

*Microelectronics, Automation  
and Employment in the  
Automobile Industry*

*Edited*

*by*

**Susumu Watanabe**

**Preface by Ajit S. Bhalla**

**Foreword by Aubrey Silberston**

**A study prepared for the International Labour Office  
within the framework of the World Employment Programme**

**JOHN WILEY & SONS**

**Chichester · New York · Brisbane · Toronto · Singapore**

# Contents

ILO Preface by Ajit S. Bhalla . . . . .	ix
Foreword by Aubrey Silbertson . . . . .	xi
Notes on the Contributors . . . . .	xv
Glossary . . . . .	xvii
<b>CHAPTER I INTRODUCTION . . . . .</b>	<b>1</b>
<i>Susumu Watanabe</i>	
1 The purpose of the study . . . . .	1
2 Plan of the volume . . . . .	5
3 The automobile industry and the new technology . . . . .	7
4 Technology, scale and organization of the industry . . . . .	12
<b>CHAPTER II ROBOTICS, NUMERICAL CONTROL AND THE COMPUTER . . . . .</b>	<b>25</b>
<i>Warren Seering</i>	
1 Robotics . . . . .	25
(i) Its evolution . . . . .	25
(ii) Limitations . . . . .	26
(iii) Strength . . . . .	28
(iv) Prospect of future development . . . . .	29
2 Numerically controlled machines . . . . .	31
(i) History . . . . .	31
(ii) How a system works . . . . .	32
(iii) The current situation . . . . .	34
(iv) Machine tools in the future . . . . .	36
3 The role of the worker . . . . .	37
4 Conclusions . . . . .	39

<b>CHAPTER III FLEXIBLE AUTOMATION AND LABOUR PRODUCTIVITY IN THE JAPANESE AUTO-MOBILE INDUSTRY . . . . .</b>	<b>41</b>
<i>Susumu Watanabe</i>	
1 Trends of the industry . . . . .	41
(i) Production and employment . . . . .	41
(ii) Contributors to labour productivity improvement . . . . .	44
2 Diffusion of microelectronic equipment . . . . .	50
3 Survey findings . . . . .	53
(i) The extent and purposes of application of microelectronic machinery . . . . .	53
(a) The assemblers . . . . .	53
(b) Major component manufacturers . . . . .	58
(c) Small subcontractors . . . . .	59
(ii) The employment impact of new technology . . . . .	61
(a) NC machine tools . . . . .	61
(b) Robots . . . . .	65
(c) The overall employment impact . . . . .	66
(iii) Skill requirements and workers' attitude . . . . .	67
(iv) Constraints on the diffusion of the new technology . . . . .	69
4 Summary and conclusions . . . . .	70
<b>CHAPTER IV MICROELECTRONICS, EMPLOYMENT AND LABOUR IN THE UNITED STATES AUTO-MOBILE INDUSTRY . . . . .</b>	<b>79</b>
<i>Bruce T. Allen</i>	
1 Structure and trends of the industry . . . . .	79
2 Diffusion of NC machine tools and robots . . . . .	84
(i) NC machine tools . . . . .	84
(ii) Robots . . . . .	86
3 Application of robots in different production processes . . . . .	90
(i) Welding . . . . .	90
(ii) Painting and finishing . . . . .	92
(iii) Casting and forging . . . . .	93
(iv) Material handling . . . . .	94
(v) Component assembly . . . . .	95
(vi) Trim, final assembly and inspection . . . . .	96

4	Implications for labour . . . . .	96
	(i) Employment . . . . .	96
	(ii) Industrial relations . . . . .	99
5	Summary and conclusions . . . . .	102

**CHAPTER V MICROELECTRONICS AND RATIONALIZATION OF THE FRENCH AUTOMOBILE INDUSTRY . . . . . 107**

*Susumu Watanabe*

1	Trends and structure of the industry . . . . .	107
	(i) Production, employment and investment . . . . .	107
	(ii) The structure of the industry . . . . .	111
2	Diffusion of microelectronic technology . . . . .	112
3	Constraints on robotization . . . . .	116
4	Impact of new technology . . . . .	117
	(i) Employment and skill requirements . . . . .	117
	(ii) Work organization . . . . .	120
	(iii) Workers' attitude . . . . .	121
5	Government policy . . . . .	122
	(i) Positive programmes . . . . .	122
	(ii) Passive programmes . . . . .	123
6	Summary and conclusions . . . . .	124

**CHAPTER VI ROBOTS, EMPLOYMENT AND INDUSTRIAL RELATIONS IN THE ITALIAN AUTOMOBILE INDUSTRY . . . . . 131**

*Francesco Silva, Piero Ferri and Aldo Enrietti*

1	Trends and structure of the industry . . . . .	131
	(i) The assembly sector . . . . .	131
	(ii) The auto-parts sector . . . . .	133
2	The case of FIAT . . . . .	135
	(i) Flexible automation . . . . .	137
	(ii) Rationalization of design and work organization . . . . .	141
	(iii) Industrial relations . . . . .	142
	(iv) Employment effects of robotization . . . . .	143
3	The case of Alfa Romeo . . . . .	143
4	Impact of the new technology on the auto-parts sector . . . . .	144

	(i) The sample firms . . . . .	144
	(ii) Diffusion of microelectronic production technology . . . . .	145
	(iii) Employment effects . . . . .	148
5	Summary and conclusions . . . . .	149

**CHAPTER VII MICROELECTRONICS AND THE INTERNATIONALIZATION OF THE BRAZILIAN AUTOMOBILE INDUSTRY . . . . . 155**

*José Ricardo Tauile*

1	General background of the industry . . . . .	156
2	Assemblers and new technologies . . . . .	160
3	Auto-parts manufacturers and microelectronics . . . . .	167
	(i) The structure of the auto-parts manufacturing sector . . . . .	167
	(ii) Diffusion of microelectronic equipment . . . . .	169
4	Impact on employment and labour . . . . .	173
	(i) Employment impact and workers' attitude . . . . .	173
	(ii) Effects on work organization . . . . .	175
5	Summary and conclusions . . . . .	176

**CHAPTER VIII A SYNTHESIS OF FINDINGS . . . . . 181**

*Susumu Watanabe*

1	General conclusions . . . . .	181
2	The extent and pattern of microelectronics application . . . . .	182
3	The employment impact . . . . .	183
	(i) The labour-saving effect . . . . .	185
	(ii) The work-amplifying effect . . . . .	188
	(iii) The impact on individual workers . . . . .	190
4	Constraints on the diffusion of microelectronics and prospects for the future . . . . .	191
5	Emerging issues . . . . .	193

**INDEX . . . . . 199**