The Study and Prediction of Gross Profit Based on the Automation Maturity Index of An Organization

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ABSTRACT

In today's competitive world, Automation plays a vital role in making an organization competitive in the marketplace and improving their operational efficiency along with the cost savings. It is not surprising that the technology in infrastructure and operations is not considered a luxury but a necessity. Be it a corporate company, research lab or an educational institution across different Sectors and Industries. Many companies have already started their Automation Journey early in the stage, few are still having challenges to kick-start their journey. Few organizations may be good in generating revenue, but they may not be delivering convincing Gross-profit due to operational in-efficiencies. This research paper discusses about an **Assessment Framework** how an organization can be assessed where they are with respect to the Automation footprint on different levers like IT, Business process, Intelligent Automation, Test Automation, Desktop Automation, Cognitive Automation and so on. Based on the Assessment, **Automation Maturity Index** is determined which will be used for the Statistical regression analysis.

The current study shows that the Automation market is expected to grow multi-fold in billion $ by 2025. So, there is a compelling need to go for an '**Extreme Automation**' to accelerate Automation implementation across the possible levers. And there is a need to know how an Automation Maturity will have an impact on an Organization's Gross profit (GP). This paper further discusses the **statistical regression correlation analysis** of Automation maturity Index on Gross profit of organizations. The statistical regression correlation analysis is conducted Finally, the Author recommends a **guiding empirical formula** for predicting the Gross profit based on the Automation Maturity index for an organization.

Keywords: Automation Maturity Index, Total Automation Business Solution, Gross Profit prediction, Statistical Correlation Regression Analysis, Robotic Process Automation

INTRODUCTION
1.1 Introduction

In today's competitive world, Automation plays a vital role in making an organization competitive in the marketplace and improving their operational efficiency along with the cost savings. Many organizations have realized that the 'Total Automation Solution' is vital to their Business and Operations. It is not surprising that the technology in infrastructure and operations is not considered a luxury but a necessity. Be it a corporate company, research lab or an educational institution across different Sectors and

Industries. Many companies have already started their Automation Journey early in the stage, few are still having challenges to kick-start their journey.

This Research paper first analyzes the Organization's current state with respect to the 'Automation maturity' in
- Desktop,
- Autonomous,
- Rules based,
- Test,
- IT (Information Technology) and
- Robotic and Business Process Automations.

Secondly, gathers the Gross Profit of an organization and calculates the GP% (Gross Profit) from the authorized financial website.

Finally, conducts the correlation statistical analysis on the Automation Maturity and the Gross-Profit of Organizations and reports the findings. The data collected are based on the experience of the author and the outcome of the 41 clients having 246+ data points. The Organizations are from various Geographies, Sectors and Industries.

Below given are the definitions of Automation Maturity and Gross-Profit of an organization.

Automation Maturity:
The Automation Maturity Index is a measure of automation level in which an organization is positioned with respect to the implementation of Automation levers like Desktop, Rule based, Information Technology and Business Process automations. Automation Maturity is assessed based on the set of parameters applied in different Automation Engagement and Project experience. Based on the project experience and input received for different parameters or questions, Automation Maturity score is assigned between 1 to 10 (being the highest rating and 1 being the lowest).

Gross Profit:
The gross profit margin calculation measures the money left from the sale of your goods or services, once the operating expenses used to generate them are deducted (e.g. labour and material costs). Gross profit is calculated by subtracting the cost of goods sold (COGS) from the total revenues.

Cost of goods sold (COGS):
The cost of goods sold refers to all the direct costs and expenses involved in producing or delivering goods and services. It does not include indirect costs, such as staff salaries or sales and marketing. Below are some examples of COGS:

Revenue:
It is the total amount of income one company generates from the sale of products or services. It shows clearly how much money is brought in from total sales. It does not include the costs of running your business, such as taxes, interest and depreciation.

Gross profit margin:

Gross Profit Margin % = (Revenue – Cost of Goods Sold) / Revenue x 100

It shows the percentage ratio of revenue a company can keep for each sale after all costs are deducted. It is used to indicate how successful a company is in generating revenue, whilst keeping the expenses low.

## 2. INFORMATION ABOUT DATA COLLECTED

2.1 Source Data

The data from 41 case studies with 246+ data points across multiple Industries are analyzed to find the effect of Automation Maturity Index on Gross-profit of an organization.

Data gathering
o Identified the top Clients from various industries
o Ensured proper mix of Clients from different regions
o Categorized the Client organizations into Small, Medium and Large segments
o Retrieved the Profit data for each year from the financial site - **https://www.macrotrends.net**.
o Calculated Gross profit % for 3 years (2018, 2019 and 2020)

Below is a snapshot of the data collection information.
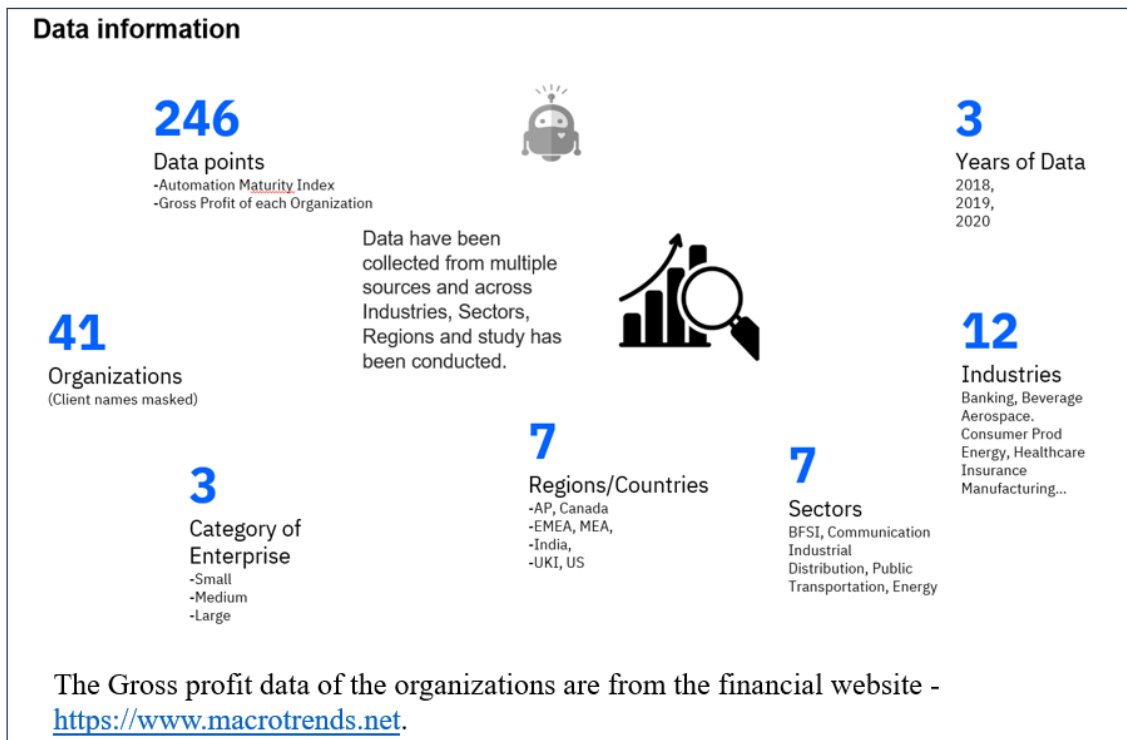
This study is important as the organizations are going thru' challenges in meeting their productivity goals and to achieve the desired business outcomes. All the organizations, enterprises, research and educational institutions will get benefitted from the outcome of this research. Based on the results they can position themselves to develop Automation journey roadmap and execute it. The research technology adopted is 'Purposive'. Organizations were selected from different Sectors and Industries. They are of

different sizes and from different regions across the globe. As the Automation cuts across different Industries and Sectors, this strategy has been adopted for the better and unbiased outcome.

The data sources for the Automation Maturity Index are thru' the case studies conducted by the Author for the 41 Organizations based 'On-the-Job' experience.

The Gross profit data of the organizations are from the third party and reliable financial website - https://www.macrotrends.net. The profit is calculated based on the reported profits by an organization for each year. Accordingly the Gross-profit % of each organizationu is calculated. The 3 years financial data 2018, 2019 and 2020 for the identified Organizations have been taken for the analysis from different streams as given below.

Clientwise – Size, Region, Sector & Industry details:

Client Name (Masked)	Size of Enterprise	GEO(HQ)	Sector	Industry
Client1	Large	EMEA	Distribution	Beverage
Client2	Medium	EMEA	Public	Pharma
Client3	Medium	UKI	Distribution	CPG (Consumer Product Goods)
Client4	Small	US	Distribution	CPG
Client5	Medium	US	BFSI	Insurance
Client6	Large	US	Industrial	Manufacturing
Client7	Medium	AP	BFSI	Banking
Client8	Medium	Canada	Energy	Energy
Client9	Large	EMEA	Industrial	Energy
Client10	Medium	EMEA	Communication	Telecom
Client11	Large	UKI	Industrial	Energy
Client12	Large	Canada	Communication	Telecom
Client13	Medium	UKI	Energy	Energy
Client14	Medium	US	Energy	Energy
Client15	Small	Canada	Energy	Energy
Client16	Small	US	Energy	Energy
Client17	Medium	US	BFSI	Banking
Client18	Medium	EMEA	Distribution	Healthcare
Client19	Medium	US	Public	Healthcare
Client20	Small	US	Public	Healthcare
Client21	Medium	US	Public	Healthcare
Client22	Medium	US	Public	Pharma
Client23	Medium	US	Public	Healthcare
Client24	Large	India	Communication	Telecom
Client25	Small	India	Communication	Telecom

Client26	Small	India	Distribution	CPG
Client27	Medium	India	Distribution	CPG
Client28	Small	India	BFSI	Insurance
Client29	Medium	Canada	BFSI	Banking
Client30	Large	EMEA	Distribution	Retail
Client31	Small	India	Distribution	CPG
Client32	Medium	India	Communication	Telecom
Client33	Small	EMEA	Communication	Telecom
Client34	Medium	US	Industrial	Retail
Client35	Small	US	Public	Pharma
Client36	Medium	US	Transport	Transport
Client37	Medium	Canada	Public	Aerospace
Client38	Small	MEA	Communication	Telecom
Client39	Small	EMEA	Distribution	CPG
Client40	Small	US	Industrial	Manufacturing
Client41	Medium	AP	BFSI	Banking

Legends:
EMEA – European Middle East Africa
US   - United States of America
MEA   - Middle East Africa
AP   - Asia Pacific
CPG   - Consumer Products and Goods
BFSI   - Banking Finance Security Insurance
UK   - United Kingdon
UKI   - United Kingdom Ireland

Automation Maturity Index:

Each organization has been assessed on different Automation Levers with the score as specified in the Maturity Assessment Framework. Then the average score has been calculated for an organization in the scale of 1 to 10 (being the highest maturity). The resultant score has been taken for the analysis as Automation Maturity of an organization.

-Automation Strategy and Goal

-Custom Asset Automation

-Desktop automation

-Robotic Process Automation

-Cognitive and Intelligent Automation and

-Test Automation

Automation Maturity Asssessment Framework:

	0 - Not tried or started	1 – 3 Initial Stage	4-6 - Making progress	7-8- Maturity in development	9 - 10- Reached Mature state	Overall Score
Automation Strategy and quantified Goal	No agreed vision for automation across the account	Very limited locally focused Independent automation plans in place in some areas	Multiple parts of the account have developed automation plans for their areas	A long term vision for Automation is in place Perculated down to the teams	An agreed vision for automation is in place Roadmap for automation is executed	S1
Custom Asset Automation	Not reviewed the list of assets available	Limited adoption of assets	Multiple applicable assets implemented	All applicable Assets implemented Home grown assets are also implemented	Multiple home grown assets implemented. Home grown assets enlisted as ECA asset	S2
Desktop Automation	No Use Case identified	Some Use Cases identified and development started	Multiple Use Cases implemented	All possible desktop automation use cases explored Implemented many of the usecases	Densely populated desktop automation across application portfolios	S3
Robotic Process Automation (RPA)	RPA is not in use	RPA Pilots done Basic automation is in place for back-end processes	RPA is in use in pockets - primarily in the back office	RPA is growing from back to front office Pilot is undeway in new areas	Sophisticated RPA, densely populate across enterprise processes	S4
Automation through COGNITIVE & INTEGRATION	Multiple automation have not been connected to each other	The use of Cognitive or AI is being piloted	Cognitive or AI is in use Integration to RPA not yet done Solutions identified is being piloted	Cognitive or AI is in use, and in some cases is being integrated with RPA The deployed solutions are used extensively	Full integration across end-to-end processes Integration spans front to back offices Cognitive and RPA are connected Automation is initiated for every project/release as BAU	S5
Test Automation	There is scope for Test Automation, but it is not explored in the account.	Architect assessment is done Feasibility analysis for different tools, frameworks, solutions are being carried out Demo for the solutions are provided	The solutions identified is been piloted The piloted solutions are taken to the deployment phase	The deployed solutions are used extensively Opportunity for new automation is assessed periodically across phases of testing life cycle	Automation is initiated for every project/release Self sufficient teams to carry out automation Explore new solutions to continuously improve automation footprint	S6
Maturity Score in a 10 point scale						Average of (S1..S6)

Automation Maturity Index has been arrived for each client which is an average of score from each Automation levers based on the assessment framework.

Automation Maturity Index = Average of (S1, S2, S3, S4, S5, S6)

(from the above table)

3. STATISTICAL CORRELATION ANALYSIS

The correlation study and the effect of Automation Maturity Index on the profit of an organization is conducted to determine the correlation coefficient (R^2 value) through the statistical analysis method 'regression analysis' using Scatter plot. The correlation coefficient (R) is the most common way of measuring a linear correlation. It is a number between –1 and 1 that measures the strength and direction

of the relationship between two variables. Based on the R value, the degree of relationship is confirmed between "Automation Maturity Index" and "Gross profit" of an organization.

The correlation analysis between the Automation Maturity Index and Gross-profit of organizations for the years 2018, 2019 and 2020 has been conducted by plotting the line chart in MS Excel. The Trend line has been added to calculate the R^2 value of the relation. The R^2 value gives correlation result between the variables Automation Maturity and Gross-profit. The R^2 value and the degree of relationship are described as below.

R^2 VALUE	DEGREE OF CORRELATION
Less than or = 0.10	No Relation /Negligible
Between 0.2 <= and < 0.4	Weak
0.4 <= and < 0.5	Moderate
0.5 <= and <= 0.7	Moderate to strong relationship
> 0.7	Very strong

3. RESULTS

On plotting the charts to study the correlation between the variables Automation Maturity Index and the Gross profit of an organization, the following scenario based results were observed.

S. No	Scenario	R^2 Value	Degree of relationship
1	Analysis on 3 Years data across the Sectors and Industries(not curated)	0.005	No Relationship
2	Analysis on 3 Years the data across the Sectors and Industries(curated)	0.636	Moderate to Strong
3	Sector wise Analysis for 1 year (Banking sector Organizations)	0.662	Moderate to Strong
4	Sector wise Analysis for 1 year (Communication sector Organizations)	0.823	Very Strong
5	Analysis on 2018 data	0.802	Very Strong
6	Analysis on 2019 data	0.560	Moderate to Strong
7	Analysis on 2020 data	0.856	Very Strong

Detailed findings:

Scenario 1: Analysis on 3 Years data of Organization across the Sectors and Industries(not curated)   (No relationship)

In this scenario, the entire 3 years data was taken for analysis without any curation. The result revealed that there is **no relationship exists** between the varilables and the different organizations. The R^2 value from the below chart1 is **0.0056**.
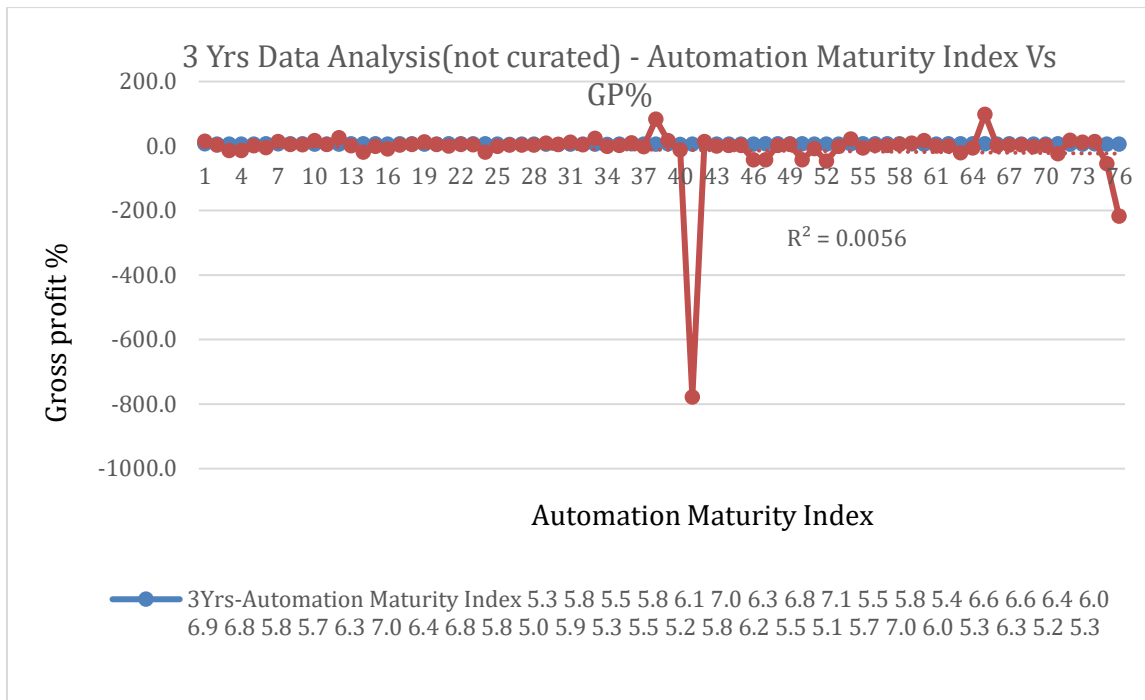
Chart1: 3 Yrs Data Analysis(Not curated)

Scenario 2: 3 Years data across the Sectors(curated)-(Moderate to Strong relationship)

In this scenario, the entire 3 years data was taken for analysis with curation of data like removing the outliers and data were sorted out. The data were curated like outliers were removed. The result revealed that there is **'moderate to strong' relationship exists** between the variables and the different organizations. The R^2 value from Chart2 is **0.6364.**
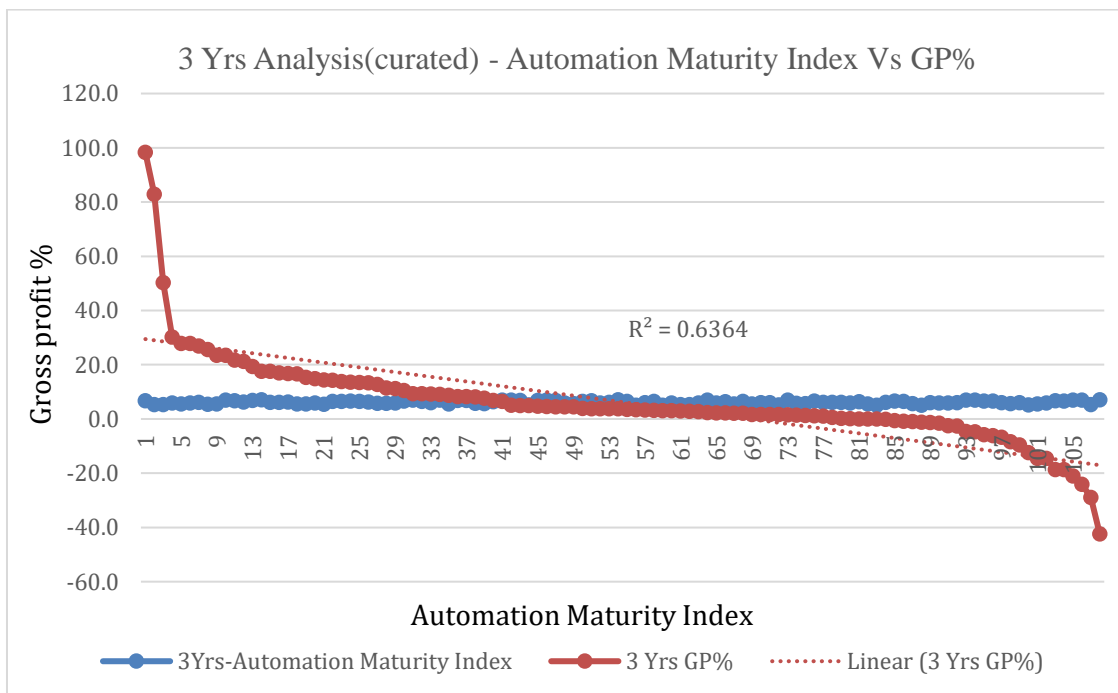
Chart2: 3 Yrs Data Analysis(Curated)

Scenario 3: Sector wise Analysis (Banking sector Organizations)
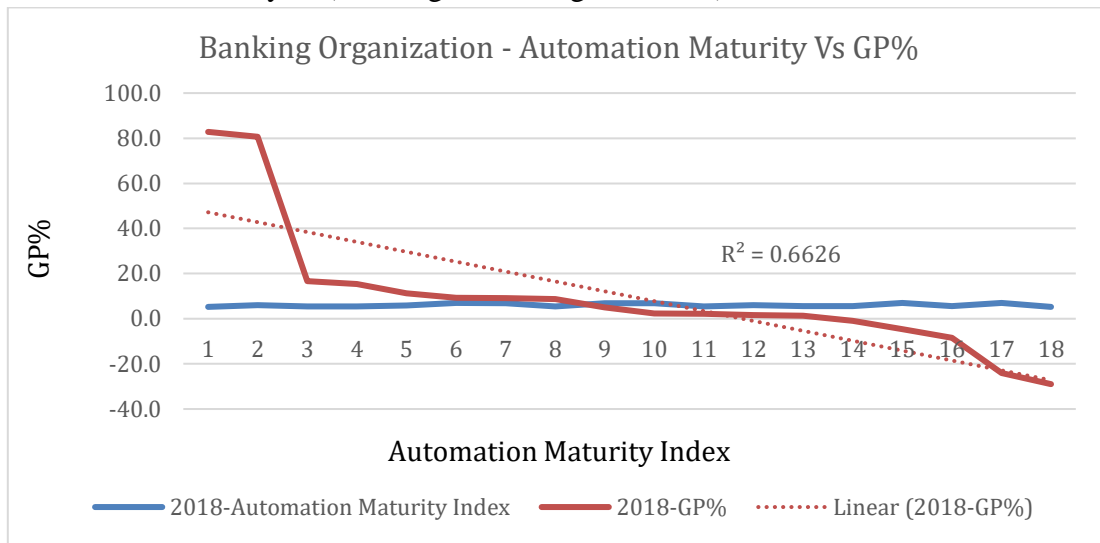
Chart3: Sector wise Analysis(Banking)

From the Chart3, the correlation coefficient R2 value 0.662 which is greater than zero inferences that there is 'Moderate to strong relationship' and Positive correlation exist between Automation Maturity Index (AMI) and the Gross-profit of an organization.

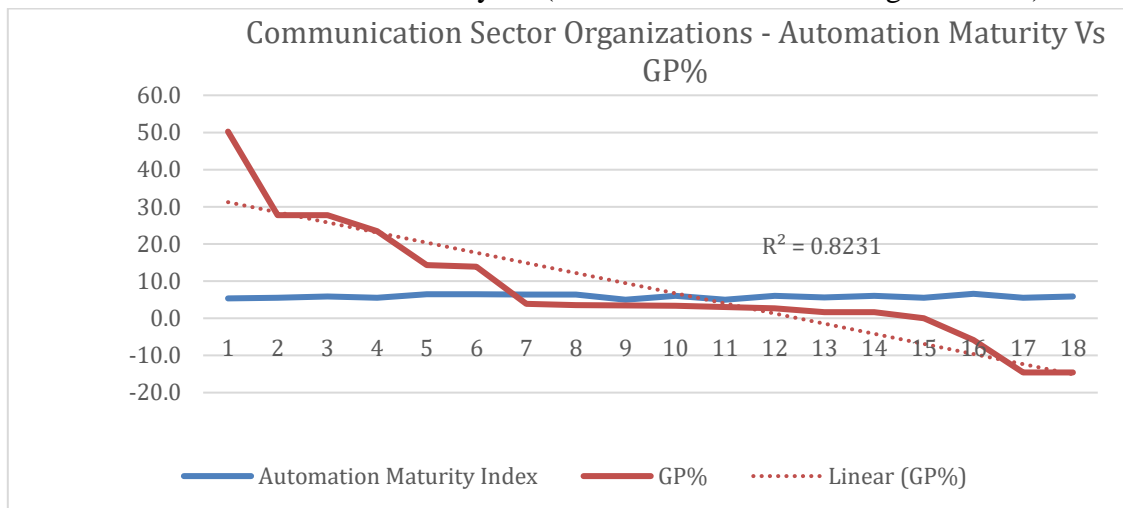**Scenario 4:** Sector wise Analysis (Communication sector Organizations)

Chart4: Sector wise Analysis(Communication)

From the Chart4 the correlation coefficient **R2 value 0.823** which is greater than zero inferences that there is '**Very Strong**' and **Positive correlation** exist between Automation Maturity Index (AMI) and the Gross-profit of an organization.

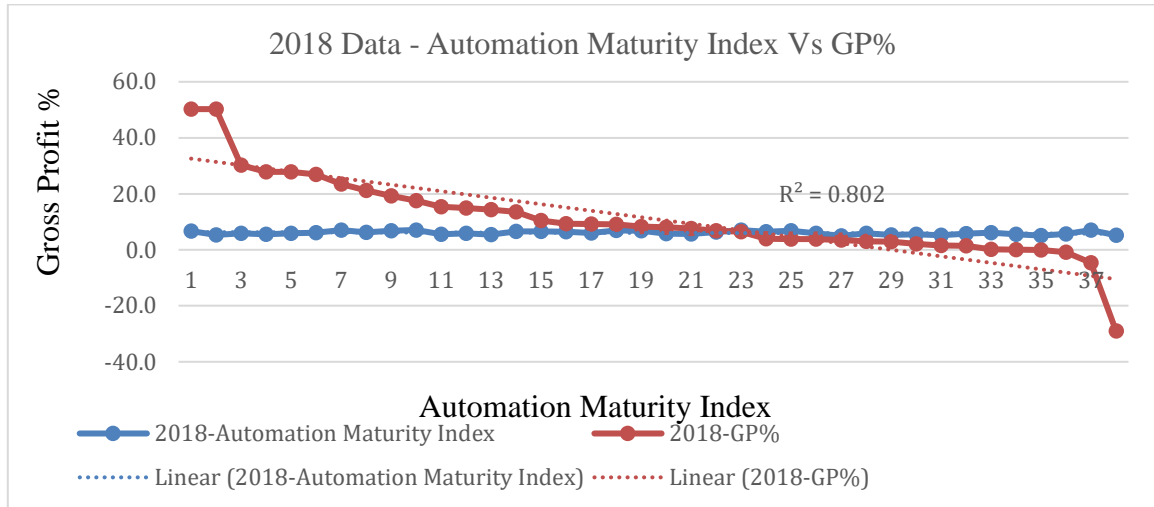**Scenario 5:** Analysis on 2018 data

Chart5: 2018 data Analysis

From the Chart5 the correlation coefficient **R2 value 0.802** which is greater than zero inferences that there is '**Very Strong'** and **Positive correlation** exist between Automation Maturity Index (AMI) and the Gross-profit of an organization.

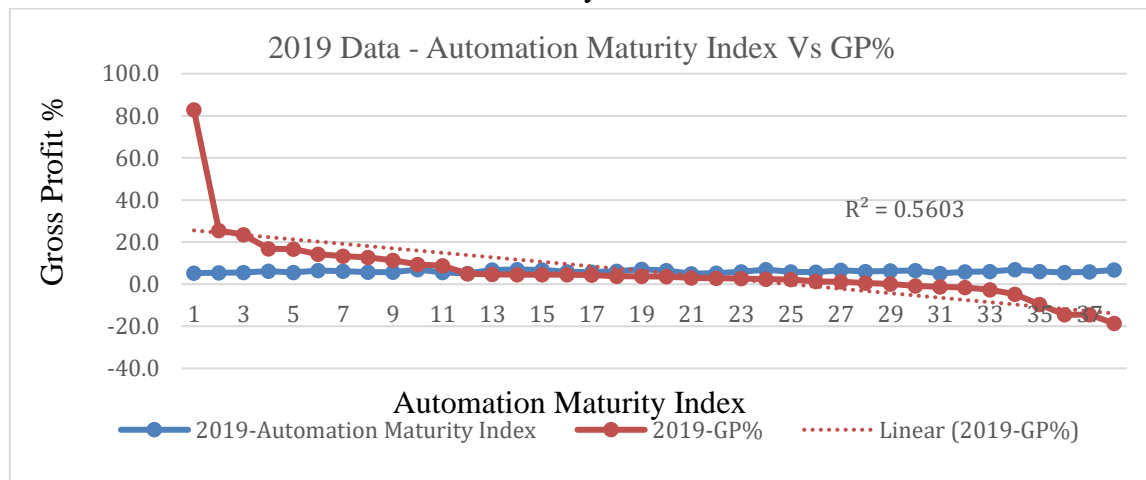**Scenario 6:** Analysis on 2019 data

Chart6: 2019 data Analysis

From the Chart6, the correlation coefficient **R2 value 0.560** which is greater than zero inferences that there is '**Moderate to strong relationship'** and **Positive correlation** exist between Automation Maturity Index (AMI) and the Gross-profit of an organization.
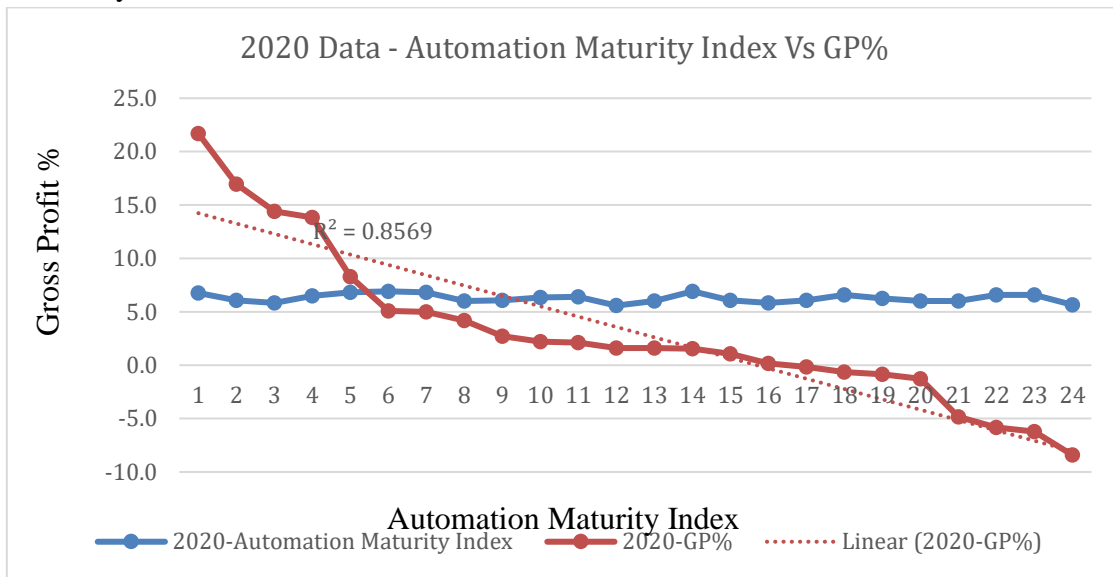
Scenario 7: Analysis on 2020 data

Chart7: 3 Yrs Data Analysis

From the Chart7 the correlation coefficient R2 value 0.8569 which is greater than zero inferences that there is 'Very Strong' and Positive correlation exist between Automation Maturity Index (AMI) and the Gross-profit of an organization.

4. CONCLUSION
4.1 Conclusion
The study and effect of 'Automation Maturity Index' on the Gross-Profit of an organization were conducted using data from 41 clients with 246+ data points. The results were analyzed and reported. The statistical correlation analysis was conducted on data collected from different Sectors and Industries using one of the Statistical analysis methods (Correlation analysis) and the analysis findings were analyzed to conclude the relation.

This study and correlation analysis revealed that there is a "Strong to Moderate" relationship exists between "Automation Maturity" and "Gross-profit" of an organization. It is highly recommended that the organizations look at reviewing the state where they are with respect to the **Automation Maturity** and improving their Automation Maturity to achieve greater **Gross profit** to be competitive in the marketplace.

Empirical formula : Determine Gross-profit based on Automation Maturity Index

Established a quantitative relationship between the Automation Maturity Index (AMI) and Gross Profit (GP), a simple
empirical formula is employed which is given below.

$$GP = a * AMI + b$$

- GP represents the Gross Profit, which is the dependent variable.

- AMI represents the Automation Maturity Index, which is the independent variable.
- 'a' represents the slope of the regression line, indicating the change in Gross Profit for each unit change in Automation Maturity Index.
- 'b' represents the intercept, indicating the Gross Profit when the Automation Maturity Index is zero
- Guidance formula will help to predict Gross Profit with the Automation Maturity Index.

Recommendation for future work

o New areas in Automation can be assessed and included to arrive at Automation Maturity for an organization like AI, Intelligent Automation.

o Increase the data points (size of sample populations) in each Industry and extrapolate the data to further harden the results

o Wall Street Journal data was not shown due to pandemic for 2020 & 2021 for few Clients. Hence data were taken from macrotrend website([Online]. Available at: https://www.macrotrends.net/).

o It is recommended to take the data from Wall street journal for the globally listed companies

o The correlation analysis can be extended to add some more levers like Gen AI and Code assistants.

BIBLIOGRAPHY

1. HM Verma, Internet of Robotics Things (IoRT) Based Integration of Robotic Applications for Advanced Research. Wasit Journal of Computer and Mathematics Science (2021).
2. Senthil Kumar K, Lakshmi B, Pennathur G, Automation photometer of Hitachi U–2000 spectrophotometer with RS–232C–based computer, Journal of Analytical Methods in Chemistry (1998).
3. Adam M Costa, ROBOTIC PROCESS AUTOMATION: BRINGING ON BOTS TO ENHANCE A CPA'S WORK. Pennsylvania CPA Journal (2020).
4. Bruno García, Pedro Merino, Pedro Merino, An End-to-End Automation Framework for Mobile Network Testbeds, Mobile Information Systems (2019).
5. Yuqing Wang, Mika Mäntylä, Antti Haukinen, A self-assessment instrument for assessing test automation maturity, Pervasive Computing Technologies for Healthcare (2019).
6. R Shwetha, V B Kirubanand, Remote Monitoring of Heart Patients Using Robotic Process Automation (RPA), ITM Web of Conferences (2021).
7. Lukas Valentin Herm, Christian Janiesch, Axel Winkelmann et al, A consolidated framework for implementing robotic process automation projects, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) (2020).
8. Financial website., Available at "https://www.macrotrends.net", Accessed on 01 July 2023.
9. Automation Input referenced from, Available at "https://www.ibm.com/in-en/automation", Accessed on 01 July 2023.
10. The definition and details of Gross-profit of an organiation were referenced from, Available at "https://www.americanexpress.com/en-gb/business/trends-and-insights/articles/gross-profit-margin-formula/", Accessed on 01 July 2023.
11. Shalley, C.E., 1995. Effects of coaction expected evaluation, and goal setting on creativity and productivity. Academy of Management journal, 38(2), pp.483-503.

12. Nariswari, T.N. and Nugraha, N.M., 2020. Profit growth: impact of net profit margin, gross profit margin and total assests turnover. International Journal of Finance & Banking Studies (2147-4486), 9(4), pp.87-96.

13. Smith, D.J., Gradojevic, N. and Irwin, W.S., 2007. An analysis of brand equity determinants: Gross profit, advertising, research, and development. Journal of Business & Economics Research (JBER), 5(11).

14. Mendenhall, W., Sincich, T. and Boudreau, N.S., 2003. A second course in statistics: regression analysis.

15. Roth, A., Jopp, R., Schäfer, R., and Kramer, G.W., 2006. Automated generation of AnIML documents by analytical instruments. JALA: Journal of the Association for Laboratory Automation, 11(4), pp.247-253.

16. Furter, J.S. and Hauser, P.C., 2019. Interactive control of purpose-built analytical instruments with Forth on microcontrollers-A tutorial. Analytica chimica acta, 1058, pp.18-28.

17. Mendenhall, W., Sincich, T. and Boudreau, N.S., 2003. A second course in statistics: regression analysis.

18. Vahrenkamp, N., Wächter, M., Kröhnert, M., Welke, K. and Asfour, T., 2015. The robot software framework armarx. it-Information Technology, 57(2), pp.99-111.

19. Rigano, G., Muratore, L., Laurenzi, A., Hoffman, E.M. and Tsagarakis, N., 2018, January. Towards a robot hardware abstraction layer (r-hal) leveraging the xbot software framework. In 2018 Second IEEE International Conference on Robotic Computing (IRC) (pp. 175-176). IEEE.

20. Gogtay, N.J. and Thatte, U.M., 2017. Principles of correlation analysis. Journal of the Association of Physicians of India, 65(3), pp.78-81.