Computer-aided design (CAD) and/or engineering (CAE)	6,938	2.7	24	76
CAD output used to control manufacturing machine(s) (CAD/CAM)	2,308	2.1	25	75
Digital representation of CAD output used in procurement activities	..	..	34	66
Fabrication, machining and assembly				
Standalone NC/CNC machines	8,346	3.5	12	88
Flexible manufacturing cell(s) or system(s)	..	..	28	72
Materials working laser(s)	206	1.8	21	79
Advanced cutting technologies apart from lasers	1,530	1.5	36	64
Advanced joining and coating technologies apart from lasers	197	2.0	19	81
Advanced heat treatment(s) apart from lasers	237	2.1	41	59
Filament winding, Reaction Injection Moulding (RIM), Pulsion, and/or casting	155	1.8	54	46
Simple pick and place robot(s)	1,257	3.7	36	64
Other more complex robots - those used for spot or arc welding	760	3.3	14	86
Other more complex robots - those used for assembly, finishing or other applications	204	2.3	18	82
Automated material handling				
Automated storage and retrieval system(s)	..	..	43	57
Automated guided vehicle system(s)	..	..	34	66
Automated inspection and/or testing equipment				
Performed on incoming materials or in process	..	..	22	78
Performed on final product	..	..	34	66
Communications and control				
Local area computer network (LAN) for technical data	..	..	28	72
Local area computer network (LAN) for factory use	..	..	32	68
Programmable logic controllers	..	..	23	77
Intercompany computer network (EDI) linking plant to subcontractors, suppliers and/or customers	..	..	44	56
Computers used for control on the factory floor	..	..	25	75

TABLE 8: PROPORTION OF ESTABLISHMENTS WITH TECHNOLOGY
AND CONTRIBUTION TO INDUSTRY TURNOVER, AUSTRALIA, 1991
(Per cent)

ASIC code	Industry subdivision	Establishments with one or more technologies	Contribution to industry subdivision turnover for year ended 30 June 1991
21	Food, beverages and tobacco	32	78
23	Textiles	34	73
24	Clothing and footwear	29	57
25	Wood, wood products and furniture	30	58
26	Paper, paper products, printing and publishing	27	63
27	Chemical, petroleum and coal products	44	88
28	Non-metallic mineral products	47	78
29	Basic metal products	62	96
31	Fabricated metal products	46	69
32	Transport equipment	54	93
33	Other machinery and equipment	64	89
34	Miscellaneous manufacturing	44	65
21-34	Total manufacturing	41	80

Number of workstations or items of equipment

- The number of dedicated workstations or items of equipment was collected in respect of technologies where discrete items of equipment existed and could usually be clearly identified (e.g. a robot).

Numbers of robots

- The most common of these was standalone NC/CNC machines, with 8,346 dedicated workstations in place at 31 December 1991. On average there were 3.5 machines in place in each establishment having this technology.

Source of technology

- There were more than 2,200 robots in place in manufacturing establishments at the end of 1991. These comprised 1,257 simple pick and place robots, 760 complex robots used for spot or arc welding, and 204 complex robots used for assembly, finishing or other applications.

- Most manufacturing establishments acquired advanced technologies from primarily overseas sources. Source refers to the origin of the technology and not the place of purchase. Where a technology consisted of components or items from different sources it was classified according to the source representing the major dollar value of the technology.

- More than half of manufacturing establishments with advanced technologies (except for filament winding, Reaction Injection Moulding (RIM), Pultrusion, and/or casting) acquired them from primarily overseas sources.

Contribution to industry turnover

- Establishments already using advanced technology were the major contributors to turnover in all manufacturing industry subdivisions. Just over 40 per cent of these establishments contributed 80 per cent of total manufacturing turnover for the year ending 30 June 1991. This is also a reflection of the fact that larger manufacturers were more likely to have acquired advanced technology (The effect of the six month lag between the reference point for having technology (31 December 1991) and measuring turnover (30 June 1991) is likely to be minimal).

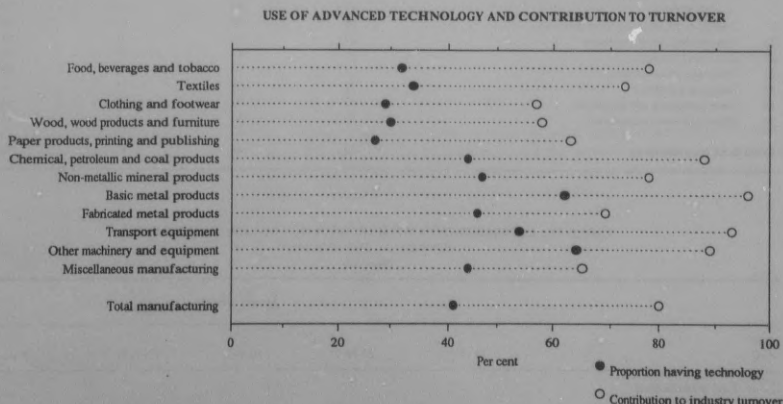


TABLE 9 : ESTABLISHMENTS WITH TECHNOLOGY BY EMPLOYMENT SIZE
AND INDUSTRY, AUSTRALIA,
1991
(Per cent)

ASIC code	Industry subdivision	Employment size			
		10-49	50-99	100-199	200+
21	Food, beverages and tobacco	16	47	67	86
23	Textiles	19	46	76	79
24	Clothing and footwear	22	47	59	89
25	Wood, wood products and furniture	24	73	79	100
26	Paper, paper products, printing and publishing	21	33	56	72
27	Chemical, petroleum and coal products	26	53	81	88
28	Non-metallic mineral products	31	81	85	97
29	Basic metal products	47	79	90	100
31	Fabricated metal products	40	63	85	92
32	Transport equipment	41	81	94	90
33	Other machinery and equipment	57	82	92	96
34	Miscellaneous manufacturing	36	62	77	83
21-34	Total manufacturing	32	61	77	88

TABLE 10 : ESTABLISHMENTS WITH TECHNOLOGY BY EMPLOYMENT SIZE
AND INDUSTRY, AUSTRALIA,
1988
(Per cent)

ASIC code	Industry subdivision	Employment size			
		10-49	50-99	100-199	200+
21	Food, beverages and tobacco	14	37	54	77
23	Textiles	20	57	57	68
24	Clothing and footwear	8	13	43	82
25	Wood, wood products and furniture	17	46	73	69
26	Paper, paper products, printing and publishing	13	31	47	70
27	Chemical, petroleum and coal products	28	55	69	83
28	Non-metallic mineral products	27	59	76	91
29	Basic metal products	33	48	87	98
31	Fabricated metal products	24	50	75	87
32	Transport equipment	32	58	85	88
33	Other machinery and equipment	47	71	85	94
34	Miscellaneous manufacturing	26	46	67	76
21-34	Total manufacturing	23	46	67	82

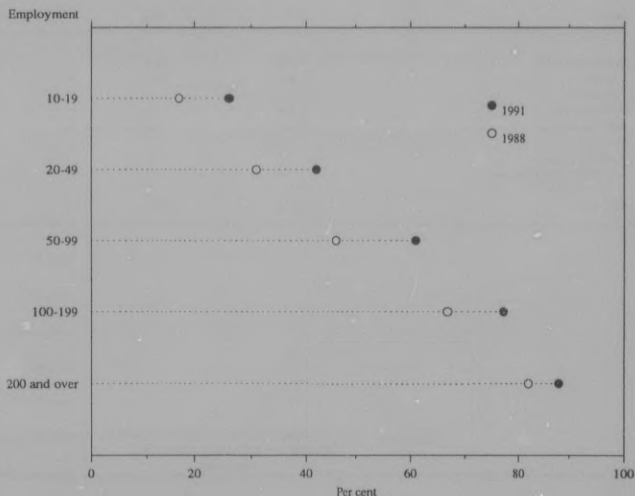
TABLE 11 : ESTABLISHMENTS WITH TECHNOLOGY BY EMPLOYMENT SIZE,
AUSTRALIA, 1988 AND 1991
(Per cent)

ASIC code	Employment size				
	10-19	20-49	50-99	100-199	200+
21-34	Total manufacturing				
1988	17	31	46	67	82
1991	26	42	61	77	88

*Manufacturers
of all sizes
increased
use of technology*

- Manufacturers in the 50-99 employment category showed the largest absolute increase (16 percentage points) in the proportion of establishments having advanced technology. On the other hand, those in the smaller category (10-19 employment) had the largest proportional increase (17 per cent to 26 per cent).

USE OF ADVANCED TECHNOLOGY BY EMPLOYMENT SIZE



*Larger manufacturers
more likely to
have technology*

- The 1988 and 1991 surveys show a strong relationship between the employment size of an establishment and the acquisition of advanced technology. Larger manufacturers were more likely to be using advanced technology. This relationship applied across all industry subdivisions.

TABLE 12 : NUMBER OF ESTABLISHMENTS WITH EMPLOYMENT OF 10 OR MORE
AND PROPORTION WITH TECHNOLOGY,
STATES AND TERRITORIES, 1988 AND 1991

State	Number of manufacturing establishments (number)		Proportion of manufacturing establishments having one or more technologies (per cent)	
	1988	1991	1988	1991
New South Wales	5,472	4,823	34	42
Victoria	5,202	4,493	32	42
Queensland	2,203	2,124	32	39
South Australia	1,278	1,156	35	43
Western Australia	1,345	1,180	31	37
Tasmania	338	326	32	45
Northern Territory	70	51	18	41
Australian Capital Territory	68	61	29	36
Australia	15,976	14,214	33	41

TABLE 13 : ESTABLISHMENTS WITH TECHNOLOGY BY INDUSTRY,
STATES AND TERRITORIES, 1991
(Per cent)

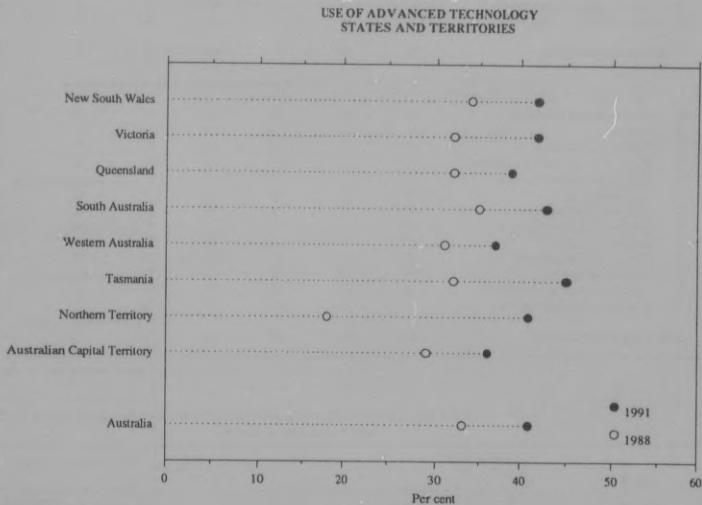
ASIC code	Industry subdivision	State							
		NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
21	Food, beverages and tobacco	35	29	34	37	25	36	33	44
23	Textiles	30	38	10	61	27	50	-	-
24	Clothing and footwear	18	33	43	32	12	43	-	-
25	Wood, wood products and furniture	35	22	36	28	23	37	40	63
26	Paper, paper products, printing and publishing	32	26	21	23	14	46	33	21
27	Chemical, petroleum and coal products	42	46	38	42	40	73	-	-
28	Non-metallic mineral products	51	43	43	54	49	47	100	25
29	Basic metal products	61	59	60	68	77	71	50	-
31	Fabricated metal products	44	55	41	47	35	38	29	50
32	Transport equipment	40	63	46	58	66	44	75	-
33	Other machinery and equipment	66	69	59	52	57	68	67	44
34	Miscellaneous manufacturing	44	45	32	57	42	66	50	50
21-34	Total manufacturing	42	42	39	43	37	45	41	36

Tasmania shows highest proportion of technology usage

* Tasmania had the highest proportion of manufacturers using technology with 45 per cent having at least one advanced technology. This was an increase of 13 percentage points from 1988.

Increased use across all States

* Between 1988 to 1991 there was an increase in the acquisition of advanced technology by manufacturing establishments in all States and Territories.



* It should be noted that the incidence of technology in a particular State or Territory will be influenced by a number of factors including the size of the establishment and the type of manufacturing activity.

TABLE 14: REASONS FOR INTRODUCING TECHNOLOGY BY INDUSTRY ,
AUSTRALIA, 1991

		Reasons							
ASIC code	Industry subdivision	Increase product quality	Lower labour costs	Lower non-labour costs	Increase output	Shorten delivery times	Improve working conditions	Flexibility in new product development/ production	Existing equipment required replacement
Proportion with reasons rated as very important									
21	Food, beverages and tobacco	61	48	25	51	22	23	25	21
23	Textiles	60	38	23	44	40	21	36	21
24	Clothing and footwear	56	46	16	65	49	33	53	29
25	Wood, wood products and furniture	50	49	19	68	37	29	32	14
26	Paper, paper products, printing and publishing	69	38	19	70	52	21	31	21
27	Chemical, petroleum and coal products	63	33	18	48	29	28	24	25
28	Non-metallic mineral products	58	46	16	58	30	28	31	24
29	Basic metal products	61	51	20	63	46	22	26	17
31	Fabricated metal products	58	50	22	58	50	29	26	14
32	Transport equipment	63	44	18	55	39	30	42	17
33	Other machinery and equipment	70	44	17	60	56	22	44	7
34	Miscellaneous manufacturing	71	46	18	65	48	27	40	21
21-34	Total manufacturing	62	46	19	60	44	26	35	17
Proportion with reasons rated as not important									
21	Food, beverages and tobacco	12	17	38	18	50	27	41	40
23	Textiles	17	29	42	26	34	45	38	57
24	Clothing and footwear	17	21	56	12	31	27	21	49
25	Wood, wood products and furniture	11	21	41	12	23	31	41	60
26	Paper, paper products, printing and publishing	12	27	55	6	15	42	37	41
27	Chemical, petroleum and coal products	15	27	43	15	43	29	41	46
28	Non-metallic mineral products	16	23	51	14	45	38	44	53
29	Basic metal products	9	21	43	10	27	30	38	50
31	Fabricated metal products	14	17	51	18	20	34	40	57
32	Transport equipment	14	18	45	13	28	31	33	60
33	Other machinery and equipment	8	22	47	11	14	34	29	65
34	Miscellaneous manufacturing	7	21	46	17	23	33	26	56
21-34	Total manufacturing	12	21	47	14	26	33	35	55

TABLE 15: REASONS FOR INTRODUCING TECHNOLOGY,
AUSTRALIA, 1988 AND 1991

Year	Reasons							
	Increase product quality	Lower labour costs	Lower non-labour costs	Increase output	Shorten delivery times	Improve working conditions	Flexibility in new product development/ production	Existing equipment required replacement
Proportion with reasons rated as very important								
1988	71	57	25	71	54	34	43	22
1991	62	46	19	60	44	26	35	17
Proportion with reasons rated as not important								
1988	11	16	38	11	24	29	30	50
1991	12	21	47	14	26	33	35	55

*Reasons for
introducing
technology*

Manufacturers using advanced technology were asked to report the degree of importance (very important, important, or not important) attached to a number of specified reasons for introducing the technology.

The primary reasons given in 1991 for introducing advanced manufacturing technology were to increase product quality and to increase output. These reasons were rated as being very important by around 62 per cent and 60 per cent of manufacturing establishments that had acquired advanced technology.

The reasons for introducing advanced technology rated as very important or important by the largest proportion of manufacturers in 1988 remained the same.

Generally, there was not much variation between industry subdivisions in the proportion of establishments that rated the specified reasons as very important or not important.

REASONS FOR INTRODUCING ADVANCED TECHNOLOGY
RATED AS IMPORTANT AND VERY IMPORTANT

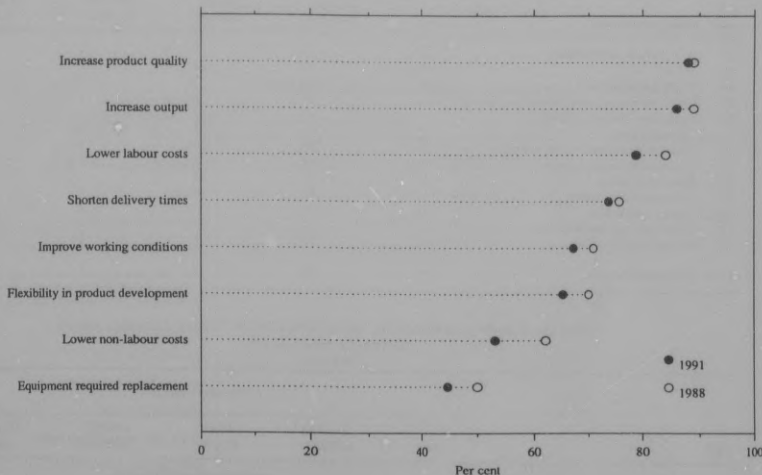


TABLE 16: PLANNED EXPENDITURE ON TECHNOLOGY BY INDUSTRY,
AUSTRALIA,
1991
(Per cent)

ASIC code	Industry subdivision	Expenditure category				
		None	Less than \$100,000	\$100,000- \$500,000	\$500,000 \$1 million	\$1 million and over
21	Food, beverages and tobacco	73	18	7	1	1
23	Textiles	73	17	8	1	1
24	Clothing and footwear	73	20	7	-	-
25	Wood, wood products and furniture	78	18	4	-	-
26	Paper, paper products, printing and publishing	76	16	6	-	1
27	Chemical, petroleum and coal products	57	26	12	2	2
28	Non-metallic mineral products	61	27	9	1	2
29	Basic metal products	52	28	13	3	4
31	Fabricated metal products	70	25	4	1	-
32	Transport equipment	59	29	9	2	2
33	Other machinery and equipment	51	39	8	1	1
34	Miscellaneous manufacturing	65	26	7	1	1
21-34	Total manufacturing	68	24	7	1	1

TABLE 17: PLANNED EXPENDITURE ON TECHNOLOGY BY INDUSTRY,
AUSTRALIA,
1988
(Per cent)

ASIC code	Industry subdivision	Expenditure category				
		None	Less than \$100,000	\$100,000- \$500,000	\$500,000- \$1 million	\$1 million and over
21	Food, beverages and tobacco	78	15	5	1	1
23	Textiles	71	14	12	1	2
24	Clothing and footwear	84	10	5	1	-
25	Wood, wood products and furniture	81	13	6	-	-
26	Paper, paper products, printing and publishing	82	11	5	1	1
27	Chemical, petroleum and coal products	57	30	9	3	2
28	Non-metallic mineral products	68	22	5	2	4
29	Basic metal products	52	24	17	1	5
31	Fabricated metal products	72	22	5	1	1
32	Transport equipment	61	23	11	2	4
33	Other machinery and equipment	50	32	13	4	2
34	Miscellaneous manufacturing	72	19	8	1	-
21-34	Total manufacturing	71	19	7	1	1

TABLE 18: PLANNED EXPENDITURE ON TECHNOLOGY BY TYPE OF ESTABLISHMENT,
AUSTRALIA, 1988 AND 1991
(Per cent)

Year	Expenditure category				
	None	Less than \$100,000	\$100,000- \$500,000	\$500,000- \$1 million	\$1 million and over
establishments with technology					
1988	26	48	19	4	4
1991	33	48	15	2	2
establishments without technology					
1988	94	5	2	-	-
1991	92	7	-	-	-

Planned expenditure on technology

Establishments with technology more likely to spend

* About 1 per cent of manufacturing establishments planned to spend over \$1 million on advanced technologies in the year ending 30 June 1992. In the same year 68 per cent of establishments expected no expenditure at all on technology. The corresponding figures for the year ending 30 June 1989 were 1 per cent and 71 per cent.

* As in 1988, there is a marked difference in the planned expenditure of manufacturers that had already acquired at least one of the surveyed technologies when compared with those not having any technology. Establishments with existing surveyed technology were more likely to plan additional expenditure on such technology in the near future than those without. Of those that had already acquired technology at 31 December 1991, around 33 per cent planned to spend nothing on technology in the year ending 30 June 1992. A further 27 per cent planned to spend over \$100,000. On the other hand, 92 per cent of those without technology planned to spend nothing on technology in the same year and only 2 per cent planning to spend over \$100,000 acquiring such technologies.

* The clothing and footwear industry recorded the largest increase between 1988 and 1991 in the proportion of manufacturers with planned expenditure on advanced technology. In that industry 27 per cent of establishments planned some expenditure in the year ending 30 June 1992. This compares with 16 per cent that planned some expenditure in the year ending 30 June 1989.

PROPORTION WITH PLANNED EXPENDITURE ON TECHNOLOGY

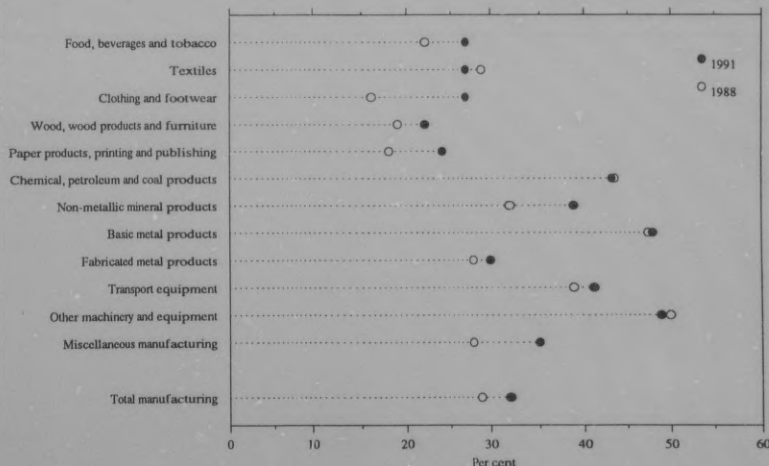


TABLE 19 : ESTABLISHMENTS WITH TECHNOLOGY AND DIFFICULTY GETTING SKILLED STAFF,
AUSTRALIA, 1988 AND 1991
(Per cent)

<i>Type of establishment</i>	<i>1988</i>	<i>1991</i>
Establishments having difficulty getting staff with the required skills	35	30
Establishments having no difficulty getting staff with the required skills	65	70

TABLE 20 : STRATEGIES USED TO ENSURE STAFF ARE SKILLED,
AUSTRALIA, 1988 AND 1991
(Per cent)

<i>Strategies used</i>	<i>Frequency of usage</i>					
	<i>1988</i>			<i>1991</i>		
	<i>Very frequently</i>	<i>Frequently</i>	<i>Infrequently or not at all</i>	<i>Very frequently</i>	<i>Frequently</i>	<i>Infrequently or not at all</i>
Recruit staff from outside	8	28	64	3	14	83
On-the-job training for existing staff	48	42	11	34	53	13
Special in-house training for existing staff	11	30	59	11	30	59
External training courses for existing staff	8	34	59	4	31	65
Seconded from research organisation	--	--	--	-	3	97

*Difficulty in
obtaining
skilled staff*

- Establishments which reported having at least one of the surveyed technologies were asked whether the introduction of the technology was associated with any difficulties in obtaining staff skilled in the normal operation, maintenance or programming of the advanced equipment.

- They were further asked to report frequency of a number of specified strategies to ensure their staff were adequately skilled.

- About 30 per cent of manufacturing establishments that had acquired advanced technology at the end of 1991 reported having difficulty getting staff with the required skill for the normal operation, maintenance or programming associated with the technology. This is a slight decrease from the 35 per cent reporting such difficulty in 1988.

- There was little or no change from 1988 in most of the methods used by manufacturers to ensure that their staff are adequately skilled. The only method to show any significant change was recruiting staff from outside the organisation. Only 17 per cent of manufacturers used this strategy either frequently or very frequently, compared to 36 per cent who did so in 1988.

- The most frequently used strategy to acquire the necessary skills was on-the-job training for existing staff. This strategy was used very frequently by 34 per cent of establishments, with only 13 per cent using it infrequently or not at all.

TABLE 21 : USE AND PLANNED USE OF MANAGEMENT TECHNIQUES BY INDUSTRY,
AUSTRALIA, 1991
(Per cent)

ASIC code	Industry subdivision	Technique					
		Total Quality Control/Management (TQC/TQM)			Just-in-time (JIT)		
		Using now	Plan to use within 2 years	Plan to use within 2-5 years	Using now	Plan to use within 2 years	Plan to use within 2-5 years
21	Food, beverages and tobacco	19	12	6	16	5	2
23	Textiles	24	15	4	27	11	1
24	Clothing and footwear	20	9	2	20	3	1
25	Wood, wood products and furniture	14	14	6	17	9	3
26	Paper, paper products, printing and publishing	20	13	2	20	3	3
27	Chemical, petroleum and coal products	34	28	8	24	17	7
28	Non-metallic mineral products	37	26	6	17	6	5
29	Basic metal products	41	19	10	28	13	5
31	Fabricated metal products	24	22	7	24	9	5
32	Transport equipment	35	20	8	33	10	4
33	Other machinery and equipment	28	28	5	23	12	4
34	Miscellaneous manufacturing	26	26	8	26	10	4
21-34	Total manufacturing	24	19	6	22	8	4

ASIC code	Industry subdivision	Technique					
		Manufacturing Resource Planning (MRP/MRPII)			Computer Integrated Manufacturing (CIM)		
		Using now	Plan to use within 2 years	Plan to use within 2-5 years	Using now	Plan to use within 2 years	Plan to use within 2-5 years
21	Food, beverages and tobacco	10	5	5	2	3	4
23	Textiles	7	14	10	4	1	3
24	Clothing and footwear	9	5	4	3	1	-
25	Wood, wood products and furniture	4	10	7	1	2	2
26	Paper, paper products, printing and publishing	6	6	2	2	1	1
27	Chemical, petroleum and coal products	27	16	7	4	2	10
28	Non-metallic mineral products	5	8	5	3	2	5
29	Basic metal products	18	10	5	3	2	8
31	Fabricated metal products	8	8	9	1	2	6
32	Transport equipment	18	10	6	2	2	4
33	Other machinery and equipment	19	10	6	2	3	5
34	Miscellaneous manufacturing	12	12	10	1	2	5
21-34	Total manufacturing	11	9	6	2	2	4

TABLE 22 : USE AND PLANNED USE OF MANAGEMENT TECHNIQUES,
AUSTRALIA, 1988 AND 1991
(Per cent)

Technique	1988		1991			
	Using now	Plan to use within 5 years	Using now	Plan to use within 2 years	Plan to use within 2-5 years	Plan to use within 5 years
Total Quality Control/Management	15	14	24	19	6	25
Just-in-time	15	10	22	8	4	12
Manufacturing Resource Planning	6	10	11	9	6	15
Computer Integrated Manufacturing	..	..	2	2	4	6
Value Adding Management	..	..	2	1	-	1
Proportion having one or more techniques	24	12	39	14	4	18

Use of advanced management techniques increases

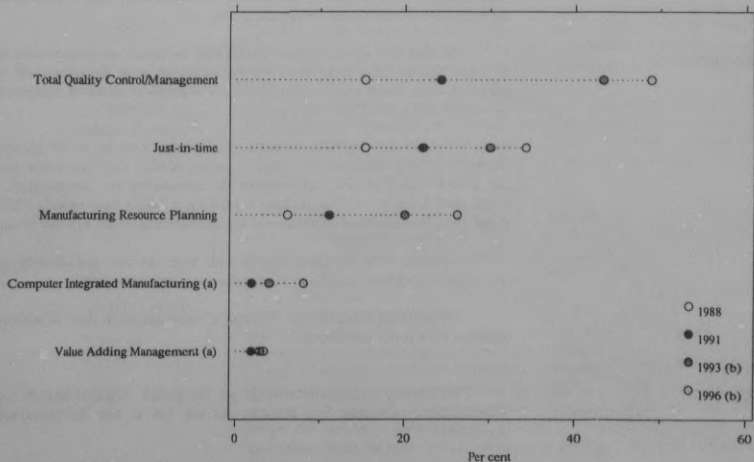
* Manufacturing establishments reported use of a number of advanced management techniques in the 1988 and 1991 surveys to improve product quality and/or efficiency. In 1991 the proportion using any such techniques was 39 per cent.

* Manufacturing management techniques surveyed were Total Quality Control/Management (TQC/TQM), Just-in-time (JIT), Manufacturing Resource Planning (MRP/MRP II) and Computer Integrated Manufacturing (CIM). Manufacturers were also asked to list any other advanced techniques in use or planned. Value Adding Management (VAM) was the only additional technique listed by a significant number of manufacturers.

* Total Quality Control/Management (TQC/TQM) is the most commonly used advanced management technique, being used by 24 per cent of manufacturing establishments at the end of 1991. A further 25 per cent planned to use this technique within 5 years. At 30 June 1988 only 15 per cent of manufacturing establishments were using TQC/TQM.

* About 22 per cent of manufacturing establishments reported using Just-in-time (JIT) in 1991, with a further 12 per cent planning to introduce it within 5 years.

USE AND PLANNED USE OF ADVANCED MANAGEMENT TECHNIQUES



(a) Not collected in 1988. (b) If expectations for future use are met.

EXPLANATORY NOTES

- This publication presents statistics compiled from the ABS Survey of Manufacturing Technology. Information was collected in respect of manufacturers' current and planned technology status as at 31 December 1991.

- This survey relates to the manufacturing sector only. Its results are comparable to other ABS economic data for the manufacturing sector with the exception that all non-manufacturing activities (e.g. selling and administration) are excluded.

Survey methodology

- A random sample of about 5200 establishments was selected using the population of manufacturing establishments on the ABS register of business units. The sample was stratified by State and by manufacturing industry subdivision (according to the Australian Standard Industrial Classification ASIC Catalogue No. 1201.0). The response to the survey was 95 per cent after allowing for ceased businesses and out of scope selections.

- The survey was conducted by mail, with forms dispatched in early February of 1992. Forms were addressed to the engineering/production manager (or equivalent) at each establishment selected.

Scope and coverage

- All manufacturing establishments with employment of 100 or more persons were included in the survey. Manufacturing establishments with employment between 10 and 99 persons were sampled, that is, only a proportion of these establishments was included in the survey. Establishments with employment less than 10 persons were excluded from the survey.

Questionnaire

- Section A of the questionnaire dealt with the usage and predominant source of each acquired manufacturing technology surveyed, plans for acquisition of the surveyed technologies and the number of workstations or items of equipment for selected manufacturing technologies.

- Section B dealt with miscellaneous issues relating to the technology introduction (For example, difficulty in getting skilled staff, strategies used to ensure staff were skilled, and reasons for introducing the technology). All establishments were asked to indicate (by ticking a range) their expected 1991-92 financial year expenditure on equipment and software associated with technologies.

- Section C of the questionnaire dealt with the use and planned use of advanced management techniques in manufacturing establishments.

- All questions except for the "Number of workstations or items of equipment" question were in tick box format.

Item definitions

... acquisition

- Technology acquisition covered two categories: acquired and in use for manufacturing operations and acquired but not yet in use for manufacturing operations.

... non-acquisition

- Technologies not acquired by 31 December 1991 covered three categories: Plan to acquire within the next 2 years, plan to acquire within the next 2 to 5 years and other (e.g. not cost effective and do not know).

... manufacturing operations

- Manufacturing operations for the purposes of this survey covered production and production related activities (such as development and design, tooling and maintenance, purchasing, inventory, materials handling and quality control).

Industry classification

- Manufacturing, as specified in Division C of the Australian Standard Industrial Classification (ASIC), broadly refers to the physical or chemical transformation of materials or components into new products, whether the work is performed by power-driven machines or by hand.

- Manufacturing establishments were classified according to the Australian Standard Industrial Classification (ASIC) class which best described their major manufacturing activities. For detailed information concerning the classification used see the Australian Standard Industrial Classification, 1983, Volume 1 (Cat. No. 1201.0).

Reliability of the estimates

- Since estimates are based on information obtained from a sample drawn from units in the survey population, the estimates shown in this publication are subject to sampling variability, that is, they may differ from figures that would have been obtained if all units had been included.

... sampling errors

- One measure of the likely difference is given by the standard error, which indicates the extent to which an estimate might have varied by chance because only a sample of units was included.

- There are approximately two chances in three that a sample estimate will differ by less than one standard error from the figure that would have been obtained if all units had been included in the survey, and approximately nineteen chances in twenty that the difference will be less than two standard errors.

... example of standard errors

- For example, the proportion of establishments with technology in the basic metal products industry is 62 per cent and the standard error 3.1 percentage points. There are nineteen chances in twenty that a complete collection (Census) would give an estimate within two standard errors of the sample estimate, that is, in the range 55.8 per cent to 68.2 per cent.

- Standard errors on the proportions of establishments with technology by industry subdivision are shown in the Special Notes on page 7. Standard errors for other estimates presented in this publication can be made available on request.

... non-sampling error

- Errors other than standard errors, referred to collectively as non-sampling errors, can occur in surveys because of deficiencies in the register of units from which the sample was selected, imperfections in reporting by respondents, or processing errors. A potential source of non-sampling error in the current survey is respondent misinterpretation of technology definitions. Several categories were broadly interpreted by many respondents but extensive querying and amendment of returned forms reduced the potential errors to a minimum. Additionally, careful design and testing of questionnaires, efficient operating procedures and use of appropriate methodologies further reduced the possible effects of non-sampling error.

Related publications

- Other statistics relating to technology may be found in the ABS publication:

Mining Technology Statistics, Australia, 30 June 1991
(Catalogue No. 8413.0).

Other manufacturing statistics

- Other statistics relating to manufacturing establishments may be found in the following ABS publications:

Manufacturing Industry, Summary of Operations, Australia,
(Catalogue No. 8202.0)

Manufacturing Industry, Australia
(Catalogue No. 8221.0)

- Other statistics on related topics published by the ABS include:

Research and Experimental Development, All Sector Summary, Australia,
(Catalogue No. 8112.0 and 8122.0)

Symbols and other usages

- Where figures have been rounded, discrepancies may occur between sums of the component items and totals.

-	nil or rounded to zero
n.p.	not available for publication but included in totals where applicable
n.a.	not available
n.e.c.	not elsewhere classified
..	not collected

Advanced technologies**Design and engineering****Computer-aided design (CAD) and/or computer-aided engineering (CAE)**

Use of computers for drawing and designing parts or products and for analysing and testing of designed parts or products.

CAD output used to control manufacturing machine(s) (CAD/CAM)

Use of CAD output for controlling machines used to manufacture the part or product.

Digital representation of CAD output used in procurement activities

Use of CAD output to produce parts lists or bills of materials. Includes use of offline electronic media, such as the Initial Graphics Exchange System (IGES) to provide suppliers with product information.

Fabrication, machining and assembly**Standalone NC/CNC machines**

A single machine either numerically controlled (NC) or computer numerically controlled (CNC) with or without material handling capabilities. NC machines are controlled by numeric commands, punched on paper or plastic mylar tape, while CNC machines are controlled electronically through a computer residing in the machine.

Flexible manufacturing cell(s) (FMC) or system(s) (FMS)

Two or more machines with automated material handling capabilities controlled by computer(s) or programmable controller(s), capable of single or multiple path acceptance of raw material and single or multiple path delivery of the sub-assemblies or finished products.

Materials working laser(s)

Laser technology used for welding, cutting, treating, scribing or marking.

Advanced cutting technologies apart from lasers

Includes water jet, plasma arc and ultrasonic devices used for cutting.

Advanced joining and coating technologies apart from lasers

Includes electron beam welding and/or vacuum brazing. Vacuum assisted, electroless nickel and hard chrome coatings, etc.

Advanced heat treatment(s) apart from lasers

Includes plasma, electron beam, sealed quench, vacuum with nitrogen quench and induction hardening treatments.

Filament winding, Reaction Injection Moulding (RIM), Pultrusion and/or casting

Filament winding is a process whereby a reinforcing filament or tape is wrapped continuously around a form in a rotating cylindrical rod.

Reaction Injection Moulding is a process whereby a mixture of two or more reactive fluids are forced under high pressure into a mould cavity. Chemical reaction then takes place in the mould very rapidly and the resultant polymer solidifies.

Pultrusion is a process whereby continuous reinforcement is pulled through a polymer bath and then through a long heated dye. The product is cured in transit.

Advanced technologies**Simple pick and place robot(s)**

A simple robot with one, two or three degrees of freedom, which transfers items from place to place by means of point to point moves. Little or no trajectory control is available.

Other more complex robots - those used for spot or arc welding

Other more complex robots - those used for assembly, finishing or other applications

Automated material handling**Automated storage and retrieval system(s)**

Computer or micro processor controlled equipment providing for automatic handling and storage of materials, parts or finished products.

Automated guided vehicle system(s)

Vehicles equipped with automatic guidance devices programmed to follow a path that interfaces with workstations for automated or manual loading and unloading of materials, tools, parts or products.

Automated inspection and/or testing equipment**Performed on incoming materials or in process**

Includes automated sensor and vision based systems.

Performed on final product

Includes automated sensor and vision based systems.

Communications and control**Programmable logic controller(s)**

A solid state industrial control device that has programmable memory for storage of instructions and which performs functions equivalent to a relay panel or wired solid state logic control system.

Local area computer network for technical data

Use of local area network (LAN) technology to exchange technical data within design and engineering departments

Local area computer network for factory use

Use of local area network (LAN) technology to exchange information between different points on the factory floor.

Computers used for control on the factory floor

Excludes computers embedded within machines or computers used solely for data acquisition or monitoring. Includes computers which may be dedicated to control, but which can be reprogrammed for other functions.

Electronic data interchange (EDI)

Intercompany computer network linking plant to subcontractors, suppliers and/or customers.

*Advanced
management
techniques*

Total Quality Control/Management (TQC/TQM)

Company wide control at every stage of processing rather than only of the finished product. Includes Zero Quality Control.

Just-in-time (JIT)

Minimisation of inventory and work in progress in the context of removing non value-adding costs.

Manufacturing Resource Planning (MRP,MRPII)

A system, usually computer based, used for planning and control of manufacturing resources.

Computer Integrated Manufacturing (CIM)

Totally automated production, in which all manufacturing processes are integrated and controlled by a central computer.

Value Adding Management (VAM)

A strategy aimed to achieve continual improvement in performance through progressive identification and elimination of all non value-adding costs.



For more information ...

The ABS publishes a wide range of information on Australia's economic and social conditions. A catalogue of publications and products is available from any of our Offices (see below for contact details).

Information Consultancy Service

Special tables or in-depth data investigations are provided by the ABS Information Consultancy Service in each of our Offices (see below for contact details).

Electronic Data Services

A growing range of our data is available on electronic media. Selections of the most frequently requested data are available, updated daily, on DISCOVERY (Key *656#). Our PC TELESTATS service delivers major economic indicator publications ready to download into your computer on the day of release. Our PC AUSSTATS service enables on-line access to a data base of thousands of up-to-date time series. Selected datasets are also available on diskette or Cd-ROM. For more details on our electronic data services, contact Information Services in any of our Offices on the numbers below.

Bookshops and Subscriptions

There are over 500 titles available from the ABS Bookshops in each of our Offices. You can also receive any of our publications on a regular basis. Join our subscription mailing service and have your publications mailed to you in Australia at no additional cost. Telephone our Publications Subscription Service toll free on 008 02 06 08 Australia wide.

Sales and Inquiries



SYDNEY (02) 268 4611
MELBOURNE (03) 615 7000
BRISBANE (07) 222 6351
PERTH (09) 323 5140

ADELAIDE (08) 237 7100
HOBART (002) 20 5800
DARWIN (089) 43 2111
CANBERRA (06) 252 6627

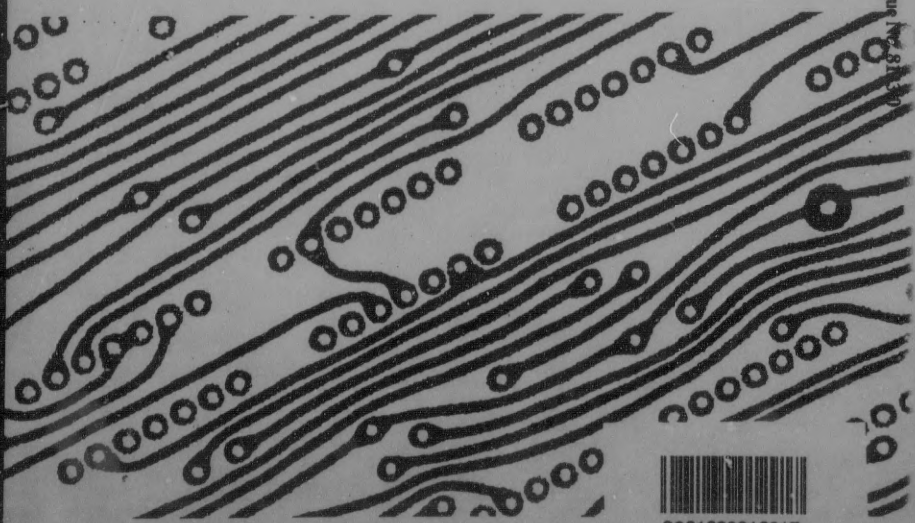


Information Services, ABS, PO Box 10, Belconnen ACT 2616
or any ABS State office.



"Our mission is to assist and encourage informed decision-making, research, and discussion within governments and the community, by providing a high quality user oriented and dynamic statistical service; we will actively co-ordinate statistical activities across government agencies and promote the use of statistical standards."

Manufacturing Technology Statistics Australia, 31 December 1991 Catalogue No. 81-30



2081230012917

ISBN 0 642 17210 2

Recommended retail price: \$20.00