

# A STUDY ON IMPACT OF BARCODE AND RADIO FREQUENCY IDENTIFICATION TECHNOLOGY ON MAXIMIZED PRODUCTIVITY IN MANUFACTURING INDUSTRIES AT SIPCOT, CHENNAI

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## ABSTRACT

*Bar-code technology has now widespread that many customers take it for granted as this technology continues to offer infinite benefits in a wide extent of businesses. The theoretical frame work is intended to gain responses with maximum users about automation and optimization of production using Barcode and RFID; since there is a limited user of RFID, the researcher was supposed to go with barcode users only. This study observed the importance and implementation of Barcode in manufacturing industries, how it works and appreciates productivity, its influence over the manufacturing chain and about its integration among the different units and frames of this sector.*

**Key words:** Bar-code, RFID, Barcode in manufacturing industries

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## 1. INTRODUCTION

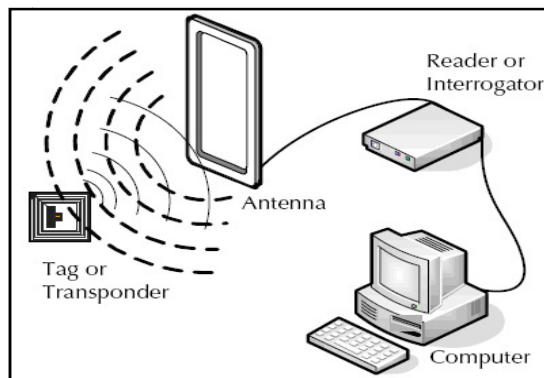
Bar Code techniques have percolated every module of human lives; it is found in grocery stores, hospitals, department stores, parcel bookings etc. They become an accepted part of our everyday events. In highly competitive & innovative environment, manufacturers depend on a well-coordinated chain of rolls to make their operation work effective. Technology rendered greatest advantage by innovating barcode methods and later the RFID methods. These two are competing technologies while RFID is highly advanced and much costlier to the former. This study provides an overview of application betterment of bar coding in manufacturing industries and how manufacturers consider and employ these technologies to have optimized productivity on a batch or real-time basis.

### 1.1. Bar-Code & RFID Introduced

A barcode is an optical, machine-scannable, representation of data; the data usually explains something about the product or object that carries the barcode. It is constructed with parallel and adjacent bars. It also consists of some narrow bars and some wide bars. The width and height of bars are declared according to the numbers or characters given to it. But the actual data would be kept on the bars. These numbers are only for references.



Radio frequency identification (RFID) is a generic definition, used to define a transmitting system that identifies the object or person wirelessly, by enable of radio waves. RFID identifies the object from a distance, unlike barcode technology's line of sight requirement.



### 2. OBJECTIVES OF THE STUDY

- To study about the importance of Bar-Code technology over traditional methods
- To find out major drivers for adopting bar-coding in manufacturing industries
- To study how it assists manufacturers in process simplification and improve efficiency
- To evaluate Cost and benefits on implementing these technologies
- To critically analyze the challenges faced by industries in adopting this technology
- To offer concrete suggestions to improve bar-code technology on the basis of result of this research

### 3. LIMITATIONS OF THE STUDY

Certain constraints/bottlenecks are unavoidable for which any researcher has to face. The main limitation of this study is as follows:

- Adequate numbers of samples were unable to employ due to time constraint.
- Self-administered questionnaire is handled as primary data source and thus probabilities of unbiased information will be less.
- The views spelt by respondents are their individual experience and perception on bar-code technology. So the degree of reliability may not be accurate.

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- As RFID is not installed in most industries because of its high installation & operational cost, the researcher is restricted to do survey only to barcode.
- As this study is conducted in Chennai zone, its results cannot be comparable with any other geographic location

**4. BRIEF VIEW OF RESEARCH METHODOLOGY**

**Survey Plan**

Survey Pattern	:	Exploratory & Descriptive
Target Segment	:	Industrial Users of Bar-Codes
Sample Size	:	310 Respondents
Sample Design	:	Convenience & Non Probability Sampling
Survey Plot	:	SIPCOT units, Chennai region

**Data Collection Technique**

Research Instrument	:	Primary Data (Questionnaire, Interview-Schedule)
Response Mode	:	Through Personal Interaction
Questionnaire Type	:	Open Ended and Multiple Option Questions
Research	:	Industrial Survey
Data Analysis	:	Mathematical Tabulation & Interpretation

**4.1. Data Analysis and Interpretation**

The primary data i.e. responses were gathered from respondents chosen from SIPCOT units in Chennai including Irungattukottai, Mappedu, Gummidipoondi, Oragadam, Siruseri, Sriperumpudur.

**Table 1** Type of Manufacturing Industry

Industry type	No. of respondents	Percentage
Automobile	96	31
Consumer durable	73	24
FMCG	65	21
Industrial product	76	25
Total	310	100

Source: Survey data of the researcher

*Inference*

The highest majority 31% of respondents are from automobile industry, followed by them, 25% deals with industrial product and 24% from consumer durable. Equal importance has been given to all type of manufacturing industries in fixing respondents for this study. This shows that the researcher is very cautious in identifying and selecting right respondents, which would give rise to accurate research results.

**Table 2** Factors influencing industries to adopt Bar-Code technology

Factors	No. of respondents	Percentage
Clients' request to provide bar-coded tags	17	5
Real-time data collection	139	45
Production control	61	20
Cost-effective track & trace	93	30
Total	310	100

Source: Survey data of the researcher

*Inference*

Majority of 139% of respondents adopt bar-code technology because of its real-time data collection. About 93% of industrialists prefer for its cost-effective track & trace. The least of 17% of respondents adopts because of the demand of client customers.

**Table 3** Industrialists' Choice Selection factors of Bar-Codes over Manual methods

Reasons to adopt bar-codes	Bar-Code method		Manual method	
	No. of respondents	% of respondents	No. of respondents	% of respondents
Precise Information Tracking	276	89	34	11
Recording inventory data	241	78	69	22
Picking raw material when in work orders	193	62	117	38
Tracking Work-in-Process (WIP)	294	95	16	5
Unique Product Identification	253	82	57	18
Recording transfer of product to shipping department	302	97	8	3
JIT Operations	297	96	13	4
Swift Product searching	282	91	28	9
No. of respondents (in average)	267	86	43	14

Source: Survey data of the researcher

*Inference*

When studied the various factors for respondents to choose bar-code methods over manual methods, an average of 86% of respondents supported bar-codes for precise information tracking, recording transfer of product to shipping department etc. A minimum of 14% respondents opine that even though they have shifted from manual methods, they can't consider manual methods an absolute one and it has its own advantage.

**Table 4** Respondents' impression on performance standards of bar-coding

Performance standard	Impression level on performance		
	Highly impressed	Just Impressed	Not impressed
Fixing codes	259	48	3
Scanning codes using scanners	243	53	14
Decoding and recognizing barcode symbology	277	30	3
Items log at Receiving dock	230	51	29
Automatic data transfer to host computer	286	18	6
No. of respondents (in average)	259	40	11

Source: Survey data of the researcher

*Inference*

An average of 259 of respondents is highly impressed with overall performance standards. In particular, 230 of the total respondents are highly impressed with working of bar-codes in receiving dock, as because;

item log in receiving department is a crucial task and is simplified by bar-codes and bar-code scanners. Decoding and recognizing barcode symbology has got second place in impressing respondents.

**Table 5** Respondents' opinion on high price tag

<b>Opinion</b>	<b>No. of respondents</b>	<b>% of respondents</b>
Affordable	218	70
High, but it is worthy	73	24
Very high	19	6
Total	310	100

Source: Survey data of the researcher

*Inference*

Majority of 70% of respondents consider cost of price tag as affordable. About 24% respondents said that though the cost is high, it is worth because of its meritorious features. A very few of 6% of respondents feel high to bear the cost.

**Table 6** Respondents' Perception on Time Management Using Bar-Codes

<b>Benefits</b>	<b>Perception Level</b>			<b>Total</b>
	<b>High</b>	<b>Average</b>	<b>Low</b>	
Ease of in-house material handling	192	115	3	310
Quick gauge of in & out shipments	224	84	2	310
Tracking dispatched equipment	219	90	1	310
Track supply lines	231	77	2	310
No. of respondents (in average)	216	92	2.0	310

Source: Survey data of the researcher

*Inference*

An average of 216 have high perception on Decoding and recognizing barcode symbology, quick gauge of in & out shipments, tracking dispatched equipment, track supply lines. About 91.5 responses feel average on the above said factors.

**Table 7** Impact of bar-code technology on productivity

<b>Impact %</b>	<b>Increased</b>		<b>Decreased</b>	
	<b>No. of Respondents</b>	<b>% of Respondents</b>	<b>No. of Respondents</b>	<b>% of Respondents</b>
Upto 10%	211	68	-	-
10 to 20%	73	24	-	-
20 to 30%	19	6	-	-
Above 30%	7	2	-	-
Total	310	100	-	-

Source: Survey data of the researcher

*Inference*

A high majority of 68% industrial respondents agreed that their production level has been raised in terms of output units from 1% to 10% post implementing bar-code technology. About 24% of respondents gained 10 to 20% increased production. And it is really wonder that no respondent has suffered any loss after turned to bar-code technology.

**Table 8** Respondents' opinion on bar-codes and increased revenue generation

Benefits	Agree		Disagree	
	No. of Respondents	% of Respondents	No. Of Respondents	% of Respondents
Improved accountability	307	99	3	1
Decreased clerical cost	308	99	2	1
Greater client satisfaction	296	95	14	5
Improved return on investment	297	96	13	4
No. of respondents (in average)	302	97	8	3

Source: Survey data of the researcher

### *Inference*

An average of 302 respondents agreed that bar-coding improvised revenue generation through improved production, improved accountability, greater client satisfaction, improved return on investment. A very low average of 8 respondents is not readily agreed with this statement.

## 4.2. Statistical Testing: Chi-Square Analysis

### *Chi-square analysis on the relationship between type of industry and maximized productivity*

To identify the type of industry which adopts bar-code technology and shows maximum production, using Chi-Square test and result of the test is given in Table 1.

Type of Industry	Impact on Production				Total
	0 to 10%	10 to 20%	20 to 30%	30 to 40%	
Automobile	67	21	3	2	93
Consumer durable	59	18	7	1	85
FMCG	41	20	5	3	69
Industrial product	44	14	4	1	63
Total	211	73	19	7	310

Difference of freedom: **9**

Table value: Five percent level – **16.91**

Calculated  $\chi^2$  (Chi-Square) value: **6.12**

One percent level – **21.66**

**Null Hypothesis:** There is no significant relationship between type of industry and level of production.

**Inference :** Chi- square test reveals that the calculated value of chi- square 6.12 is less than the table value at 5% level (  $\chi^2 = 6.12 < 16.91$  ) so the null hypothesis is accepted. Hence it is inferred that there is no significant relationship between type of industry and level of production.

### *Chi-square analysis on the relationship between choice selection of bar coding and maximized productivity*

Selection criteria	Impact on Productivity				Total
	0 to 10%	10 to 20%	20 to 30%	30 to 40%	
Precise Information Tracking	23	11	4	1	39
Recording inventory data	19	8	3	1	31
Picking raw material when in work orders	31	10	2	0	43
Tracking Work-in-Process (WIP)	24	12	3	1	40
Unique Product Identification	36	6	2	1	45
Recording shipping activity	26	9	1	1	37

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JIT Operations	29	11	3	1	44
Swift Product searching	23	6	1	1	31
Total	211	73	19	7	310

Difference of freedom: **21**

Table value: Five percent level – **32.67**

Calculated  $\chi^2$  (Chi-Square) value: **5.47**

One percent level – **38.93**

**Null Hypothesis:** There is no significant relationship between choice selection of bar-coding and level of production.

**Inference :** Chi- square test reveals that the calculated value of chi- square 5.47 is less than the table value at 5% level (  $\chi^2 = 5.47 < 32.67$  ) so the null hypothesis is accepted. There is no significant relationship between selection choice of bar-coding and level of production.

***Chi-square analysis on the relationship between time management using bar coding and maximized productivity***

Perception level	Impact on productivity				Total
	0 to 10%	10 to 20%	20 to 30%	30 to 40%	
High	158	40.5	12	6	216.5
Average	52	31.5	7	1	91.5
Low	1	1	0	0	2
Total	211	73	19	7	310

Difference of freedom: **5**

Table value: Five percent level – **11.07**

Calculated  $\chi^2$  (Chi-Square) value: **11.35**

One percent level – **15.08**

**Null Hypothesis:** There is no significant relationship between time management using Bar-codes and increased production.

**Inference :** Chi- square test reveals that the calculated value of chi- square 11.35 is greater than the table value at 5% level (  $\chi^2 = 11.35 > 11.07$  ) so the null hypothesis is rejected. Hence it is inferred that there is significant relationship between time management using Bar-codes and increased production.

## 5. FINDINGS

- Alpha-Numeric bar-code methods are preferred by most manufacturing industrialists.
- Firms adopts bar-codes for its real time data collection which delivers Value to manufacturing and distribution
- Buy, implement and maintain of bar-code technology is feasible to any size of business
- Precise information tracking reduces storage space and labour costs which is less significant in manual methods
- Working of bar-codes in receiving dock impressed most industrialists.
- Scanning a bar code, which produces greater than 99.9% data accuracy—is a far superior method of entering data into a host system than keyboard entry, or, worse yet, manual data keeping with pencils/pens and forms.
- Efficient time management using bar-code is a milestone progress for manufacturers
- Increased production level as well as appreciation in revenue generation is really effected by bar-code technology

## 6. CONCLUSION

Bar-code technology has now widespread that many customers take it for granted as this technology continues to offer infinite benefits in a wide extent of businesses. The theoretical frame work is intended to gain responses with maximum users about automation and optimization of production using Barcode and

RFID; since there is a limited user of RFID, the researcher was supposed to go with barcode users only. This study observed the importance and implementation of Barcode in manufacturing industries, how it works and appreciates productivity, its influence over the manufacturing chain and about its integration among the different units and frames of this sector. The empirical results have been done to examine their work practices within the related field and initiatives.

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