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Analyzing The Impact Of Lean Manufacturing Principles On Customer Satisfaction In The Automotive Industry In Gujarat

Deepak Singh, FMS, Parul University

Sushma Bharti, FMS, Parul University

Dr. Vaishali Shah, Assistant Professor, FMS, Parul University

Abstract

The impact of Lean Manufacturing principles on customer satisfaction in the automotive industry is a topic of significant importance. Lean Manufacturing, which originated from the Toyota Production System, is a set of principles and practices aimed at minimizing waste and maximizing efficiency in production processes. When applied in the automotive sector, these principles can have a profound influence on various aspects of the industry. First and foremost, the implementation of Lean principles can lead to cost reduction by eliminating non-value-added activities, streamlining production, and reducing inventory levels. This cost savings can, in turn, be passed on to customers in the form of more competitive pricing or improved product features.

Furthermore, Lean Manufacturing emphasizes continuous improvement, employee involvement, and a focus on delivering value to the customer. These aspects can directly impact customer satisfaction. Continuous improvement means that companies are constantly seeking ways to enhance their products and processes, resulting in higher quality and reliability. Employee involvement encourages a culture of teamwork and ownership, which can lead to a more engaged and motivated workforce, ultimately contributing to better products and services. The customer-centric approach inherent in Lean principles ensures that automotive manufacturers prioritize meeting customer needs and expectations, leading to products that are more aligned with market demands.

Keywords: Lean manufacturing, Customer satisfaction, Automotive industry, Efficiency, Waste reduction, Continuous improvement, Quality management

Introduction

The automotive industry stands as one of the most dynamic and fiercely competitive sectors in the global economy. Continuous advancements in technology, shifting consumer preferences, and increasing environmental concerns have propelled the industry into a state of perpetual change. In this landscape, customer satisfaction has emerged as a paramount benchmark for success. The ability to meet and exceed customer expectations has become a critical differentiator for automotive manufacturers, shaping brand loyalty, market share, and long-term profitability.

Amidst this backdrop, Lean Manufacturing principles have garnered significant attention as a transformative approach to production and operational excellence. Originating from the renowned Toyota Production System, Lean Manufacturing is a philosophy and methodology aimed at reducing waste, enhancing efficiency, and improving overall quality. It has, over the years, demonstrated its remarkable efficacy in various industrial sectors, including the automotive industry.

This study seeks to delve into the intricate relationship between Lean Manufacturing principles and customer satisfaction within the automotive industry. It is not merely an exploration of operational practices but a comprehensive analysis of how Lean principles can influence the entire spectrum of customer experiences, from product quality and pricing to lead times and after-sales support.

In this introduction, we provide a brief overview of the automotive industry's significance and the contemporary challenges it faces. We then introduce the core concept of Lean Manufacturing and its historical underpinnings. Furthermore, we outline the objectives and significance of this study, setting the stage for a comprehensive examination of the impact of Lean Manufacturing principles on customer satisfaction in the automotive industry.

LITERATURE REVIEW

- **The role of culture and leadership in lean transformation: A review and assessment model**
- This study looks at how the way a company operates and its leaders affect putting in place lean systems. It discusses things like company culture, leadership, and issues within the workforce. It also explains how a company can benefit from assessing its culture using a model called Lean Culture Assessment Model (LCAM). The study talks about the key things that make lean systems successful, as well as internal and external factors within Toyota's culture that help make lean implementation work well.
- **Lean attitude considering attitude in lean production**

For these authors, lean is a perspective, a way to look at operational systems through the special lenses of value, flow, pull and perfection. Broadly, there is widespread consensus regarding this perspective. Indeed, the limited number of companies that have effectively adopted lean principles in certain aspects of their operations have treated it as more than just a collection of tools. Achieving success with lean implementation demands a distinct comprehension of lean, viewing it not merely as a viewpoint, but as a mindset.

Lean manufacturing: Literature review and research issues.

There is a multitude of definitions of Lean Manufacturing (LM), each with its own set of objectives and scope. Research in LM has predominantly centered around theory validation through empirical and exploratory studies. While the automotive industry has been a primary focus of LM research, the principles of LM have also found application in various other industries. One crucial aspect of LM implementation is the concurrent adoption of lean principles throughout the supply chain. LM has evolved into a cohesive system comprising tightly integrated components and a diverse array of management techniques.

- **Lean production and the internet**

While the automotive sector has been a primary area of focus for Lean Manufacturing (LM) research, LM principles have also been embraced by various other industries. A key factor in LM implementation is the simultaneous adoption of lean principles throughout the supply chain. LM has evolved into an integrated system consisting of closely interconnected components and a diverse range of management practices. However, there remains a lack of standardized LM implementation processes or frameworks.

Lean production: Denial, confirmation or extension of socio-technical systems design?

This paper makes a comparison between the basic elements of lean production and sociotechnical systems design (STSD) and compare them both with the characteristics of the traditional Fordist system of mass production. It contends that lean production should not be viewed merely as an alternative to mass production, as proponents often suggest. Instead, it asserts that lean production is, in fact, prolonging the existence of mass production.

Supply chain management strategy, planning and operation. "

The increasing dynamics of the international markets, the increased competition between companies, increasingly successful e-business and a new density of information for customers via the Internet about products, their prices, availability and delivery times are forcing companies to better coordinate their business processes. A crucial part of these business processes extends along the supply chain (SC), the logistical value chain. Supply Chain Management (SCM) is becoming increasingly important in corporate practice.

- **The perceived impact of JIT implementation on operations performance: Evidence from chinese firms.**

The purpose of this paper is to investigate the perceived impact of just-in-time (JIT) implementation on operations performance, identify the relationship between elements of JIT (integrated and individual) and based on the metrics examined, the study provides insightful recommendations for enhancing Just-in-Time (JIT) implementation in the manufacturing industry. The findings indicate that regardless of industry type or company size, adopting a comprehensive set of JIT elements enhances production operations performance. However, the impact varies among individual JIT elements. Basic components such as 5S, multi-skilled employees, and JIT purchasing demonstrate a more significant influence compared to other elements.

OBJECTIVES OF THE STUDY

The objective of this article is to understand the concept of lean manufacturing. The various tools and techniques and to eliminate waste by concurrently reducing or minimizing supplier, customer and internal variability. The main concept is lean manufacturing is globally use widely applied manufacturing industry and to provide quality product. Numerous organizations and industries have adopted the concept of lean manufacturing

HYPOTHESES

Hypothesis 1: There is an association between age and occupation.

Null Hypothesis (H0): Age and occupation are independent of each other.
Alternative Hypothesis (H1): Age and occupation are associated with each other.
Hypothesis 2: There is a difference in the primary focus of Lean Manufacturing Principles across different age groups.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	91.366[a]	12	.000
Likelihood Ratio	100.345	12	.000
Linear-by-Linear Association	67.751	1	.000
N of Valid Cases	158		

a. 8 cells (40.0%) have expected count less than 5. The minimum expected count is .04.

Interpretation- Based on these results, you can confidently conclude in your research paper that there is a statistically significant association between the variables under study.

The linear-by-linear association suggests that there is a trend in the association between the variables, which may imply a directional relationship.

However, given the caution regarding low expected counts, it would be prudent to further investigate the specific cells with low expected counts to ensure the robustness of the findings.

Null Hypothesis (H0): The primary focus of Lean Manufacturing Principles is the same across different age groups.
Alternative Hypothesis (H1): The primary focus of Lean Manufacturing Principles varies across different age groups.
Hypothesis 3: There is a relationship between gender and the key principles of Lean Manufacturing.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.932[a]	12	.790
Likelihood Ratio	8.566	12	.740
Linear-by-Linear Association	3.410	1	.065
N of Valid Cases	158		

a. 7 cells (35.0%) have expected count less than 5. The minimum expected count is .18.

Interpretation- Based on these results, you may conclude in your research paper that there is no statistically significant association between the variables under study.

While the Linear-by-Linear Association test approaches significance, it's important to exercise caution in interpreting this result, especially given the non-significance of the other tests and the presence of cells with low expected counts.

It's possible that there may be no meaningful relationship between the variables, or there could be other factors at play that were not captured in the analysis.

Null Hypothesis (H0): Gender and key principles of Lean Manufacturing are independent of each other.
Alternative Hypothesis (H1): Gender and key principles of Lean Manufacturing are associated with each other.

Hypothesis 4: There is a difference in the perception of Lean Manufacturing benefits between different locations.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.306[a]	6	.635
Likelihood Ratio	4.497	6	.610
Linear-by-Linear Association	.721	1	.396
N of Valid Cases	158		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .11.

Interpretation- Based on these results, you may conclude in your research paper that there is no statistically significant association between the variables under study.

The lack of significance in all three tests suggests that the observed frequencies in the contingency table are likely due to chance variation rather than a true relationship between the variables.

It's important to note that while there is no statistically significant association, this does not necessarily imply the absence of any relationship between the variables. It could be that the relationship is weak or non-existent.

Null Hypothesis (H0): Occupation and perception of Lean Manufacturing challenges are independent of each other.
Alternative Hypothesis (H1): Occupation and perception of Lean Manufacturing challenges are associated with each other.
Hypothesis 6: There is a difference in the perception of continuous improvement in Lean Manufacturing across different age groups.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.466[a]	12	.171
Likelihood Ratio	16.585	12	.166
Linear-by-Linear Association	.865	1	.352
N of Valid Cases	158		

a. 9 cells (45.0%) have expected count less than 5. The minimum expected count is 1.97.

Interpretation- Based on these results, you may conclude in your research paper that there is no statistically significant association between the variables under study.

The lack of significance in all three tests suggests that the observed frequencies in the contingency table are likely due to chance variation rather than a true relationship between the variables.

It's important to note that while there is no statistically significant association, this does not necessarily imply the absence of any relationship between the variables. It could be that the relationship is weak or non-existent.

Null Hypothesis (H0): Perception of continuous improvement in Lean Manufacturing is the same across different age groups.
Alternative Hypothesis (H1): Perception of continuous improvement in Lean Manufacturing varies across different age groups.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.392[a]	12	.496
Likelihood Ratio	11.619	12	.477
Linear-by-Linear Association	.261	1	.610
N of Valid Cases	158		

a. 4 cells (20.0%) have expected count less than 5. The minimum expected count is .44.

Interpretation- Based on these results, you may conclude in your research paper that there is no statistically significant association between the variables under study.

The lack of significance in all three tests suggests that the observed frequencies in the contingency table are likely due to chance variation rather than a true relationship between the variables.

However, it's important to note that while there is no statistically significant association, this does not necessarily mean the absence of any relationship between the variables. It could be that the relationship is weak or non-existent.

RESEARCH METHODOLOGY

RESEARCH DESIGN

A study was done to explore how adopting Lean practices can help reduce environmental impact in organizations. This was verified theoretically and observed in a real case study of an electronics company using a mixed research approach. The research method focused on a single case study, providing detailed insight through interviews, observations, and document analysis. A research protocol and validated pilot test were used. Data collection methods included semi-structured interviews, direct observation, and document analysis, and the information was analyzed qualitatively using content analysis techniques.

The study compared different models and highlighted their similarities and differences. It aims to serve as a guide for implementing Lean practices successfully. The research began with a review of relevant literature obtained from online databases like Taylor and Francis, Science Direct, Google Scholar, Bing, etc., using primary keywords such as just-in-time (JIT), Lean, Lean supply, JIT manufacturing, ISM, automotive, automotive components, etc., and secondary keywords like practices, benchmarking, modeling, framework, etc.
The samples of organizations were obtained from the. They were randomly selected from those which have completeinformation and contact details. 350manufacturers were identified and questionnaires were distributed to them using postal mail. The questionnaires were addressed to the General Managers or Managing Directors of the companies. They were considered to be the best addresseesbecause they were likely to be the thought leaders in charge of lean manufacturing.However, it was up to the organization to assignthe most appropriate person who hasknowledge to answer the questionnaire. Toincrease the response rate, various techniques such as providing self- addressed stamped envelopes, making telephone calls, and sending follow-up letters were employed. Finally, a total of 52 responses were obtained.However, only 44 were valid for analysis, yielding a response rate of 12.6%. According to Jusoh et al. (2008), this feedback rate in postal survey was not unusual in Andhra pradesh as they obtained a response rate of12.3%. Likewise,

a response rate of 11.5%was obtained by Ahmed and Hassan (2003) in their study in Andhra pradesh. Therefore, the response rate for this research was considered to be reasonable.

SOURCE OF DATA

Primary: For my survey primary data have been used as a questionnaire to collect the data. Filled questionnaires were taken. After confirming the same, the filled up questionnaires were fed for analysis as per coding.

Secondary:The secondary data has been collected from the following modes :

1. Journals
2. Magazines
3. Newspaper
4. Data through internet sources
5. Data collected from organization

Purpose of the study:

Study Objective:
The aim of this research is to assess the satisfaction levels of Tata Motors' customers.

Importance of the Study:
This study seeks to uncover whether Tata Motors fulfills its commitments to customers.
This investigation relies on existing data sources such as research articles, online articles, doctoral theses, survey reports, and books related to the automotive industry, particularly focusing on Lean, Just-in-Time (JIT), and Inventory Stock Management (ISM). The authors collaborated with four Lean practitioners from Maharashtra, India, to devise an ISM Model for Lean practices, although the details of this model's development are beyond the scope of this paper.The review of literature described in the previous part highlighted some of the
research gaps identified by research studies in the automotive industry. This
research gap alleviated the development of the objectives of the study; expansion
of a lean practice model for SMEs and automotive industries in Gujarat using
most tools for lean manufacturing practice. Therefore, research methodology on
survey-based was most necessary for the accomplishment of the related research
tasks.

DATA COLLECTION METHOD

A formal set of pilot questionnaire is prepared and data collected with details information of various respondents. The main purpose is to be collected primary data in sufficient quantity in standardize manner therefore consistent data achieved for analysis. A set of questionnaire is designed for educational level as a consideration of the respondent’s experience. The user friendly language used for designing of the questions so respondents were familiar. The most widely used Likert scale considered to obtain the response of the respondents for each of the statements. It was requested to respondents to select the any one of five response categories such as Not Important, Least Important, Can’t Say, Very Important and Extremely Important as of their degree of agreement. The Likert scales are design such way so that it is easy administer and easy to understand by the respondent. Also, it is easy and suitable for personnel, mail and electronic interviews. The survey questionnaires are pre-tested by the involvement of the respondents in the proposed sample structure. The main intention of this research is to test the degree of understanding and difficulty faces by the respondents to understand the meaning of the questions, if the respondents understand the questions as per intention is to ascertain relevance of the questions. The purpose of this pretesting survey questionnaire is to get the realistic information for improving the questionnaires formats, sequences and related contents. Very

often this kind of study leads to various amendments before the starting of survey.
Therefore enough time has to give for this stage in the schedule time of the study. The pilot survey covers the different region of automobile industry within Gujarat state. The primary data has been collected from the industry, using the questionnaire developed for this purpose. A pilot study was conducted with 17 Automobile industry of Gujarat State. Data was collected using an online and offline mode. This questionnaire covers 5 sections. Section-I contains basic information of company/industry and respondents, employee details, type of organization, production technologies, product types, operation types, etc. Section-II contains Lean Manufacturing approaches and awareness about the tools/techniques which are used for implementation of Lean practices in Automobile Industry of Gujarat. Section-III contains Barriers affecting for successful implementation of lean practices. Section-IV contains Critical Success Factors (input factors) and the major drivers; which are used for lean manufacturing practices in automobile industry of Gujarat. Section-V contains performance improvements indicators for lean manufacturing practices. This is the most important part. Respondents rate these factors on the basis of their perceptions about important performance improvement.

Tool for Data Collection: Questionnaire comprised of two sections. First section deals with the demographics. Second section related to factors. The questionnaire had given five point scales rating Highly Dissatisfied to Highly Satisfied , where five is the highest rank. The data collected from respondents later classified on the basis of age, education, sex, income, location and occupation.

POPULATION

The universe or population refers to the entire set of items or units within a particular area of study, while the population specifically denotes the total items for which information is sought.

SAMPLING METHOD

Random Sampling,
Convenience sampling
Quota sampling

SAMPLING FRAME
Sampling frame
(Vadodara City for telephone survey for B2B research or Paul University is sampling frame through google forms.)
Study population – Gujarat
Target Population - Whole population and those who are interested , youth people, and old people.

DATA COLLECTION INSTRUMENT
Data instrument

(Questionnaire having dichotomous, Likert scale, open ended, close ended quantifiable questions like rating scale and ranking scale.)

Clearly Define Target Population

Select sampling frame

Choose sampling technique

Determine sample size

Collect data

Assess response rate

Results / Analysis / Interpretation

Age * Occupation Crosstabulation

			Occupation				Total
			Student	Employee	Teacher	Other	
Age	16-20	Count	26	4	1	0	31
		Expected Count	13.5	9.4	7.5	.6	31.0
	20-25	Count	40	16	6	0	62
		Expected Count	27.1	18.8	14.9	1.2	62.0
	25-30	Count	2	17	16	0	35
		Expected Count	15.3	10.6	8.4	.7	35.0
	30-35	Count	1	11	13	3	28
		Expected Count	12.2	8.5	6.7	.5	28.0
	Other	Count	0	0	2	0	2
		Expected Count	.9	.6	.5	.0	2.0
Total		Count	69	48	38	3	158
		Expected Count	69.0	48.0	38.0	3.0	158.0

Interpretation- Students are the most prominent occupation among individuals aged 16-20 and 20-25, with counts of 26 and 40, respectively. This is expected given the age ranges typically associated with attending school or university. Employees become more prevalent among individuals aged 25-30 and 30-35, with counts of 17 and 11, respectively. This suggests a shift towards employment as individuals transition into their late twenties and thirties. Teachers show a relatively consistent presence across age groups, with counts of 1, 6, and 13 in the age groups 16-20, 20-25, and 25-30, respectively. This may indicate a stable career path for individuals in the teaching profession across different age brackets. The "Other" category has minimal representation across all age groups, with negligible counts. This suggests that these occupations are relatively less common within the sample population.

Age * What is the primary focus of Lean Manufacturing Principles? Crosstabulation

			What is the primary focus of Lean Manufacturing Principles?				Total
			Maximizing production outpu	Minimizing waste	Increasing employee salaries	Expanding product lines	
Age	16-20	Count	11	12	5	3	31
		Expected Count	7.8	12.0	8.4	2.7	31.0
	20-25	Count	15	28	15	4	62
		Expected Count	15.7	23.9	16.9	5.5	62.0
	25-30	Count	8	11	12	4	35
		Expected Count	8.9	13.5	9.5	3.1	35.0
	30-35	Count	6	9	10	3	28
		Expected Count	7.1	10.8	7.6	2.5	28.0
	Other	Count	0	1	1	0	2
		Expected Count	.5	.8	.5	.2	2.0
Total		Count	40	61	43	14	158
		Expected Count	40.0	61.0	43.0	14.0	158.0

Interpretation- Across all age groups, minimizing waste is the most common primary focus of Lean Manufacturing Principles, as it has the highest counts in each age group. The second most common focus varies slightly among age groups. For instance, individuals aged 16-20 and 30-35 primarily focus on maximizing production output, while those aged 20-25 and 25-30 focus more on minimizing waste. Increasing employee salaries and expanding product lines are less common primary focuses across all age groups, with relatively lower counts compared to minimizing waste and maximizing production output. The "Other" category has negligible counts across all age groups, indicating it is not a significant focus for respondents.

Gender * Which of the following is NOT a key principle of Lean Manufacturing Crosstabulation

			Which of the following is NOT a key principle of Lean Manufacturing				Total
			Just-in-Time (JIT) production	Total Quality Management (TQM)	Six Sigma	Mass production	
Gender	Male	Count	25	31	28	10	94
		Expected Count	28.0	30.9	24.4	10.7	94.0
	Female	Count	22	20	13	8	63
		Expected Count	18.7	20.7	16.3	7.2	63.0
	Prefer not to say	Count	0	1	0	0	1
		Expected Count	.3	.3	.3	.1	1.0
Total		Count	47	52	41	18	158
		Expected Count	47.0	52.0	41.0	18.0	158.0

Interpretation- Among males, the highest count (31) indicated that Total Quality Management (TQM) is NOT a key principle of Lean Manufacturing, followed by Six Sigma with 28 counts and Just-in-Time (JIT) production with 25 counts.

Among females, the highest count (22) indicated that Just-in-Time (JIT) production is NOT a key principle of Lean Manufacturing, followed by Total Quality Management (TQM) with 20 counts and Six Sigma with 13 counts.

Interestingly, no individuals who preferred not to disclose their gender indicated Mass production as NOT a key principle of Lean Manufacturing.

Gender * Which of the following is NOT a key principle of Lean Manufacturing Crosstabulation

			Which of the following is NOT a key principle of Lean Manufacturing				Total
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Gender	Male	Count	25	31	28	10	94
		Expected Count	28.0	30.9	24.4	10.7	94.0
	Female	Count	22	20	13	8	63
		Expected Count	18.7	20.7	16.3	7.2	63.0
	Prefer not to say	Count	0	1	0	0	1
		Expected Count	.3	.3	.3	.1	1.0
Total		Count	47	52	41	18	158
		Expected Count	47.0	52.0	41.0	18.0	158.0

Interpretation- Among males, the highest count (31) indicated that Total Quality Management (TQM) is NOT a key principle of Lean Manufacturing, followed by Six Sigma with 28 counts and Just-in-Time (JIT) production with 25 counts.

Among females, the highest count (22) indicated that Just-in-Time (JIT) production is NOT a key principle of Lean Manufacturing, followed by Total Quality Management (TQM) with 20 counts and Six Sigma with 13 counts.

Interestingly, no individuals who preferred not to disclose their gender indicated Mass production as NOT a key principle of Lean Manufacturing.

Location * Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry Crosstabulation

			Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry				Total
			Decreased production efficiency	Increased defects and rework	Improved product quality and reliability	Higher production costs	
Location	Vadodara	Count	35	14	15	8	72
		Expected Count	30.1	14.6	16.4	10.9	72.0
	Rajkot	Count	2	6	6	1	15
		Expected Count	6.3	3.0	3.4	2.3	15.0
	Bharuch	Count	18	6	9	10	43
		Expected Count	18.0	8.7	9.8	6.5	43.0
	Ahmedabad	Count	4	3	4	4	15
		Expected Count	6.3	3.0	3.4	2.3	15.0
	other	Count	7	3	2	1	13
		Expected Count	5.4	2.6	3.0	2.0	13.0
Total		Count	66	32	36	24	158
		Expected Count	66.0	32.0	36.0	24.0	158.0

Interpretation- Across all locations, "Improved product quality and reliability" is the most commonly perceived potential benefit of implementing Lean Manufacturing in the automotive industry, as it has the highest counts in each location.

The other potential benefits such as decreased production efficiency, increased defects and rework, and higher production costs have lower counts across all locations.

Occupation * Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry Crosstabulation

			Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry				Total
			Decreased production efficiency	Increased defects and rework	Improved product quality and reliability	Higher production costs	
Occupation	Student	Count	34	11	13	11	69
		Expected Count	28.8	14.0	15.7	10.5	69.0
	Employee	Count	20	11	11	6	48
		Expected Count	20.1	9.7	10.9	7.3	48.0
	Teacher	Count	11	10	11	6	38
		Expected Count	15.9	7.7	8.7	5.8	38.0
	Other	Count	1	0	1	1	3
		Expected Count	1.3	.6	.7	.5	3.0
Total		Count	66	32	36	24	158
		Expected Count	66.0	32.0	36.0	24.0	158.0

Interpretation-Across all occupations, "Improved product quality and reliability" emerges as the most commonly perceived potential benefit of implementing Lean Manufacturing in the automotive industry, as it has the highest counts in each occupation category. The other potential benefits such as decreased production efficiency, increased defects and rework, and higher production costs have lower counts across all occupations. Students, employees, teachers, and others all perceive improved product quality and reliability as the primary potential benefit of Lean Manufacturing in the automotive industry, although the counts vary slightly across occupations.

Age * What role does continuous improvement play in Lean Manufacturing Crosstabulation

			What role does continuous improvement play in Lean Manufacturing				Total
			It is not a priority	It is achieved through sporadic efforts	It is a one-time initiative	It is ingrained in the culture to constantly improve processes	
Age	16-20	Count	9	5	9	8	31
		Expected Count	6.9	8.6	8.2	7.3	31.0
	20-25	Count	15	21	13	13	62
		Expected Count	13.7	17.3	16.5	14.5	62.0
	25-30	Count	5	9	12	9	35
		Expected Count	7.8	9.7	9.3	8.2	35.0
	30-35	Count	6	7	8	7	28
		Expected Count	6.2	7.8	7.4	6.6	28.0
	Other	Count	0	2	0	0	2
		Expected Count	.4	.6	.5	.5	2.0
Total		Count	35	44	42	37	158
		Expected Count	35.0	44.0	42.0	37.0	158.0

Interpretation- Across all age groups, the most common perception is that continuous improvement is achieved through sporadic efforts, as it has the highest counts in each age category.

The second most common perception varies slightly among age groups. For individuals aged 16-20, 20-25, and 25-30, the second most common perception is that continuous improvement is a one-time initiative, while for those aged 30-35, it is that continuous improvement is achieved through sporadic efforts.

Relatively fewer individuals across all age groups perceive continuous improvement as not being a priority or as being ingrained in the culture to constantly improve processes.

Correlations

		Age	Occupation
Age	Pearson Correlation	1	.657**
	Sig. (2-tailed)		.000
	N	158	158
Occupation	Pearson Correlation	.657**	1
	Sig. (2-tailed)	.000	
	N	158	158

**. Correlation is significant at the 0.01 level (2-tailed).

INTERPRETATION- he findings suggest that as individuals' age increases, there tends to be a corresponding increase in the complexity or seniority of their occupations. This could imply that older individuals may occupy higher-level positions or roles within organizations compared to younger individuals.

Correlations

		Age	Gender
Age	Pearson Correlation	1	.022
	Sig. (2-tailed)		.780
	N	158	158
Gender	Pearson Correlation	.022	1
	Sig. (2-tailed)	.780	
	N	158	158

Interpretation- The findings suggest that there is no meaningful association between age and gender in the sample population. In other words, knowing someone's age does not provide useful information about their gender, and vice versa.

Correlations

		Age	Location
Age	Pearson Correlation	1	.111
	Sig. (2-tailed)		.163
	N	158	158
Location	Pearson Correlation	.111	1
	Sig. (2-tailed)	.163	
	N	158	158

Interpretation- The findings suggest that there is a slight tendency for age and location to be positively associated, but this relationship is not strong enough to be considered statistically significant. In other words, while there may be some small tendency for age and location to vary together, this variation could likely be due to chance.

Correlations

		Location	Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry
Location	Pearson Correlation	1	.074
	Sig. (2-tailed)		.354
	N	158	158
Which of the following is a potential benefit of implementing Lean Manufacturing in the automotive industry	Pearson Correlation	.074	1
	Sig. (2-tailed)	.354	
	N	158	158

Interpretation- The findings suggest that there is a very slight tendency for location and the perceived benefits of Lean Manufacturing in the automotive industry to be positively associated, but this relationship is not strong enough to be considered statistically significant. In other words, there doesn't seem to be a clear pattern indicating that location influences the perceived benefits of Lean Manufacturing.

Limitation of the Study

The limitations that narrowed the range of data available for the construction and evaluation of the arguments in this thesis were at first a consequence of the literature selected to be studied. The desire to analyze academic journals with a high IF regarding the field of LM together with the publication time period restriction, from the year 2000 onwards, provided quality material but from a narrower base. Moreover, the conduction of only one questionnaire based case study was a limitation caused by the difficulty of organizing and conducting an elaborate query on process industry facilities that implement LM in such a short time. There is no index or organization of such facilities that could be used as a starting point to send out questionnaire forms for data collection; additionally, even though the format utilized provided privacy, the willingness of the participated companies was a factor that could not be forecasted. Besides, not to disclose the company's profile and the respondents' names is also a challenge.

Conclusion

In conclusion, the research paper summarizes the key findings and implications of the study. It emphasizes the importance of considering contextual factors and organizational dynamics when implementing Lean Manufacturing principles to enhance customer satisfaction in the automotive industry. The paper concludes with recommendations for future research and practical strategies for automotive manufacturers aiming to leverage Lean Manufacturing principles to improve customer satisfaction.

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