



UNDERSTANDING OF CALIBRATION AND MEASUREMENT SYSTEMS AT MSME INDUSTRIES

Mr. K. Radhakrishnan* **Dr. B. Thayumanavar****

**Ph.D. (Part-Time) Research Scholar, Department of Management Studies, Sree Saraswathi Thyagaraja College (Autonomous), (Affiliated to Bharathiar University), Pollachi, Tamil Nadu State.*

***Associate Professor, Department of Management Studies, Sree Saraswathi Thyagaraja College, (Autonomous), (Affiliated to Bharathiar University), Pollachi, Tamil Nadu State.*

Abstract

Calibration is a comparison between a known measurement and the measurement using the tool. Typically, the correctness of the kind should be ten whiles the accuracy of the mensuration maneuver is verified. However, an exactness proportion of 3:1 is adequate for most ideal establishments. The determination of calibration is to abolish or decrease dimension classification to the situation base. Calibration is to minimize any dimension indecision by guaranteeing the precision of the test tackle. Calibration enumerates and controls errors or qualms within extent developments to a suitable level. Thus, Methodical and periodic checking of tests & measuring Instruments are veritably essential for dependable measures. The process of periodic checking of TMI by comparison with another instrument of better delicacy is nominated Estimation. A commercial metric is a computable measures that corporate use to track, screen, and measure the achievement or disappointment of numerous business developments. The main point of using specialized metrics is to transfer an administration's growth toward certain long- and short-term objectives. The main aim of the study is to identify the key performance indicators and elements of Metrological Traceability and the Sources of calibration and avoid variation in measurements and Role in Calibration traceability in MSME Sector.

Key Words: *Calibration, Traceability, MSME, Industries, Performance, Measurements.*

1. Introduction

Calibration is the procedure of constructing a gadget to provide an outcome for a model within a satisfactory series. Barring features that beget inaccurate measures is an abecedarian facet of composition design. MSMEs would now be defined grounded on their gross development, and businesses with earnings upto Rs.50 million will be considered micro in nature, those with earnings above Rs.50 million but below Rs.750 million will be measured as small, whereas those with revenue above Rs.750 million but below INR 2.5 billion would be considered medium enterprises. Measurement is the project of figures to material things to represent the relations among them with respect to particular properties. Traceability is the competence to corroborate the history, position, or operation by means of proven recorded identification. Other common definitions include the capability of keeping track of a given set or type of information to a given degree, or the ability to chronologically interrelate uniquely identifiable entities trendy a means that is verifiable.

Measurement Traceability

“Traceability denotes the worth of a type everywhere it can be connected to specified positions nationwide or worldwide values through a constant hawser of contrasts, all having stated doubts (ISO)”. To shorten, extent traceability is a way of guaranteeing that dimension is taking into interpretation all reservations and is a correct depiction of an object being restrained. The foundation of this method is that a measurement should be tested against a higher calibration reference standard. One



common misconception about traceability means that the measuring equipment is traceable; however, only the dimension outcome or standard value is truly noticeable.

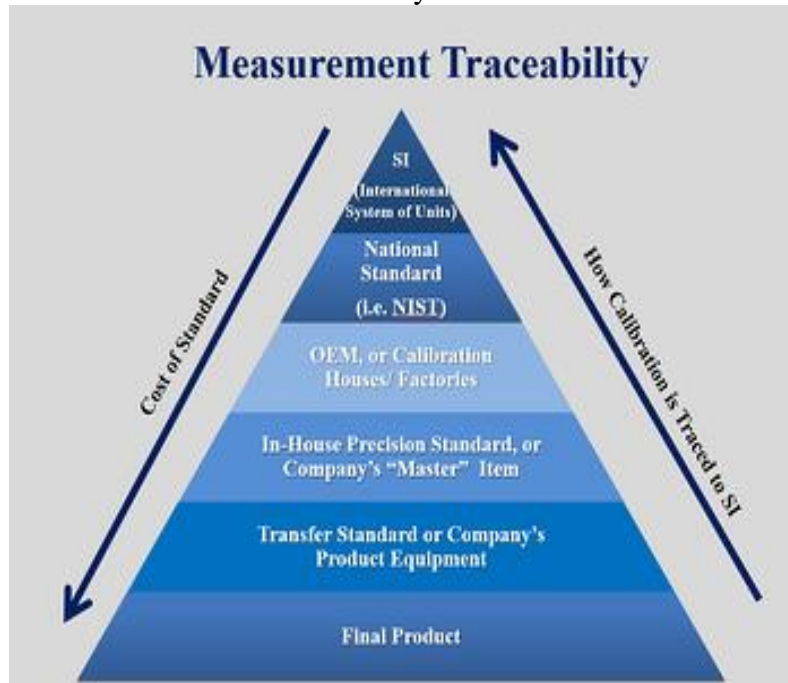


FIGURE - 1: MEASUREMENT TRACEABILITY

The usual standardization grading for quantity traceability is shown in Figure - 1. The morals from the layer above should be used to calibrate each level of the pyramid. It is excellent repetition to preserve a 4 to 1 delicacy rate when going up the gauge or with each traceable estimate; the accuracy should be four times closer to the higher standard's ideal precision.

Need for Calibration

Calibration ensures that a measuring instrument displays an accurate and reliable value of the measure being unhurried. Thus, calibration is an essential activity in any measurement process. Measurement is vital in science, industry, and commerce. Measurement is also performed extensively in our regular life. Measurements for health care, such as measuring body temperature with a clinical thermometer, checking blood pressure, and many other tests, Checking the time of day, buying cloth for dresses, Purchase vegetables and other groceries, Promoting power feasting through a liveliness cadence, delicacy and trust ability of all similar measures would be doubtful if the instruments, used are not calibrated.

2. Review of Literature and Research Gap

2.1 Calibration and Measurements

Standardization of gadgets and developments is essential for checking their performances against known standards. Provides steadiness in analyses and condenses errors, thus validating the capacities collectively. It involves a judgment of the utensil against primary or secondary standards. Setting guarantees that devices and processes meet expected recital specifications within commonly tolerable stages and precision. It regulates whether capacities made before the standardization were binding. Confidence that future measurements will be accurate. Ensures compatibility and consistency with



products made abroad. leads to analyses of the repeatability and reproducibility of the instruments and processes. Provides confidence that products meet their specifications, thus reducing legal liability.

Calibration is the usual of process that create, under specified situations, rendering to the International Organization (1993), the link between the known values of a measure and the values shown by a measuring device, a measuring system, A fundamental aspect of science is measurement and a key challenge to scientists is to minimize associated errors in cost-effective ways.

Dawkins (2001) estimation consistent elasticities, dimensions, and administration for small and medium enterprises. Taticchi (2010) and large companies propose to research, to determine the readings, and to establish the dependability of the gadget, and calibrating different analytical instruments and acceptance criteria Aparna (2015) calibration clarifies the source of objectivity f measurement outcomes, Tal (2017) the flora of quantity accuracy, and the close rapport between extent and prophecy SMEs, and in doing so, develop adapted assessment systems that can accurately assess the performance of SMEs Jamil Mohamed (2011) needs the selection and construction of performance measures are key elements that a PMS can contribute to SMEs' development Soto-Acosta (2008); Zhang & Zhou, (2013); Larsson, Syberfeldt and Säfsten (2017); Singh et al., (2018); Dobrovic et al., (2018)

Performance appraisal process though successful, it is important for management to take a critical look at these outcomes so as to maintain a successful performance measurement system, Ankrah (2015) to ensure the sustainability of the process, training should be integrated into routine monthly review meetings held between management and the employees. Performance measures: they indicate the relevance of a series of metrics for planning organizational development, encouraging continuous improvement, and supporting decision-making among others Bitencourt Machado et al (2015). The relevance of performance. Routine dimension systems from the findings are labor force performance and client satisfaction Ankrah (2015) relationship between internal factors and organizational performance. Measures in operational terms are also stressed as they maintain the efficient use of resources Thanki & Thakkar (2016). Small business is a momentous element of economic growing Bello, Jibir and Ahmed (2018) .

2.2 Performance and Evaluation of MSME Industries

The Quality of the system depends on Kowalak (2009) on relevant information resources to effectively manage the enterprise measure of the performance and of efficiency of the traceability organization adopted by the company Dabbene (2011) different principles and practices for engaging and enhancing the presentation of a traceability system.

Panigrahi (2012) needs of improving MSMEs issue and challenges are noticeable but to conduct any research Joshi (2012) at the national or regional level an evaluation model is needed. interpret the various problems faced by the entrepreneurs Pazir (2013) and also identify the challenges for Micro, Small, and Medium Enterprises in this area and remedial measures for evolution and expansion of the Indian MSME segment since the introductory of the economy in 1991 Sharma (2014) looks into the contemporary set-up of MSMEs provide access of resources for infrastructure, marketing development, and other similar requirements of the sector Murthy (2016) measures are expected to help in accelerating the pace of growth of the sector. According to the Reserve Bank of India (2017), in the year 2015–16, Leading industries of the MSME sector, Retail trade (except for motor vehicles &



motorcycles) and Repairs of individual and family goods – 39.85%, Manufacturing of wearing apparel- 8.75%, Manufacturers of foods and beverages - 6.94%, Other services activities - 6.2%, other business activities – 3.77%, Guesthouses, and restaurants -3.64%, Sales keep of motorized automobiles – 3.57%, Furniture manufacturing - 3.21%, Textile - 2.33%, Fabricated metals and others 19.4%.

The performance of MSMEs has a positive impact on the growth of the economy of the country Goswami (2017) and the government should support this sector as it reduces poverty and helps in the development of the country. Competitive performance of the selected agro-food dispensation organizations of J&K and influence of the information & communication technology (ICT) in improving competitive Sultan (2017) stages of dispensation organizations of agriculture & horticulture.

Marathe (2017) result of the monetary crises of 2007-08 on MSMEs by using the Graphical representation, and results show that MSMEs have contributed to the monetary advance of India and also financial crises have affected the MSMEs in India. Ashoka (2019) highlights the gratification level of the businesspersons near the SIDBI supports performance measurement and annoyed verification with data available in the municipal field were used by Makhija and Goel (2019) to meet the growing need for substitute apparatuses and ways to quantify MSME performance. Farther exploration in emerging an inclusive rubric of isolated actions for administrative routine.

Johan (2020) the MSME recital by privileged and external MSMEs in order to realize a positive commercial and be able to contest in general and international markets. Lean Six Sigma lowness to micro, small and medium Enterprises in India Bhat (2020) initiatives of the government.

Jember Regency Utami (2020) linked to the zones that essential to be improved Eugene (2020) an acquaintance as well as SMEs' business performance. Vásquez et al (2021) assess the level of implementation of sustainability strategies and practices in this type of business, Waśniewski (2021) small businesses measured their performance, especially from non-financial perspectives importance of this research to measure these variables for companies Müller et al (2021) to improve their business management and increase their competitiveness and sustainability in their production processes.

Rank of applying Lean industrial techniques for pretty market keenness and efficiency in the Indian MSMEs Bhattacharya and Ramachandran (2021) reserve optimization, and flexible engineering. Sudharani and Jayasheela (2021) validate an instrument designed to measure the variables García et al (2022) value perception, purchase intention, trust, and satisfaction of Micro, Small, and Medium Enterprises dedicated to selling clothing.

2.3 Research Gap

Despite investigating various subjective measures, the current study conducts the calibrations and measures of the MSME sector. The present study efforts to narrow this research gap that is “Understanding of Calibration and Measurement Systems at MSME Industries”.

3. Objectives

- 1 To classify the key performance indicators and elements of Metrological Traceability in MSME.
- 2 To determine the Sources of calibration and *Avoid differences in dimensions.*



- 3 To examine the Measurement instrument in calibration and its Role in Calibration traceability in MSME Sector.

4. Research Methodology

As no earlier studies have been conducted to evaluate MSME in Calibration and measurements. This study used the descriptive investigation of Calibrations and Measurements in MSME industries. The research study utilized primary data, which was obtained directly from the sample population. The researcher is well-known in developing the kind of information to answer the explore inquiries. Data analysis was analysed using descriptive statistics. SPSS package was used to analyse and summarize the data. To investigate the Performance indicators and elements of Metrological Traceability, Sources of calibration and *Avoid variation in measurements*, Measurement instruments in calibration, and their Role in Calibration traceability in MSME Sector, inferential statistics were used.

5. Results

5.1 Percentage Analysis

The characteristics of the defendants are given in Table - 1. The results explain gender is male working in MSEM 65 percent, the maximum of working age category people is 26-35 years of people are 42 percent, and her average qualification is Post Graduate 60 percent. Working experience is 60%, Joint Secretaries, personal assistants, and Executive employees are more collaborative throughout the data collection. Rs.20,001 to Rs.30,000 is the maximum of people having a Monthly salary. Most Married people are working in MSME companies. MSME sectors are Machinery & equipment is 55 percent.

Table - 1: Characteristics of Respondents

Category	Frequency	Percent
Gender of the Respondents		
Male	167	65.0
Female	90	35.0
Age of the Respondents		
20-30 years	65	25.3
26-35 years	107	41.6
36-45	7	2.7
Above 45 years	78	30.4
Designation		
Senior Administrative	11	4.3
Senior Technical	9	3.5
Joint Secretary	137	53.3
Executive Employee	21	8.2
Personal Assistant	79	30.7
Marital Status		
Married	132	51.4
Unmarried (Single)	125	48.6
Category	Frequency	Percent
Literacy Level		
School Level	24	9.3
Graduate	77	30.0



Post Graduate	156	60.7
Monthly Income		
Below Rs.20,000	70	27.2
Rs.20,001 to Rs.30,000	148	57.6
Rs.30,001 to Rs.40,000	5	1.9
Above Rs.40,000	34	13.2
MSME Sector		
Food products	21	8.2
Textile	37	14.4
Apparel	6	2.3
Fabricated metal products	51	19.8
Machinery & equipment	142	55.3
Types of Key Performance Indicators		
Strategic	69	26.8
Operational	61	23.7
Functional unit	127	49.4
Working Experience		
Below 1 year	14	5.4
1-5 years	51	19.8
5-10 years	159	61.9
10-15 years	10	3.9
Above 15 years	23	8.9

5.2 Skewness and Kurtosis

Table - 2: Skewness and Kurtosis of Performance Indicators in MSME

Performance Indicators	Mean	SD	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Business Entity	4.40	.712	-1.545	.152	4.101	.303
Quality	4.44	.851	-2.130	.152	5.364	.303
Business Ventures are Profitable	4.19	1.106	-1.669	.152	2.325	.303
Track the Efficiency and Progress of Individuals	4.18	1.198	-1.718	.152	1.989	.303
Total	17.21	3.867	-7.062	0.608	13.779	1.212

The above table designates the value of Mean, SD, Skewness, and Kurtosis, measures of Performance indicators in MSME are Business Entity, Quality, Business Ventures are Profitable, and Track the Efficiency and Progress of Individuals. The Skewness value in between the indicators is -2.130 to -1.545 and the kurtosis assortment is between 1.989 to 5.364.



5.3 Chi-Square Test

Table - 3: Demographic Profile of the Respondents and the MSME Sector Measurements

Category	Pearson Chi-square / Value	DF	Asymptotic Significance (2-sided)	Hypothesis Accepted / Rejected
Gender	54.544 ^a	4	.000	Accepted
Age	21.185 ^a	12	.048	Accepted
Working Experience	115.165 ^a	16	.000	Accepted
Marital Status	18.327 ^a	4	.001	Accepted
Literacy level	89.592 ^a	8	.000	Accepted
Monthly Income	33.020 ^a	12	.001	Accepted
Types of Key Performance Indicators	109.822 ^a	8	.000	Accepted

Table - 3 indicates the chi-square value of the defendant profile and the Measurements of the MSME Sector, there is no significant difference between the personal profile of the accused in the company and the measures of organizations. All the significant value is less than the p-value of 0.05, so that the hypothesis is rejected.

The figure - 2 indicates the Pearson chi-square value of the respondent’s profile. The highest value of the working experience of the employee is 115.165 and the lowest Pearson of the value is the age of the suspects.

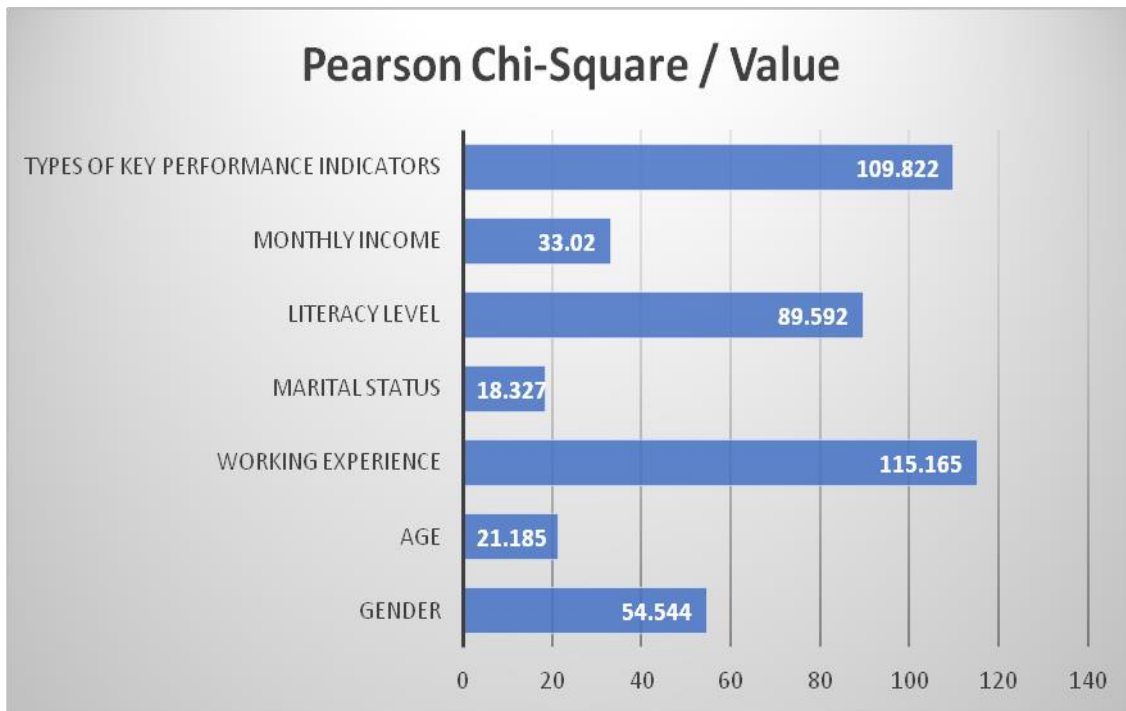


Figure - 2: Pearson chi-Square Value



5.4 ANOVA

Table - 4: Source of Calibration and MSME Sectors

ANOVA						
Source of Calibration		Sum of Squares	DF	Mean Square	F	Sig.
Traceability of the standard.	Between Groups	25.612	4	6.403	10.483	.000
	Within Groups	153.921	252	.611		
	Total	179.533	256			
Measurement uncertainty	Between Groups	20.905	4	5.226	5.329	.000
	Within Groups	247.126	252	.981		
	Total	268.031	256			
Availability of trained manpower	Between Groups	174.625	4	43.656	22.077	.000
	Within Groups	498.309	252	1.977		
	Total	672.934	256			
Market reputation.	Between Groups	7.736	4	1.934	3.220	.013
	Within Groups	151.353	252	.601		
	Total	159.089	256			

The F-values are clarifying that there exists a substantial gap in the views of respondents about calibrations in MSME. The source of Calibration is Traceability of the standard, Measurement uncertainty, Availability of trained manpower, and Market reputation for identification of the measures of calibration of the individual sub-sectors of MSME.

5.5 T- Test

Table - 5: One-Sample Test - Avoid Variation in Measurements

Variation in Measurements	Mean	SD	Mean Difference	t	Sig. (2-tailed)
Using clearly defined diagnostic criteria	3.05	1.634	3.047	29.893	.000
Observing environmental conditions	4.38	.595	4.381	118.047	.000
Training spectators	4.29	.582	4.288	118.126	.000
Extraordinary witnesses	3.67	1.472	3.669	39.954	.000
Calibrated, easy-to-use equipment	2.96	1.700	2.961	27.928	.000
Employing standardized measurement methods	4.11	.910	4.105	72.289	.000

The above table indicates the Mean, Standard Deviation, and t-value to *avoid variation in measurements, sub-variables* are Using clearly defined diagnostic criteria, observing environmental conditions, Training spectators, Extraordinary witnesses, and participants, Calibrated, easy-to-use equipment, and Employing standardized measurement methods. t-value range between 27.928 to 118.047. All the significant value is accepted, so the irrelevant intention is rejected.

5.6 Independent Samples Test

Equal variances assumed – EVA

Equal variances not assumed - EVNA



Table - 6: Independent Samples Test- Methods Are Not Properly Understood

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	DF	Sig. (2-tailed)	Mean Difference
Method and measuring equipment	EVA	30.295	.000	2.625	255	.009	.393
	EVNA			3.105	254.999	.002	.393
Calibration of devices and instruments	EVA	10.649	.001	.855	255	.393	.073
	EVNA			.924	225.215	.356	.073
Accuracy and degradation of measuring instruments	EVA	56.944	.000	5.444	255	.000	.884
	EVNA			6.303	252.940	.000	.884
Calibration frequency decision	EVA	15.157	.000	3.722	255	.000	.455
	EVNA			4.376	254.853	.000	.455
Calibration certificates	EVA	10.890	.001	-.485	255	.628	-.075
	EVNA			-.444	142.918	.657	-.075
Dependency on external agency's	EVA	4.723	.031	3.033	255	.003	.355
	EVNA			3.449	248.214	.001	.355

From the above table, it is conditional that relating to the methods in the MSME industry, out of six factors, show a significant difference with the respondents since the significant charge is fewer than the "P" value (0.05%) in Levene's Test for Equality of Variances. Hence the assumption is rejected. In the t-test for Equality of Means; need to improve the Calibration of devices and instruments.

5.7 Rank Test

Table - 7: Rank the Mean Measurement in Calibration and MSME Sector

Measurement in calibration* MSME Sector					
MSME Sector	Mean	Flow calibration	Sensor calibration	Calibration of food products	Calibration of images
Food crops	Mean	4.29	4.24	4.62	4.14
Material	Mean	3.76	3.84	4.41	4.24
Apparel	Mean	4.17	4.17	4.67	4.17
Fabricated metal products	Mean	3.76	4.02	4.39	3.90
Machinery & Equipment	Mean	4.16	4.14	4.34	4.08
Total	Mean	4.04	4.08	4.39	4.07
Rank		IV	II	I	III

Table - 7 represents the Measurement in Calibration and MSME Sector, Calibrations include Flow calibration, Sensor calibration, Calibration of food products, and Calibration of images and MSME Sectors are Food crops, Material, Apparel, Fabricated metal products, Machinery & Equipment, Rank the sub variables, First rank is Food products measures and the fourth rank is flow calibration. The mean value of MSME's highest mean source is 4.67.



Figure three represents the mean score of the measurement in calibration in the MSME sector. Flow calibration indicates a blue bar, Sensor calibration designates orange colour, Calibration of food products specifies the gray colour, and Calibration of images indicates the yellow colour and MSME Sectors are Food crops, Material, Apparel, Fabricated metal products, Machinery & Equipment.

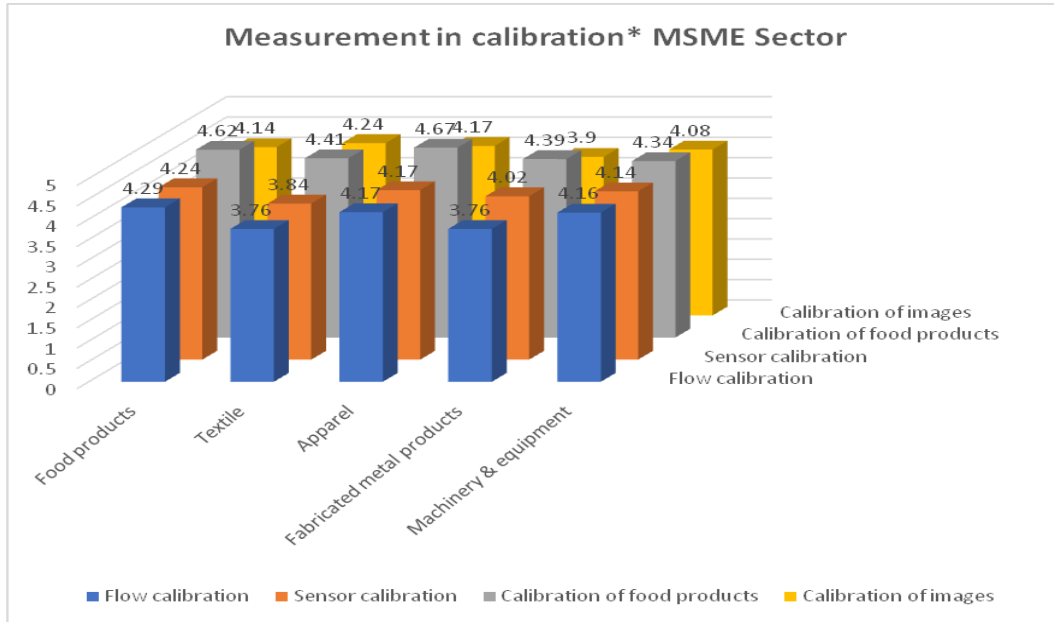


Figure - 3: Measurement in Calibration and the MSME Sector

5.8 Linear Regression

Table 8.1: Role of Calibrations Traceability

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.418 ^a	.175	.159	1.263

a. Predictors: (Constant), Method development, validation, and verification, Calibration using reference data, Calibrations with certified reference materials, Confirmation of identity, Calibrations using other materials.

The linear regressions are shown in table 8.1 the perfect rapid table demonstrates that the R square for this model is 0.175. This means that 17 % of the variation in the overall calibration can be clarified by the six sovereign variables. The table also shows that the adjusted R-Square of the model is 0.159.

TABLE 8.2: ANOVA

ANOVA ^a						
Model		Sum of Squares	DF	Mean Square	F	Sig.
1	Regression	84.873	5	16.975	10.648	.000 ^b
	Residual	400.123	251	1.594		
	Total	484.996	256			

a. Dependent Variable: MSME Sector



b. Predictors: (Constant), Method development, validation, and verification., Calibration using reference data, Calibrations with certified reference materials, Confirmation of identity, Calibrations using other materials.

The ANOVA table, 8.2 shows the F ratio for the regression model that indicates the numerical significance of the overall regression model. The F ratio is calculated in the same way for regression analysis as it was for the ANOVA technique. The variance-independent variable that is associated with the dependent mutable is devoted to as explained variance. The remainder of the total variance in the independent flexible that is not associated with the dependent variable is stated as an unexplained variance.

The larger the F ratio, the more will be the alteration in the dependent variable that is associated with the autonomous variable. The F ratio is 10.648. The statistical significance is .000 the Significant”. So, we can reject the conjecture which means there is an affiliation between independent and reliant on variables.

Table 8.3: Co-Efficients

Co-efficients ^a						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	1.825	.899		2.029	.043
	Confirmation of identity	-.171	.072	-.140	-2.358	.019
	Calibrations with certified reference materials	.363	.095	.226	3.839	.000
	Calibrations using other materials	.456	.105	.259	4.350	.000
	Calibration using reference data	.011	.083	.008	.137	.891
	Method development, validation, and verification	-.180	.113	-.096	-1.586	.114
a. Dependent Variable: MSME Sector						

To regulate if one or more independent variables are significant predictors of factors influencing, we examine the statistics provided in the coefficient table. Out of six independent statements, four statements are statistically most significant.

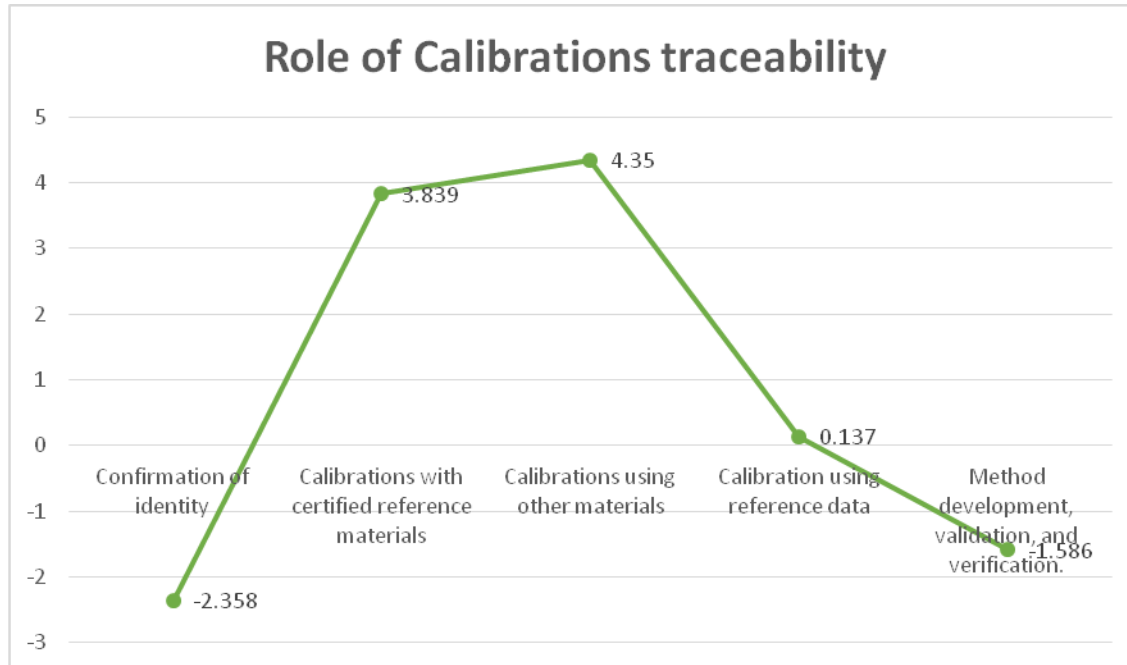


Figure - 4: Role of Calibrations Traceability

6. Conclusion and Suggestions

Instrument correction is one of the prime processes used to continue apparatus exactness. Adjustment is the development of setting up a device to give a reading for a sample that falls within a reasonable range. The international standard for the ability of difficult and standardization workrooms. Workshops of all sizes use it to pledge their customers they operate knowledgeably and produce valid consequences, thus endorsing self-assurance in their work. Calibrating equipment is essential for the **Preserve business agreement and evenness, reducing costly errors**, eliminating safety risks, minimise downtime, keep your customers satisfied. This is safety equipment that can save the lives of people. At present, there is a need to improve the Poor Knowledge of measurement systems, Calibration using reference data, Method development, validation, and verification, and Calibration certificates. Calibration of devices and instruments. Poor handling of measuring instruments and equipment, Future tactic to provide training and awareness.

References

- 1 Ankrah, E., & Mensah, C. C. Y. (2015)., “Measuring performance in small and medium scale enterprises in the manufacturing industry in Ghana”, *International Journal*, 2 (12), 34-43.
- 2 ANS (1994)., “Calibration laboratories and measuring and test equipment: general requirements”, *American National Standards Institute/National Conference of Standards Laboratories*, 1(5), 159-162.
- 3 Aparna, C. H., & Gowrisankar, D. (2015)., “A Review on Calibration of Analytical Instruments”, *International Journal of Pharmaceutical, Chemical & Biological Sciences*, 5(3), 572-582.
- 4 Ashoka, M. L., Rakesh, T. S., & Abrishami, M. (2019)., “A Study on MSME Entrepreneurs Perception Towards Financial Institutional Support”, *Journal of Entrepreneurship and Management*, 8(3), 31-35.



- 5 Bello, A., Jibir, A., & Ahmed, I. (2018)., “Impact of small and medium scale enterprises on economic growth: Evidence from Nigeria”, *Global Journal of Economic and Business*, 427(5917), 1-9.
- 6 Bhat, S., Gijo, E.V., Rego, A.M. and Bhat, V.S. (2021)., "Lean Six Sigma competitiveness for micro, small and medium enterprises (MSME): an action research in the Indian context", *The TQM Journal*, 33(2), 379-406. <https://doi.org/10.1108/TQM-04-2020-0079>
- 7 Bhattacharya, I., & Ramachandran, A. (2021)., “Lean manufacturing techniques – Implementation in Indian MSMEs and benefits realized thereof”, *Indian Journal of Engineering & Materials Sciences*, 28 (1), 89-101.
- 8 Bitencourt Machado, T. R., Sornberger, G. P., & Josende Coan, F. M. (2015)., “Evaluation of organizational performance in small and medium enterprises: Multi case study in Dealers Agricultural Machinery and implements”, *Revista Contabilidade E-Controladoria-Rc C*, 7(3), 21-37.
- 9 Dabbene, F., & Gay, P. (2011)., “Food traceability systems: Performance evaluation and optimization”, *Computers and Electronics in Agriculture*, 75(1), 139-146.
- 10 Dawkins, C., Srinivasan, T. N., & Whalley, J. (2001)., “Calibration”, *Handbook of Econometrics*, 3653–3703. doi:10.1016/s1573-4412(01)05011-5
- 11 Dobrovic, J., Lambovska, M., Gallo, P., & Timkova, V. (2018)., “Non-Financial Indicators and Their Importance in Small and Medium-Sized Enterprises”, *Journal of Competitiveness*, 10(2), 41–55. <https://doi.org/10.7441/joc.2018.02.03>
- 12 Eugene Tafadzwa Maziriri (2020)., “Green packaging and green advertising as precursors of competitive advantage and business performance among manufacturing small and medium enterprises in South Africa”, *Cogent Business & Management*, 7 (1), 586-590.,<https://doi.org/10.1080/23311975.2020.1719586>
- 13 García-Salirrosas, E. E., & Acevedo-Duque, Á. (2022)., “Pervainconsa Scale to Measure the Consumer Behaviour of Online Stores of MSMEs Engaged in the Sale of Clothing”, *Sustainability*, 14(5), <https://doi.org/10.3390/su14052638>, 1-16.
- 14 Goswami, P., & Thakur, Y. S. (2017)., “MSME performance and classifying problems of micro, small and medium enterprises in India”, *Asian Journal of Research in Business Economics and Management*, 7(7), 245-268.
- 15 IOS (1993)., “International Organization for Standardization”, *International Vocabulary of Basic and General Terms in Metrology*, 1-356.
- 16 Jamil, C. M., & Mohamed, R. (2011)., “Performance measurement system (PMS) in small medium enterprises (SMES): A practical modified framework”, *World Journal of Social Sciences*, 1(3), 200-212.
- 17 Johan, T. U. M. I. W. A., Octavia, T. U. E. G. E. H., & Szilárd, N. A. G. Y. (2020)., “Factor Influencing MSME Performance Measurement-A Literature Review”, *Annals of the University of Oradea, Economic Science Series*, 29 (1), 151-162.
- 18 Joshi, N., Goyal, C. K., & Joshi, N. (2012)., “Synthetic Model for Evaluation of Micro, Small and Medium Enterprises in India”, *Geography and Economics*, 1(2) 27-33.
- 19 Kowalak, R. (2009)., “Benchmarking jakometodazarządzaniawspomagająca controlling przedsiębiorstwa”, *PraceNaukoweUniwersytetuEkonomicznego we Wrocławiu. Seria: Monografie i Opracowania*, 187 (69), 198-210.



- 20 Larsson, C., Syberfeldt, A., & Säfssten, K. (2017)., “How to visualize performance measures in a manufacturing SME”, *Measuring Business Excellence*, 21 (4), 337-350. <https://doi.org/10.1108/MBE-03-2017-0002>
- 21 Makhija, P., & Goel, A. (2019)., “Measuring organizational performance in Indian MSMEs: A qualitative study”, *Journal of Management Research and Analysis*, 6(1), 45-53, <http://doi.org/10.18231/j.jmra.2019.009>
- 22 Marathe, S. (2017)., “Indian MSME: Past and Present Performance Scenario”, *Indian Journal of Accounting (IJA)*, 49(2), 127-132.
- 23 Müller, J., Acevedo-Duque, Á., Müller, S., Kalia, P., & Mehmood, K. (2021)., “Predictive sustainability model based on the theory of planned behaviour incorporating ecological conscience and moral obligation”, *Sustainability*, 13(8), 4248-4255, <https://doi.org/10.3390/su13084248>
- 24 Murthy, D. S. (2016)., *Performance Evaluation of MSMEs – An Empirical Study Abstract*, *International Journal of Research and Development - A Management Review* 5 (1), 2319-5479.
- 25 Panigrahi, C. M. A. (2012)., “Risk Management in Micro, Small and Medium Enterprises (MSMEs) in India: A Critical Appraisal”, *Asia Pacific Journal of Marketing & Management Review*, 1(4), 59-72.
- 26 Pazir, D., & Hussain, S. (2013)., “Problems and prospects: Micro, Small and Medium Enterprises (MSMES) in Rajouri and Poonch districts, (J&K)”, *ZENITH International Journal of Business Economics & Management Research*, 3(10), 187-199.
- 27 RBI. (2017)., “Handbook of statistics on Indian economy”, Mumbai: Reserve Bank of India, <https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0HANDBOOK2017C9CF31D4B78241C9843272E441CD7010.PDF>
- 28 Sharma, R., & Afroz, Z. (2014)., “Growth and Performance of MSME’s in Present Scenario for the Development of India”, *International Journal of Interdisciplinary and Multidisciplinary Studies* 1 (5), 136-143.
- 29 Singh, S., Olugu, E. U., Musa, S. N., & Mahat, A. B. (2018)., “Fuzzy-based sustainability evaluation method for manufacturing SMEs using balanced scorecard framework”, *Journal of Intelligent Manufacturing*, 29(1), 1–18. <https://doi.org/10.1007/s10845-015-1081-1>
- 30 Soto-Acosta, P. (2008)., “The e-business performance measurement in SMEs”, *International Journal of Enterprise Network Management*, 2(3), 268–279. Scopus. <https://doi.org/10.1504/IJENM.2008.018781>
- 31 Sudharani, Jayasheela (2021)., “Performance Evaluation of MSMEs- An Analytical Study”, *Journal of Emerging Technologies and Innovative Research* 8(7), 612-621.
- 32 Sultan, A. (2017)., “ICT for Improving Competitive Performance of Small and Medium-Sized Enterprises (SME's) through Information & Knowledge Management: An explorative study”, *Trends in Information Management*, 11(1), 68-80.
- 33 Tal, E. (2017)., “Calibration: Modelling the measurement process”, *Studies in History and Philosophy of Science Part A*, 65, 33-45.
- 34 Taticchi, P., Tonelli, F., & Cagnazzo, L. (2010)., “Performance measurement and management: A literature review and a research agenda”, *Measuring Business Excellence*, 14(1), 4–18. <https://doi.org/10.1108/13683041011027418>
- 35 Thanki, S. J., & Thakkar, J. J. (2016)., “Value-value load diagram: A graphical tool for lean-green performance assessment”, *Production Planning & Control*, 27(15), 1280–1297. <https://doi.org/10.1080/09537287.2016.1220647>



- 36 Utami, W., Khrisnabudi, N. G., Farida, L., Apriono, M., Utami, E. S., Gumanti, T. A., & Wulandari, D. A. R. (2020)., “Measurement of maturity of small medium agroindustry business processes in Jember Indonesia”, In *Journal of Physics: Conference Series*, 1538 (1), 1-12.
- 37 Vázquez, J., Aguirre, S., Puertas, E., Bruno, G., Priarone, P. C., & Settineri, L. (2021)., “A sustainability maturity model for micro, small and medium-sized enterprises (MSMEs) based on a data analytics evaluation approach”, *Journal of Cleaner Production*, 311, (127692), 1-13.
- 38 Velychko, O., & Gordiyenko, T. (2019)., “Metrological Traceability at Different Measurement Levels”, *Standards, Methods and Solutions of Metrology*. doi:10.5772/intechopen.84853
- 39 Waśniewski, P. (2021)., “Informal performance measurement in small enterprises”, *Procedia Computer Science*, 192(5), 3310-3319.
- 40 Zhang, J. L., & Zhou, S. Y. (2013)., “The construction of Informatization performance measurement Indicator system for small-and-medium sized enterprises”, In *Applied Mechanics and Materials*, 291 (2), 2990-2994.