



# Quid Pro Quo

## BDM Capstone Project Snippets



IIT MADRAS  
BS DEGREE PROGRAM

# **QUID PRO QUO**

## **BDM Capstone Project Snippets**



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**First Edition - 2024**



# ABOUT THE COORDINATORS



## DR. ANDREW THANGARAJ

Dr. Andrew Thangaraj, Professor in the Department of Electrical Engineering, Indian Institute of Technology Madras, has been with the institute since June 2004. He completed his bachelor's from IIT Madras and obtained his PhD. His research interests are in the areas of information theory and error-control coding. He has served on the editorial boards of the IEEE Transactions on Communications and IEEE Transactions on Information Theory.

From Nov 2011, he has been one of the Coordinators of the **National Programme on Technology Enhanced Learning (NPTEL)**, a multi-institutional project funded by the Ministry of Education and managed by IIT Madras. At NPTEL, he played a key role in starting the online courses and certification on a massive scale through the **SWAYAM portal**. He is currently the Principal Investigator for SWAYAM.

At IIT Madras, he led a team of faculty that started the **Bachelor of Science Degree in Data Science & Applications (IIT Madras Degree Program in Data Science and Applications)**, launched in June 2020, with course content delivery and in-person exams. He is currently a coordinator for the program and Chairperson for **Center for Outreach & Digital Education (CODE)**.



## **DR. VIGNESH MUTHUVIJAYAN**

Dr. Vignesh Muthuvijayan is a Professor in the Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, IIT Madras. He completed his BTech in Chemical Engineering from A. C. Tech, Anna University, India. He pursued his master's degree in Chemical and Biochemical Engineering at the University of Maryland, Baltimore County, and his PhD in Chemical Engineering at Oklahoma State University.

He also worked as a post-doc at Johns Hopkins University. He joined the Department of Biotechnology at IIT Madras in 2010. His research interests are in the area of biomaterials and their applications. Prof. Vignesh Muthuvijayan is also a Coordinator for the IIT Madras BS in Data Science and Applications program and **National Programme on Technology Enhanced Learning (NPTEL)**.



## **BHARATHI**

Bharathi is the driving force behind the operations of NPTEL and the BS Degree program. She has over 15 years of work experience, 13 of which have been with NPTEL and the BS program. She also has over 8 years of administrative experience in managing the IITM campus trust activities including IITM Campus Creche, the Waste Management Group within IITM, the Charities Trust, and volunteering at the Pediatric ward of the Cancer hospital. She heads all Operations of CODE, IIT Madras at present.

# FOREWORD BY DR. ANDREW THANGARAJ



“ It gives me great pleasure to write a few words on this wonderful compendium of Capstone Projects from IITM’s UG Data Science Program. The landscape of the Indian Education System can greatly benefit from scaling through technology to bridge the current gap of employability and enable quality education to reach the masses and benefit the society at large. IITM’s data science program is a pioneering effort in this direction and today has more than 29000 students at various stages. At the diploma level in this program, students are expected to work on a business data management project that characterises data generated by a business and derives useful insights from it. The projects in this book are a true testament to the quality of our students and the untiring hard work put in by the course team. It is a matter of immense pride to see projects of such high standards from students under our tutelage. Some of our students have gone above and beyond overcoming all challenges including physical limitations, age and financial barriers.

In today’s data driven era, the ability to harness, analyse and derive insights from the vast data becomes very important. The capstone projects featured in this book truly exemplify our student’s innovative spirit and problem solving acumen through the mastery of data science techniques, methodologies and tools that they developed through this program. Each project showcases the depth and breadth of the skills our students have developed during their time in this program. Moreover these projects address real-world challenges across various domains thereby demonstrating the applicability and versatility of data science in today’s time.

I commend our students and the course project team (Prof. Ashwin Baliga and Dr. Aditya Chandel) for their hard-work and dedication in bringing these projects to fruition, and hope that these projects serve as an inspiration and motivation to them to keep continuing doing this beyond the academic curriculum. I extend my gratitude to our faculty, teaching assistants, mentors and stakeholders who have been supportive to our students throughout their journey.

To you readers, I sincerely wish and hope that this book inspires and motivates you to push the boundaries of knowledge, tackle complex problems and drive positive change in the world through the transformative power of data.

”

Wish you all a happy and enriching reading.

Warm Regards,

**Dr. Andrew Thangaraj,**

Chair – Center for Outreach & Digital Education (CODE),  
Coordinator - BS in Data Science & Applications program  
IIT Madras.

## FOREWORD BY BHARATHI



“

It gives me immense pleasure as I see the first edition of the BDM Capstone Project book being launched. To see how we have scaled from a humble beginning in the year 2021 with the sole intention of democratizing and making quality education accessible to all by leveraging and utilising the technology to building a strong 30000+ community is a true testament to the commitment of our faculty, instructors, administration and of course the students. This book represents the diligent work, innovative thinking and practical applications by our students and is a pivotal point in our academic curriculum.

In today's data driven world, effective utilisation of data is imperative for any organisation or individual running a business to have a competitive advantage and make informed decisions. The BDM Capstone project is a significant milestone in our curriculum as it provides our students an opportunity to apply their acquired knowledge and skills to solve real world challenges and come up with solutions that can be transformed into business decisions through an analytical approach.

Throughout this book you will find projects across various domains, each of them highlighting our students' proficiency in deriving meaningful insights by leveraging the various data science tools and techniques. The project also hones the communication and interpersonal skills of the student in convincing the business owner to share their business data and also being exposed to the first step in all data driven processes, which is the collection of data.

The course faculties Dr. Ashwin and Dr. Aaditya, ably supported by their army of TAs, have worked tirelessly to streamline the work done, evaluating it in 4 stages and providing detailed feedback at every stage to ensure the student is on the right track and also that quality of work done ultimately benefits the business.

To our readers, I invite you to explore the various projects presented here that should give you a glimpse into the domains attempted and the practical skills the program inculcates in our students. We hope you enjoy the business cases shared.

”

Happy Reading!!!

**Bharathi**  
Director of Operations  
Center for Outreach and Digital Education  
IIT Madras



# About the BS degree program in Data Science by IIT Madras

IIT Madras, India's top technical institute, introduced the world's first 4-year Bachelor of Science (BS) Degree in Data Science and Applications with options to exit earlier in the foundation, diploma or BSc degree from an IIT regardless of age, location, or academic backgrounds. Currently there are more than 29000 students enrolled in the program.



Awarded by QS Reimagine Education and The Wharton School, University of Pennsylvania



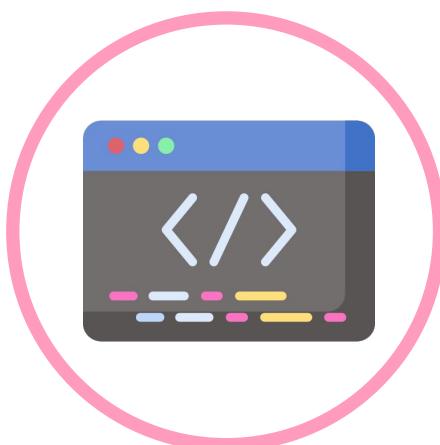
Learners from < 5LPA eligible for up to 75% fee waivers. 2000+ students study for free.



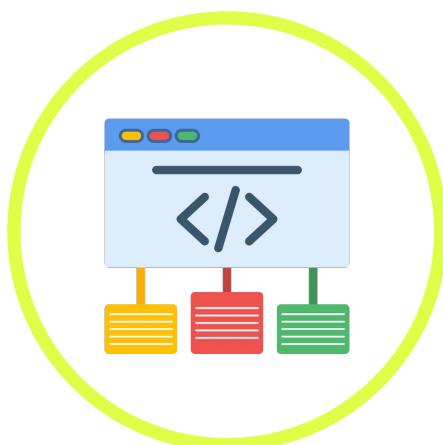
Learners from any age and anywhere in the world can study in this program. Current age of learners: 17 - 81 years.



ML Foundations, Deep Learning, Reinforcement Learning, Computer Vision, LLMs, Big Data



Python, Java, PostGreSQL, Linux Commands, C Programming, Full Stack Application Development



Business Data Management, Business Analytics, Tools in Data Science, Financial Forensics, Market Research, Managerial Economics

# **About BDM Capstone Project by Dr. Aaditya Chandel and Dr. Ashwin J. Baliga (Course Faculty for the BDM Capstone Project)**

BDM Capstone Project is an integral part of the curriculum in the IIT Madras Degree Programme in Data Science and Application. This unique independent project enables the application of the classroom learning of data analysis approach/techniques to data obtained from unorganized and organized businesses.

The project is divided into different phases, where the student, at the initial stage, has to find the business and identify the problem faced. In the next stage, students obtain and clean the data and justify the best approach to resolve the identified problem. The findings and recommendations based on the data analysis approach are presented and implemented in the final stage. Peer reviews are done at each stage, and feedback is given to students.

This project is unique because it helps enhance the students' personalities with their technical data-centric analysis skills. Most of the unorganized sectors are focusing on traditional ways of business. The word "data" for them is not very concerning and alerting. The project helps them understand the importance of data. Our students have focused on nearly 230 domains of the unorganized sectors for their project completion since the inception of this course.

## **Benefits of the Project to students**

Students focus and learn either on big mathematical equations or theories that would be referred to in the classroom lectures. However, the expansion or implementation of this classroom learning in industrial-oriented challenges, projects or tasks can be a difficult task for students.

This project not only boosts confidence within the students, as it is an independent project, but also helps students to develop their skills across various domains, such as:

- **Technical expertise:** Hands-on experience in collecting data, cleaning data, finding USPs of business, and identifying important SKUs that benefit the business based on a data-centric analysis approach.
- **Critical thinking:** Many small-scale businesses don't focus on cost analysis, inventory analysis, supply chain management, or optimization of resources due to a lack of knowledge and limited resources. As a result of this information lag, students develop critical thinking skills required for data analysis to resolve the business problem. The approaches developed provide feasible/optimal solutions, including identifying patterns and interpreting meaningful outcomes/suggestions/recommendations.

- **Problem-Solving Approach:** This is the critical and most important aspect that an industry, business, or startup looks for. Most businesses focus on their expansion, reaching out to newer customer segments, and marketing. Identifying existing problems is a major concern that many small-scale and new startups or organizations face. Situations like these help students identify the business problem, define and translate it into data-driven questions, and identify the root cause.
- **Practical Applications:** Data-centric projects expose students to real-world business challenges, allowing them to apply theoretical knowledge to solve actual problems.
- **Industry Insights:** Students gain a deeper understanding of how businesses leverage data to make informed decisions, improve processes, and drive innovation. Students are also exposed to various organizational structures.
- **Networking Opportunities:** Working on projects with companies or organizations can lead to valuable networking contacts and potential mentorship.

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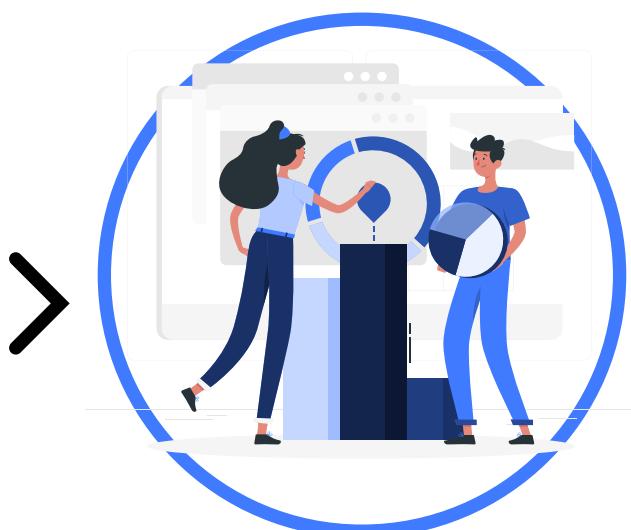


# About the BDM Capstone Project

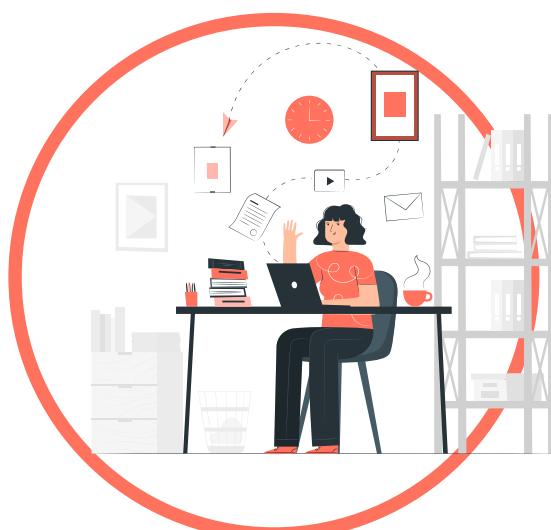
A project is defined as a temporary endeavor with definite beginning and end. It is an individual or collaborative enterprise that is carefully planned to achieve a particular aim. Projects either help solve a problem, meet a requirement or capitalize on an opportunity. A well planned project helps in achieving the desired results by optimal utilization of resources, mitigation of risks and in a cost effective manner.



**Data**, today plays a pivotal role in defining the success of project along with other project management techniques.



In today's era, where every individual or organization is trying to optimize every resource at their disposal in order to achieve the end objective, a well planned project backed by data driven decision making becomes very important and provides a competitive edge.

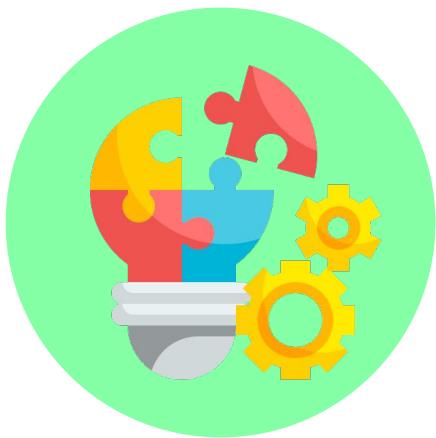


Having knowledge of how to use the information available and translate into meaningful data. Hence it becomes very important that every individual has hands on experience of handling and leading data driven projects.

# **Benefits for Students**

Every University or Institute realized the need of students being exposed to certain degree of practical or real world scenarios and hence projects or internships are made part of the curriculum.

Many professional courses also have Mini projects that simulate real world scenarios before the students can take up actual projects. These mini projects help and stimulate the thinking among the student community to define the problem statement of their main project. The main project:



**Exposes the students  
to the real world  
problem**



**Equips them with the  
necessary skill sets**



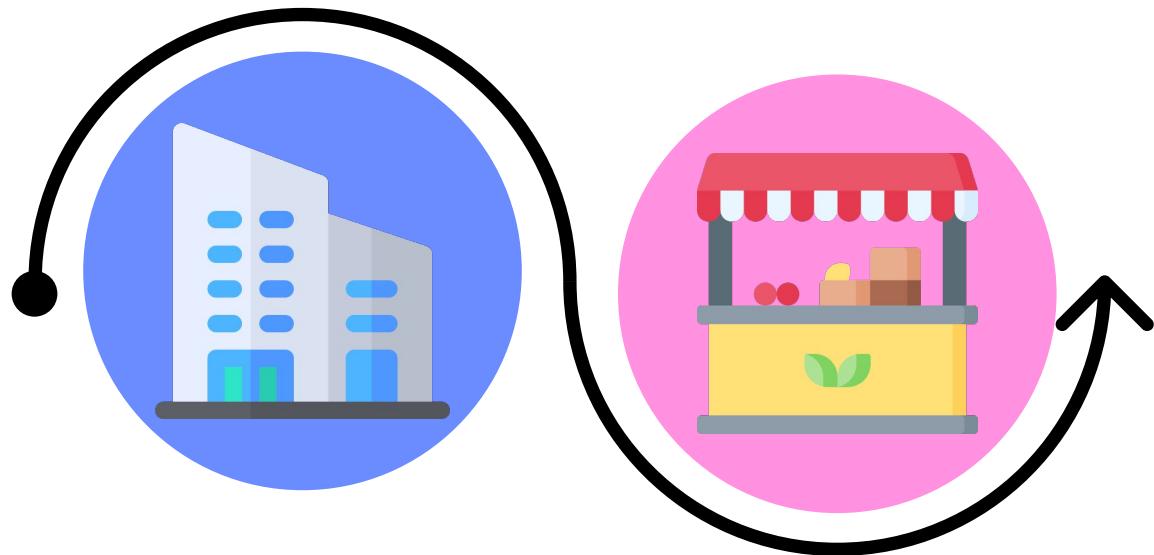
**This in turn helps them  
kickstart their career**

The projects help the students to put in practice the theory that they have learnt in the classroom and helps bridge the gap between the theoretical and practical scenarios. Projects stimulate creative thinking, thereby helping achieve results which would have otherwise been farfetched and help unlock new areas of interest which otherwise would have been difficult to discover.

Capstone projects are such types of projects which apart from giving the technical exposure required, also exposes students to the nuances of the real world. Apart from enhancing the technical skills it also enables the personality development among the students. While institutes invest significant time and effort on polishing the soft skills of the students, Capstone projects acts as a catalyst in developing these skills as these skills play a very significant role in the project.

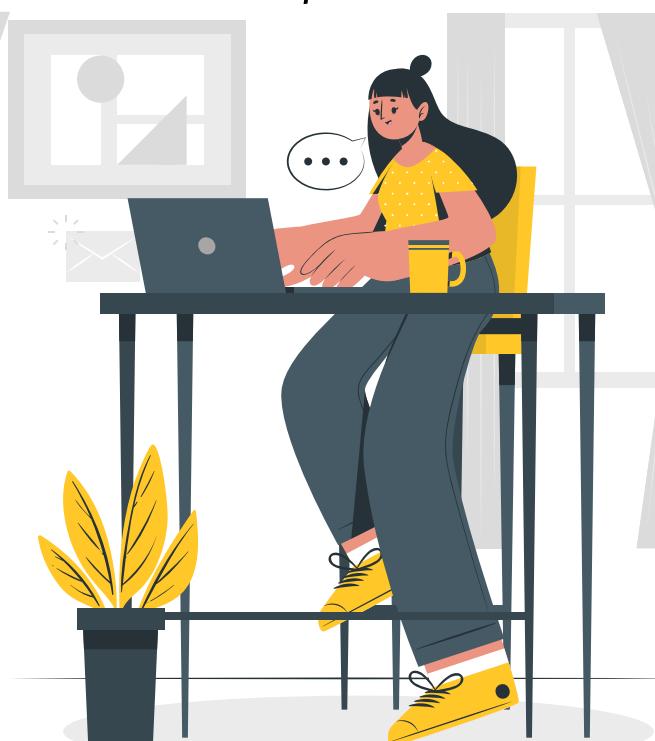
Students learn the skills of people management, time management and at the same time the ability to convince the counterparties to extend their support and share the requisite information to them. An exposure to a Capstone project also provides the students with a competitive edge when compared to other projects as these projects give you a scope to reflect and improve upon both your learning and outcomes, and helps in continuous improvement. As these projects are more to do with real life scenarios they also compel

the students to achieve results that can solve these problems and the findings or the outcomes of these projects translate to solve business problems or take business decisions. Capstone projects enable to pick up a problem statement in both organized and unorganized business sectors. These projects can be undertaken with highly unorganized and small businesses like hawkers, vegetable vendors, neighbourhood stores and also with organized business sectors such as Start-ups, mid-sized business to multi-national companies.



Each of these sectors poses its challenges, while in the unorganized sector collection and availability of information in structured format may become a challenge, data confidentiality and the extent of information that can be made available becomes a challenge in the organized sector.

#### ***Find out a real world problem***



#### ***Reach out and read about the organisation***



In either case, any spectrum of business the students wish to take up such projects they always come out with an enriching learning experience and gets them better prepared both in terms of Soft skills and technical skills in their professional journey. The beauty of Capstone projects is that unlike other projects where students try hard to get internships.



Solve the real world problems



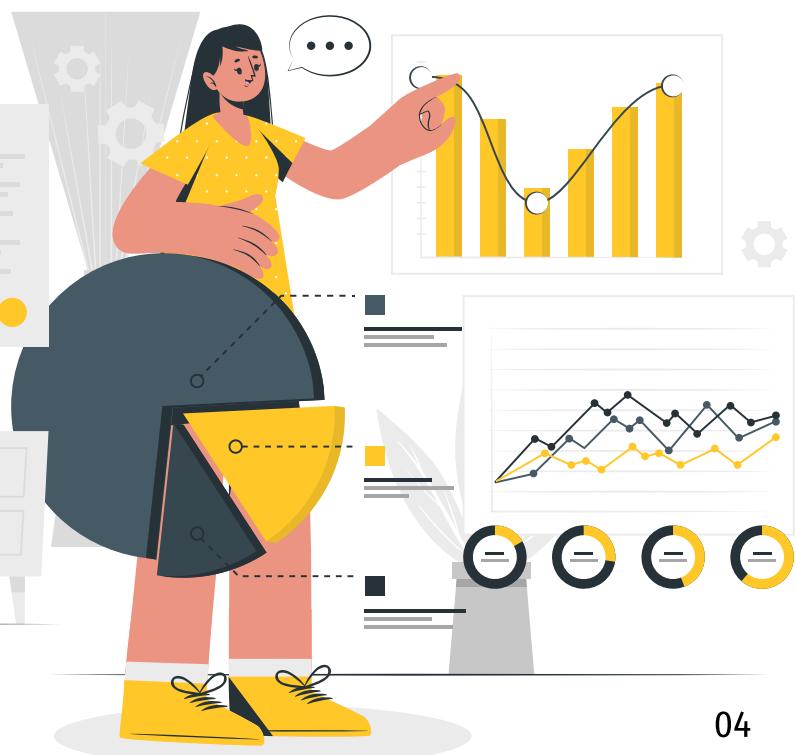
Success of project depends on the intents & efforts

Capstone projects are easily accessible as they intend to solve the real world problems and the success of the Capstone project purely depends on the intent and efforts put by the students. It is highly recommended that students take up many such projects in their curriculum with a sole intent of enhancing their knowledge and rather just taking it up as another subject of the curriculum.

#### ***Interview the company***



#### ***Present and recommend solutions***



# Benefits for Businesses - Unorganised Sector

The Unorganised sector takes up  
**85%**  
of market share



Overall contribution to the economy is  
**50%**  
approx.



Most affected by the recent  
**Pandemic**

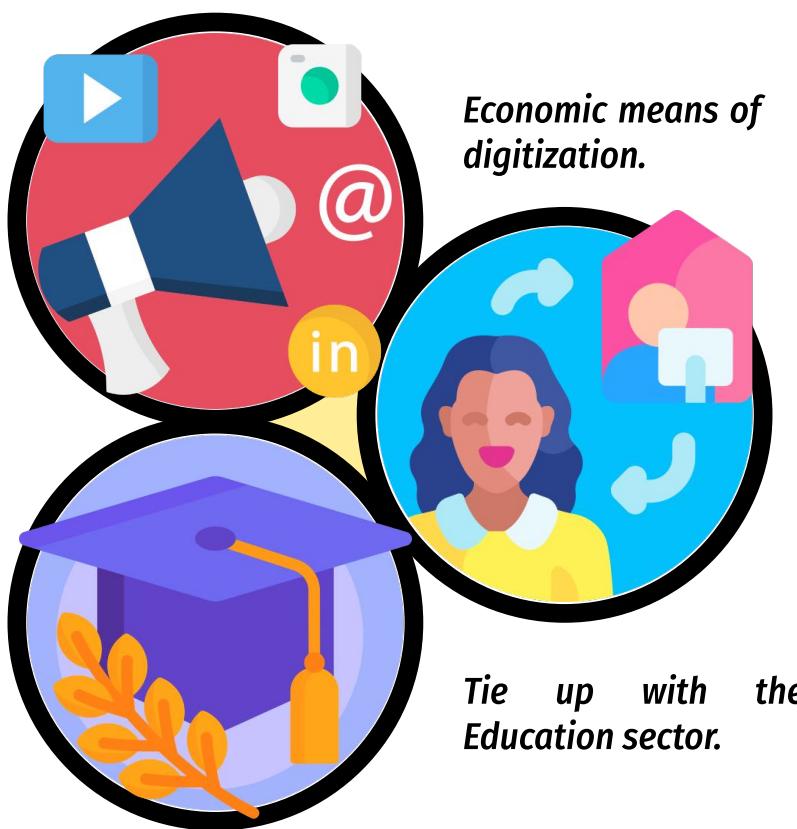
as:

- This sector primarily consists of proprietors, partnerships and large nos. of informal businesses.
- Not much data stored due to lack of time and energy, hence data loss.



However, if the businesses are able to leverage on these techniques through either economic means of digitization, collaborating with freelancers or with the education sector, the benefits that the businesses can gain become multi-fold.

If the businesses are able to leverage on these techniques through either sector, the benefits that the businesses can gain become multi-fold.



These techniques are beneficial for the businesses in reducing the operational overheads and for businesses dealing with perishable products in reducing the wastage. For example, a local vegetable seller always buys from a central market in bulk, due to the non-availability of the data on the sales it is very likely that he procures the products in a pattern within taking into consideration the fast moving and slow moving SKUs (Stock Keeping Units) and also the shelf life of the products. This would lead to having frequent stock out of the fast moving products and wastage of the products that are not moving. The non-availability of this data also makes the process of procuring the products heavily dependent on a person and cannot be delegated to any other person with the business as there is no data to access on what is to be brought and in what quantities thereby having an impact on the business continuity. Individual businesses may not have enough time and resources to have these analyses done on their own. Hence, it would be a good option for these businesses to collaborate with institutes so that they are able to get some value addition to the business. Such collaborations lead to a win-win situation for both parties.

As businesses get insights and different perspective of what things can be done right and when it comes to the institutes the student community gets better exposure to the real world scenarios. However, the success of such collaborations are also determined by the amount of time and information the businesses are willing to share and at the same time the commitment of the students towards these projects. Hence, mutual trust between the two parties becomes very important.

# Benefits for Businesses - Organised Sector



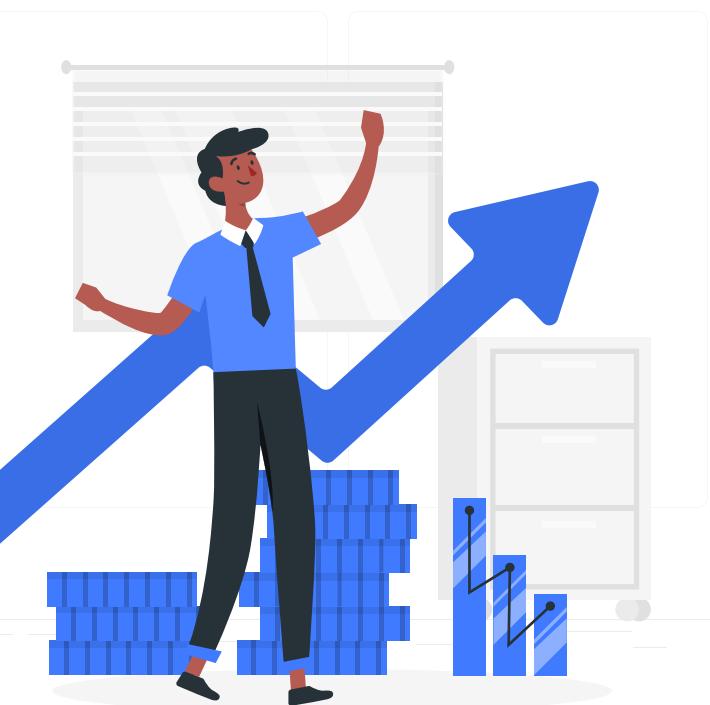
Businesses in this sector are well structured and the information pertaining to these businesses are available and accessible when approached through right channels. Information in this segment is generally available as a part of the regulatory and compliance requirement.

The businesses in this sector generally have resources dedicated to working on projects so as to always have a competitive edge. These businesses usually invest on research projects around the brand perception, customer affiliation towards the brand, product positioning etc.



The focus is generally on the customer focusing or revenue generating areas. Since the focus is more on the business side of things there is always a significant gap when it comes to streamlining the backend operations.

While this might not be the case in mature businesses, the recent boom in the start-up ecosystem has left this area to be addressed.

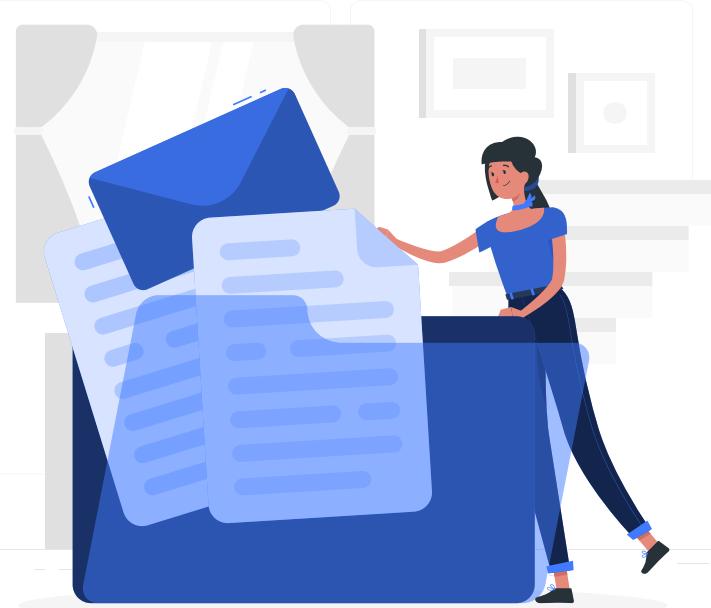


*Huge gap in the backend processes  
that could lead to high operational  
overheads*

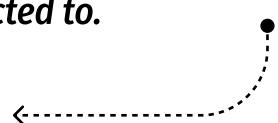


## ***Challenges in the Startup Business***

*Startups focus and spend resources  
on Revenue Generation*



*This leads to these businesses to not  
break-even at a rate they are  
expected to.*



In recent times, we have all read about how a leading ed-tech business which was once valued at Billions of Dollars lost its valuation due to incorrect processes and reporting.

Hence, it becomes very important for the business to not only focus on generating revenue and capturing the market share but at the same time also strengthen the back end processes. While it is understandable that the early stage businesses do not have all the resources required to address each of these areas and their primary focus would be on having a better market share, they can always leverage on their brand and collaborate with educational institutes to help them plug in the gaps by creating various internship programs.



***Since focus of startups would be primarily on market share,***

***collaborating with educational institutions to create internships is a strategic move.***



### ***Benefits of such internship programs:***

- Such internships not only help businesses to streamline and strengthen their process but also provide them with an opportunity to have the best of the talent working for them without paying high salaries. They can later on convert such resources into full time employees if deemed fit thereby reducing their hiring and training expenditure.
- While such an approach is not deemed to yield results in the short term it is definitely going to benefit in the long run.

- While creating such internship programs itself will not be sufficient, it is important that the businesses spend some time in designing these programs to get the maximum benefit and the students participating in such internship programs remain committed to the program and make the maximum utilization of these programs beyond their academic credit requirement.



It is also important that both the businesses and the students commit themselves to these projects and reflect on the findings of such projects. It is important that students present the findings that can be translated to business decisions and at the same time for the businesses to spend some time in evaluating these findings in a manner that they can be implemented to solve certain business problems. For such collaborations to be successful

it is important that both parties work with an open mindset with an attitude to unlearn and relearn newer things. If either party has a rigid mindset then it is most likely that such collaborations do not yield the desired result.

The recent boom in data science and the young talent taking on freelancing projects has further increased the focus of Capstone projects with an emphasis on the importance of using real data and practical analysis techniques.



In addition such projects foster a mindset of collaboration, networking, adaptability and innovation among the candidates. With the recent advent of data science the focus of these projects is on the below areas:

- Ethical considerations in data science such as bias detection, transparency in AI models and algorithms and so on.
- Methods to make complex models interpretable with an importance to interpret and explain machine learning models.
- Addressing challenges related to data scalability, efficiency and handling large datasets using distributed computational frameworks.
- Automated machine learning tools and techniques to streamline model development and optimization processes.
- Human centered approach with a focus on understanding user needs, designing user friendly interfaces and incorporating feedback into data-driven solutions.
- Promote open science practices, including sharing code, data and methodologies for transparency and replicability.

In recent times such projects have become a yardstick for evaluation as these projects are strongly integrated with the academics, which helps students or candidates demonstrate a comprehensive understanding of their field of study and at the same time is linked with the real world scenarios. Such projects allow demonstration of competencies while preparing for the upcoming professional roles and the same time allows an in-depth analysis providing a holistic view of the candidate's capabilities.

To conclude, the advancement in the computational tools & techniques and the availability of information has played a significant role in boosting the importance of having data driven projects in every walk of life. However, for such projects to be successful it is also important that collaborations are achieved between the industrial sector and the educational sector. For such collaborations to be successful it is imperative that they are built on trust, commitment and flexibility on either sides. With right kind of design and collaboration it is very likely that these data driven projects are going to benefit the society as a whole.

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# **INSIGHTS FROM STUDENTS PROJECTS**

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# Increase ROI and yield for a farmer without compromising on the quality of the produce

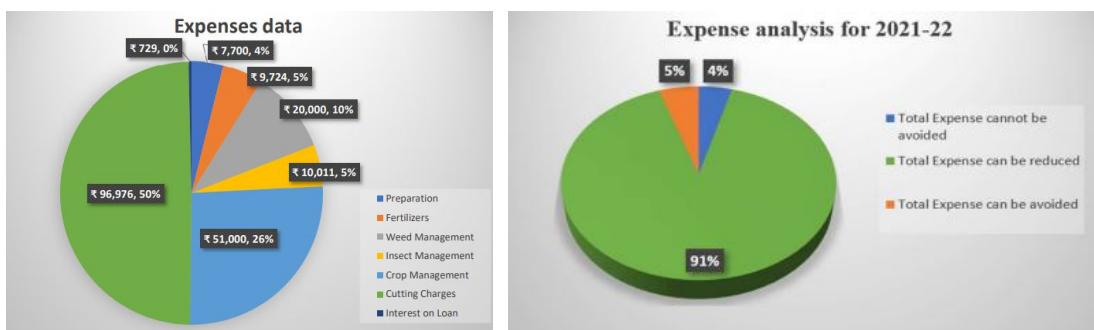
01

R. Hariharan | AGRO INDUSTRY

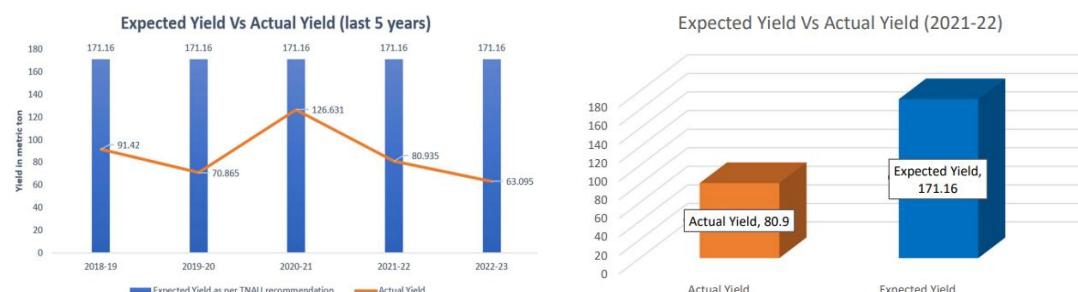
Business problems was the Increase in the cost of cultivation due to increase in labour cost and other expenses.

## Analysis done

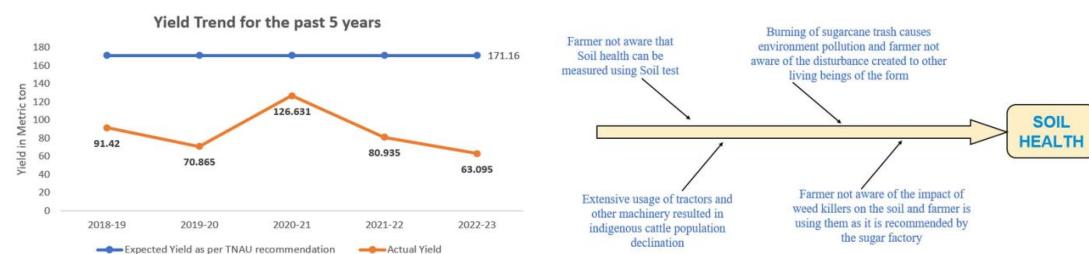
### 1. Expense categories breakdown analysis.



### 2. Yield Data Analysis.



### 3. Yield Statistics.



## Recommendations Given

- Use of natural manure, proper soil leaching and proper land utilization.
- Intercropping and Natural farming.
- 5 Why's root cause analysis to improve soil health.

# Profitability Analysis of “Capsicum Production” for Frais Agro Organization | Vijayanandam V M

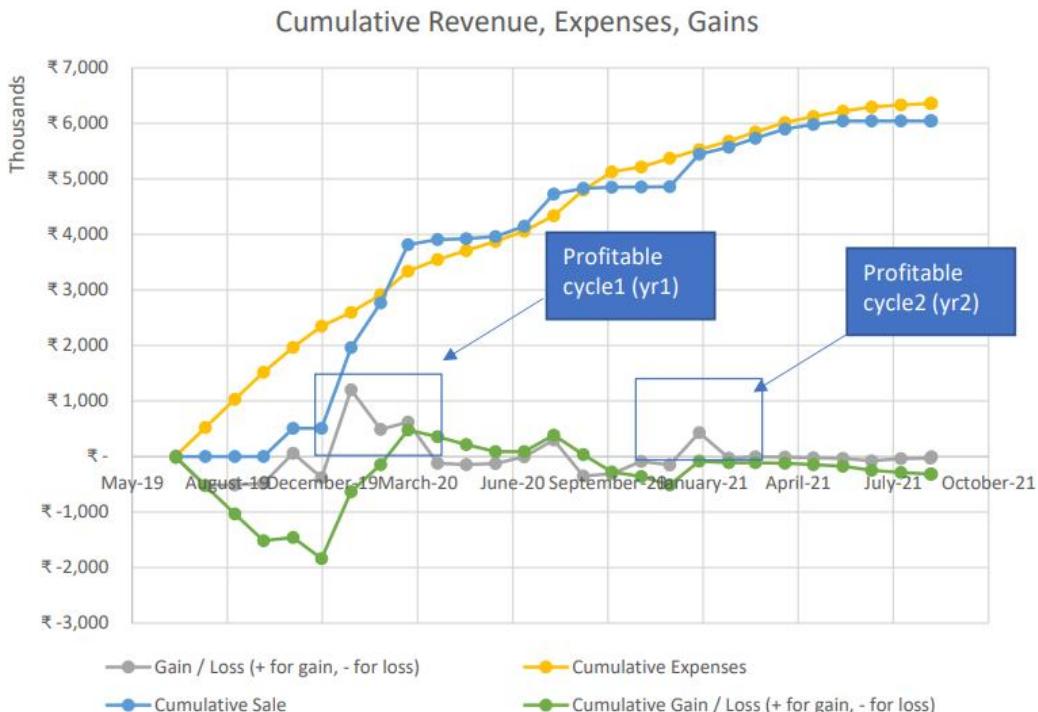
## AGRO INDUSTRY

02

The Business problem in this project was that the **Organization was unable to visualize profitability and needed help in analyzing Key costs and Revenue Contributors.**

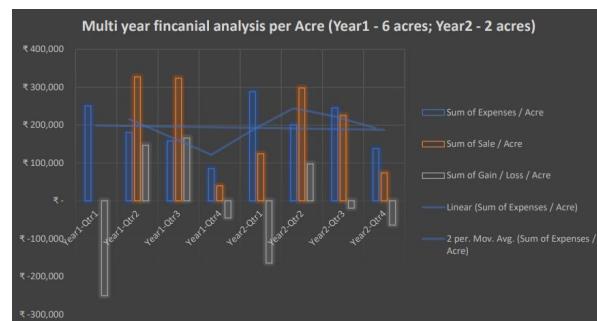
### Analysis done

1. Expenses, Sales and P/C analysis for a 2 year period.



2. Pareto Analysis

Expense category	Grand Total	% of expenses	Cumulative % of expenses
Fertilizers & Medicines	₹ 1,650,056	25.9%	25.9%
Development Expense	₹ 1,619,632	25.5%	51.4%
Weekly Labor Expense	₹ 1,321,550	20.8%	72.2%
Monthly Salary / Advance	₹ 957,048	15.0%	87.2%
Maintenance Expense	₹ 311,610	4.9%	92.1%
Electricity Bill	₹ 279,390	4.4%	96.5%
Agri Consulting fee	₹ 220,000	3.5%	100.0%
Mobile & Data card	₹ 706	0.0%	100.0%
Grand Total	₹ 6,359,992	100%	

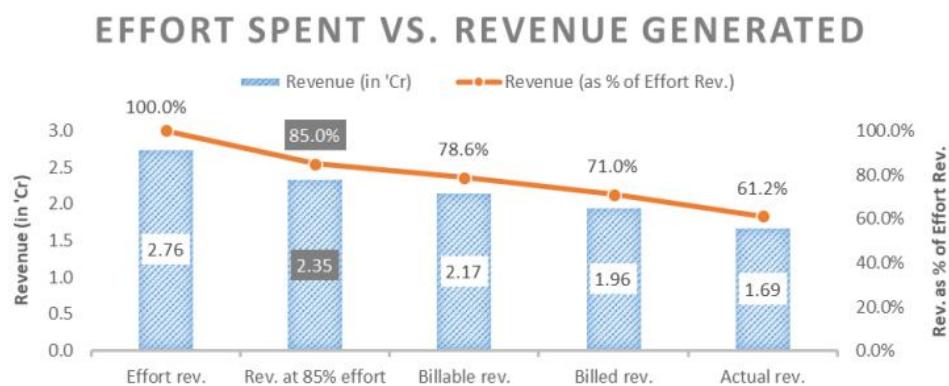


### Recommendations Given

- Align sowing and harvesting to account for seasonal demand.
- Review with Agro consultant to optimize fertilizer and medicine usage.
- Convert to Agricultural electric connection to save 1.5 Lakhs / year.
- Increase scale of operations to optimize costs.

# Analysis of resource management and its impact on revenue and profitability at a Healthcare IT services company | Anupam Chandra | SERVICES

The Business problem that required solutions to were **Low Profit Margins**. Despite high utilization, low revenues were generated. Data was collected regarding No. of projects, Project parameters, Hours available, allocated and worked by employees and Billing details of the project.



The result was that only 79% of the working hours were billable. Therefore,

- The efforts was disproportionate to revenue.
- Out of this, only 61% translated to revenue.

**Analysis Done:**

- Data Availability and Governance: (i) Single point of truth recommended (Implemented)
- Governance: (i) Build a process to collate and share data between teams (Power BI Dashboard) (ii) Weekly / Monthly review of KPI's related to revenue and profitability (iii) Employee Utilization: (a) To increase utilization of existing teams by training them on additional managerial roles. (b) Increasing billing utilization of senior resources.

**HRS WORKED VS. % BILLED BY LEVEL**



# Qualitative Analysis of Business Model & Revenue Enhancement Strategies of STEM Education Startup (3D CAD Masters) | Vikram Suriyanarayanan | SERVICES

The Business problems in this project were **Drop outs, less user traffic following high bounce rates, lack of sufficient alumni data.**

## Analysis done

### 1. Audience Overview



### 2. Acquisition Overview



### 3. Behaviour Overview

## Recommendations Given

- Developing a closed loop feedback mechanism by means of a survey and this will help in preventing dropouts.
- To make the program self paced or more flexible.
- Targeted Google Ad Campaigns on Young Parents of the age groups 25-30 years (parents of 5 - 10 year olds)
- Improve website for lower bounce rate.
- In person marketing/flyers.
- To streamline operations through standardized weekly module content.

# Creating an Automation Template for Investment Analysis for Financial Firm | Lily Sinha | SERVICES

05

Business problems which were significant in this project were that the **Investment analysis** were done manually which was cumbersome and that were are less number of clients.

## Analysis done

### 1. Fetching financial attributes dynamically.

STOCK WATCHLIST												
STOCK	SYMBOL	VOLUME	PRICE	CHANGE	CHANGE%	52 Week Low	52 Week High	52 Week Range	mark.	▼	52 Week Range	
HDFC Bank Ltd.	NSE:HDFCBANK	10,678,560.00	1590.35	12.6	0.8	1365	1757.5	0.5741401274	1203252484900			
ICICI Bank Ltd.	NSE:ICICIBANK	7,247,843.00	969.85	-0.7	-0.07	796	1008.7	0.817348378	6788034873750			
Infosys Ltd.	NSE:INFY	1,760,566.00	1419.9	3.25	0.23	1185.3	1672.6	0.4793761543	5972700361000			
Bajaj Finance Ltd.	NSE:BFINANCE	840,724.00	7258	22.4	0.31	5485.7	7999.9	0.7049160767	4392049507600			
Kotak Mahindra Bank Ltd.	NSE:KOTAKBANK	1,772,884.00	1789.45	-0.9	-0.05	1643.5	2064.4	0.3467569494	3561208688000			

Symbol	Sector	Market Cap	No. of Shares	Price Paid per share	Date Bought	Amount Paid	Current Price	Total Value	Total Allocation	Total Gain/Loss	Total Change	1D
NSE:BAFIN	Non banking financial companies	\$4,380.00 Large	50	\$8225.00	8/9/2021	\$31,125.00	\$7,252.00	\$382,600.00	22.71%	\$51,350.00	18.50%	\$10,401.00
NSE:TCS	Computers - software & hardware	\$12,343.81 Large	100	\$3,400.00	8/11/2022	\$340,000.00	\$3,574.00	\$337,400.00	21.13%	-\$2,600.00	-0.76%	-\$1,551.45
NSE:LTLT	Civil construction	\$3,815.84 Large	120	\$248.00	9/4/2020	\$113,760.00	\$2,151.50	\$325,908.00	20.41%	\$212,149.00	16.49%	\$20,552.48

Stock Historical Market Data - Last 5 years												
Date	Open	High	Low	Close	Volume	Trend						
8/30/2022 15:30:00	410	411.9	402.95	406.75	304179							
9/1/2022 15:30:00	407.15	411.9	406.75	410.15	94881							

Final_BDM_project_Lily.ipynb													
Date	High	Low	Close	Adj Close	Volume	Ticker	Fund Name	Yield	Trailing PE	Morning Star Overall Rating	Morning Star Risk Rating	Annual Total Return	Beta
76.819298	76.819298	76.819298	76.819298	0.0	0P0000XVJQ.BD	SBI Bluechip Fund Direct Growth	0.103544	20.899460	5	4	0.025	0.1700	0.99
112.300003	112.300003	112.300003	112.300003	0.0	0P00009WBB.BD	Tata Langender Equity Fund	0.046403	24.774084	1	3	0.005	0.8506	1.01
420.917603	420.917603	420.917603	420.917603	0.0	0P0000XVPD.BD	Tata Large Cap Fund Direct Growth	0.097259	26.495966	4	4	0.000	0.2025	0.97
25.190001	25.190001	25.190001	25.190001	0.0	0P0001BAP6.BD	Invesco India largecap Fund Dividend Reinvestment	0.117073	26.186090	2	5	0.000	0.5606	1.00

### 2. Creating Automation templates.

### 3. SWOT Analysis.



## Recommendations Given

- Create engaging platforms to the client.
- Motivation for SIP to clients to increase asset under management.
- Create financial awareness to ensure social presence.
- Make insights from SWOT analysis to make organisation progress to the next level.

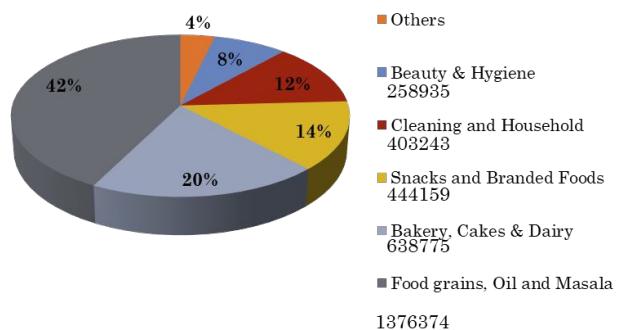
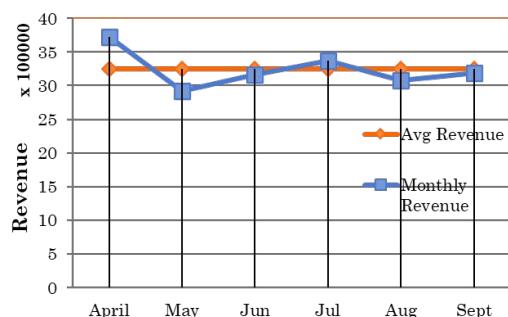
# A Study and Analysis of Sales data of a Co-operative Store and facilitate organization to improve Patronage by its members | Prashanth S

## RETAIL

The Business (Revenue) was shrinking in this organization; Profit earned were unable to meet the Expenditure. These were some of the issues faced.

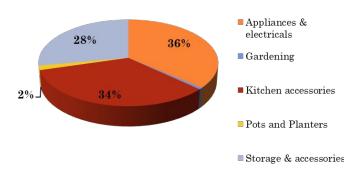
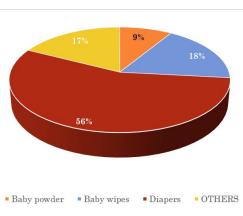
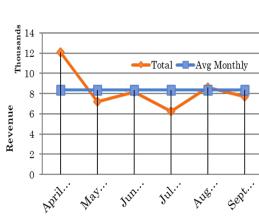
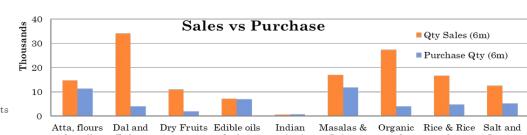
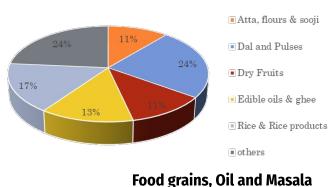
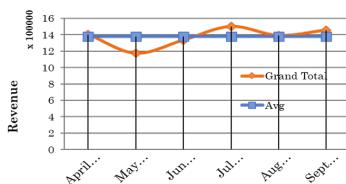
### Analysis done

#### 1. Analysis of Revenue in main categories



#### 2. Analysis of Expenditure

#### 3. Analysis of product sale in three categories



### Recommendations Given

- Average revenue should increase by 4L and reach 36L to make breakeven.
- Increase SKUs, Brands in Baby care, Textile, Fruits & Vegetable and Meat categories.
- Use database for inventory management, improve ROCE
- Ensure availability of Complementary products (Ex: Birthday items, Ingredients for Masala)
- Implement Job Enrichment/Enlargement.
- Professional Training to Staff in May months
- Patronage: Leading brands, Aesthetics, Price and promotion display, visual appeal, Disabled friendly access, assistance from staff

# Identifying localities to expand and business reach of an Optometrist's Shop | Aashrit B K

07

## RETAIL

The Business problems was that the **Business owner did not know the problem even existed in the first place. Secondly, he did not know the existing reach and where to expand his business further.**

**Analysis:** Based on the existing customer billing data, the localities/streets were segregated based on the number of orders and categorized into:

Category	Frequency	Number of streets
<b>Business presence</b>	1	63
<b>Repeated customers</b>	2 to 4	12
<b>Frequent customers</b>	5 to 19	2
<b>Shop's vicinity</b>	20 and above	1
Total number of streets		78

Table 2: Classification adopted to distinguish streets according to the number of customers they bear

**Geo Mapping** was done to identify the streets / Areas of interest. Then grids were created to an optimal resolution.

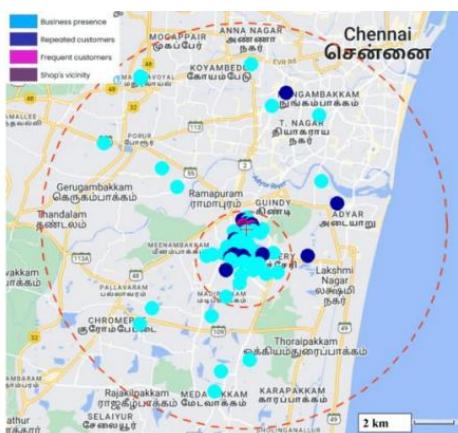


Figure 8: A map with regions of interest identified

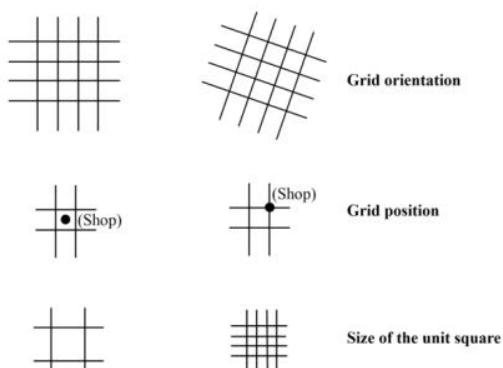
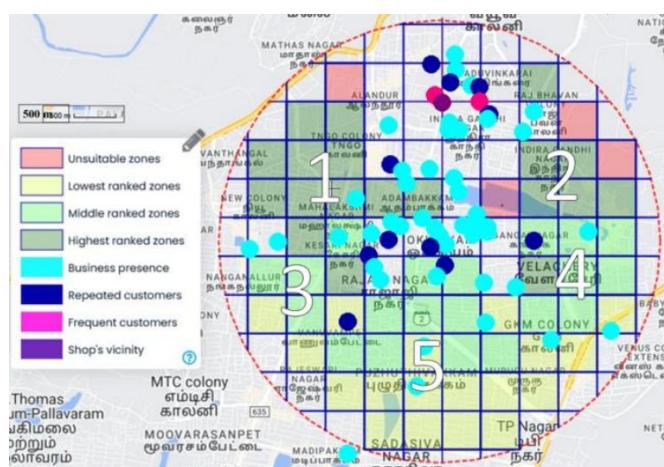


Figure 9: Illustration of choices in grid construction

**Quantitative score** was developed by creating a composite score of distance and density followed by ranking of grid zones



# Optimizing sales profits and improving customer frequency for a Ladies Tailor Shop

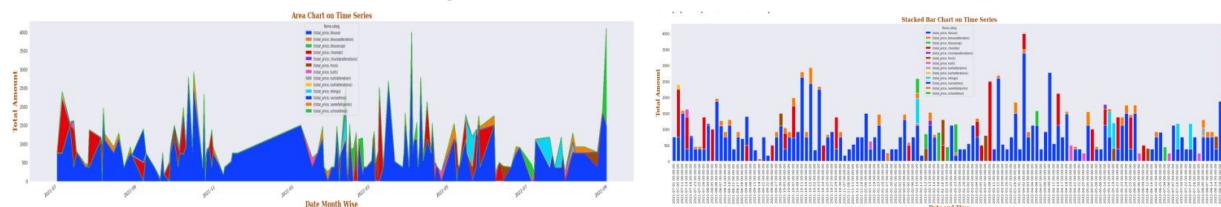
08

| Kumar Chandan | RETAIL

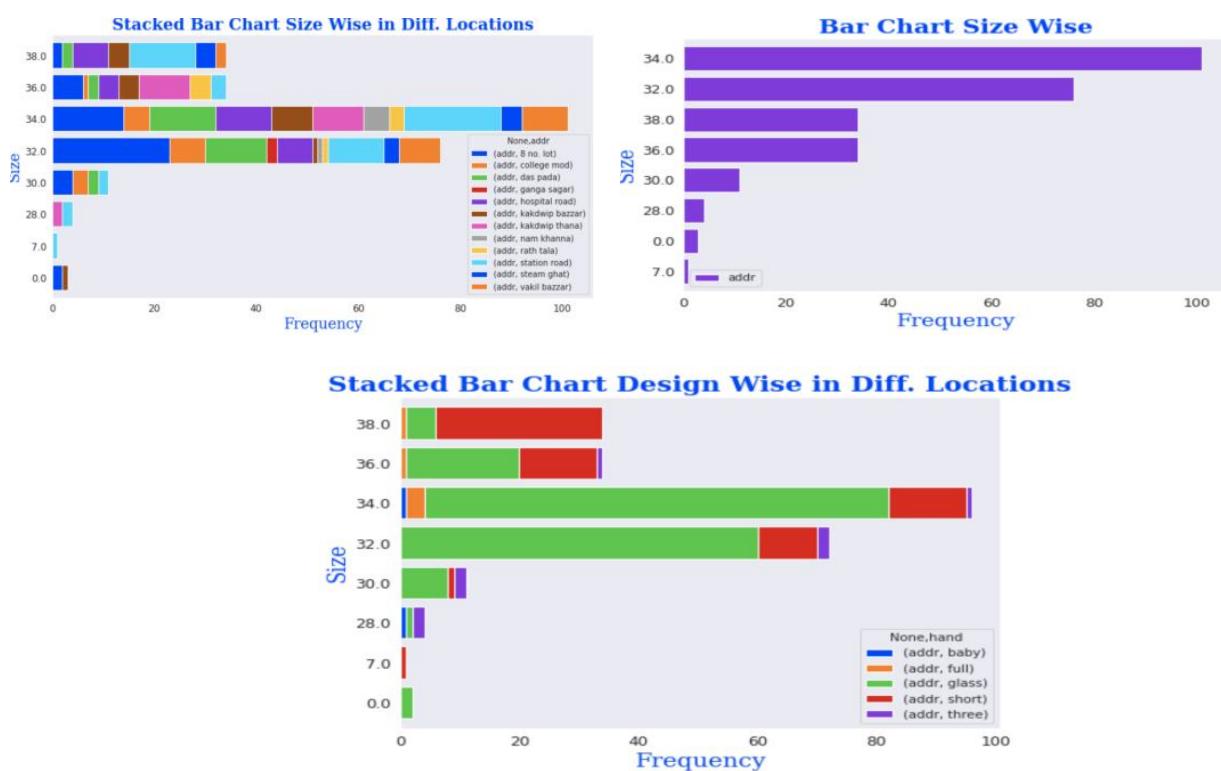
Business problems were that the Business struggles to keep up with the e-commerce industry, is unable to update to technology, faces customer loss, is headed by the owner who is in another state and follows traditional method of data management.

## Analysis done

1. Time series analysis using stacked bar chart and area chart.



2. Deep Analysis for Prime product.



## Recommendations Given

- Organizing Data based on customer details.
- Hire people to do work post training.
- Buy automated machines.
- Whatsapp marketing for potential customers.
- Crowd marketing.

# Achieving Sustainable Success in a Challenging Market: A Comprehensive Analysis of a Rural Cement Retailer | Parag Sarkar | RETAIL

The Business problems was that the **Market was competitive and that there were Stockout Issues (600 units stock capacity)**

## Analysis done

### 1. Cement inventory:

- Fluctuation in closing stock.
- Utilization of inventory was 82% which means that the rest 18% of inventory was empty.
- 2. Safety stock and reorder point was calculated for the 3 brands.

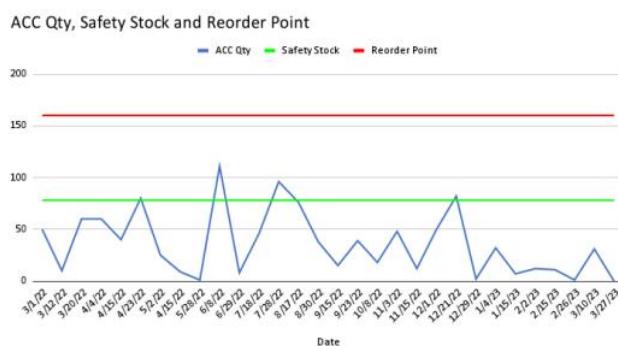


Chart - 3. Acc cement quantity, Safety Stock, and Reorder Point

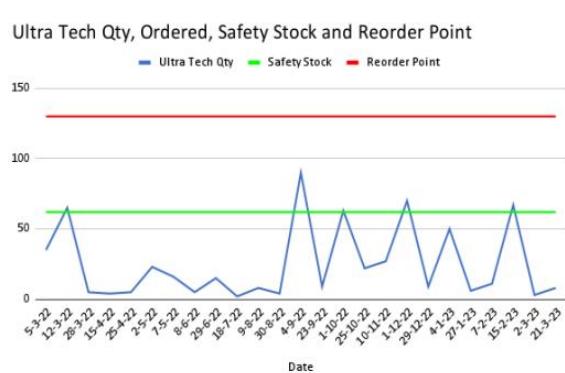


Chart - 4. Ultra Tech cement quantity, Safety Stock, and Reorder Point



Chart - 5. Power Plus cement quantity, Safety Stock, and Reorder Point

## Recommendations given

- Increase the inventory capacity from 600 to 800.
- Diversify offerings: Lower priced alternatives to be tried.
- Establish relationship with multiple suppliers to avoid stockout.
- Introduce computerized inventory tracking through spreadsheets or mobile apps.
- Continuous monitoring to be done, and adaptation and fine tuning of strategies based on changing market dynamics should be implemented.

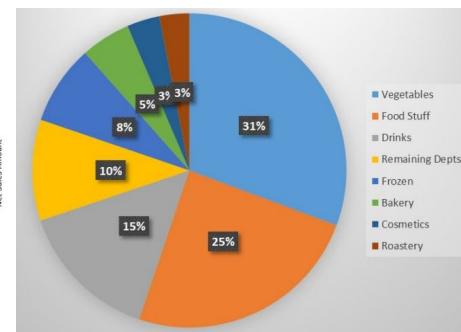
# Unlocking Profit Potential: Data-Driven Strategies for Supermarket in Abu Dhabi's Labor Camp Area | Rasheena A T | RETAIL

10

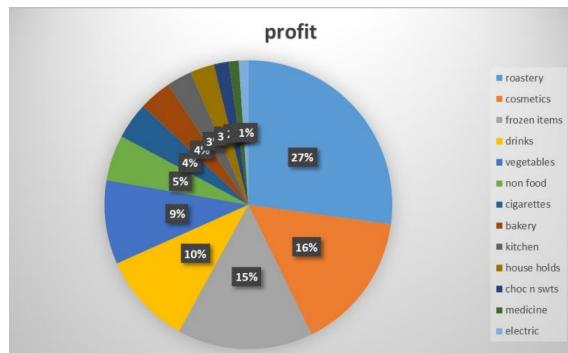
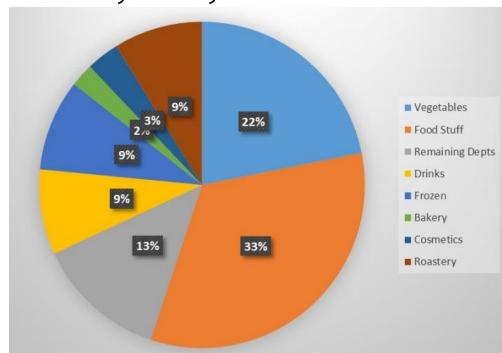
Business problem faced by this particular business was Decrease in Sales and customers due to nearby competitor, and lack of loyalty programs for customers.

## Analysis done

### 1. Percentage Contribution Analysis

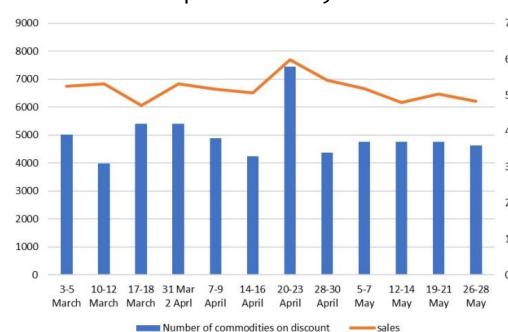


### 2. Profitability Analysis



### 3. Correlation Analysis.

### 4. Promotional Impact Analysis.



## Recommendations Given

- Maximizing Returns through Promotional Impact Analysis.
- Maximizing Profits through Departmental Insights and Profit Margins.
- Maximizing customer footfall through Department-wise promotional impacts.
- Strategic Approach for Promoting Non-Food Items.

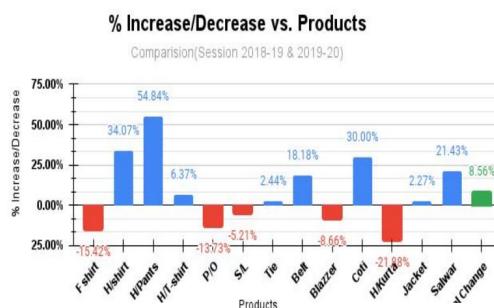
# Optimizing inventory and stockout for a School Uniform manufacturing and selling business

| Sankalp Arora | RETAIL

Unsold stock of some products/sizes as well as stockout situations for some products/ sizes were some of the business problems that were prominent in this business.

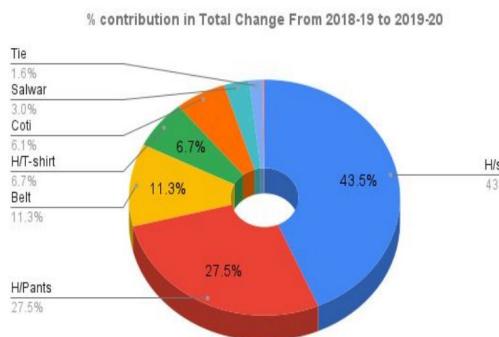
## Analysis done

### 1. Analysis Of % Increase/Decrease of various products



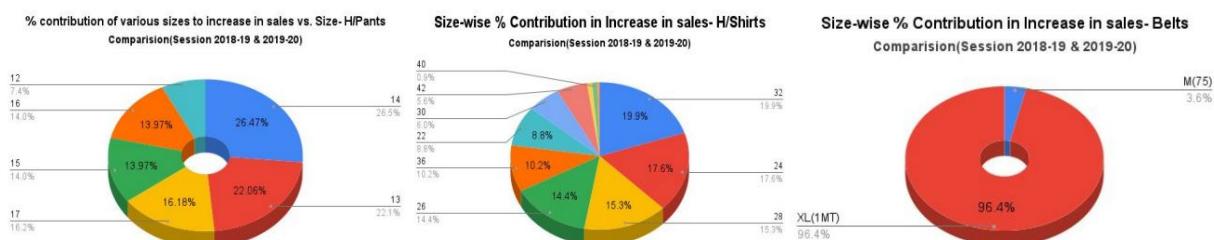
Products	2018	2019	Sales analysis of session 2018-19 and 2019-20	
			Productwise Overall % Increase/Decrease Session(2018-19) to Session(2019-20)	Change
F shirt	603	510	-15.42%	-93
Hshirt	631	846	34.07%	215
H/Pants	248	384	54.84%	136
H/T shirt	518	551	6.37%	33
P/O	357	308	-13.73%	-49
S/L	192	182	-5.21%	-10
Tie	328	336	2.44%	8
Belt	308	364	18.18%	56
Blazer	127	116	-8.65%	-11
Cott	100	130	30.00%	30
HKurt	96	75	-21.80%	-21
Jacket	44	45	2.27%	1
Salwar	70	85	21.43%	15
Total Change	3622	3932	8.56%	310
		% distribution in Total Change from 2018-19 to 2019-20		100.00%

### 2. Volume Pareto Analysis



Volume Pareto Analysis(Increasing sales Trend Products)				
Product	Change	% contribution in total change in 2018-19 to 2019-20	Cumulative Sales	Cumulative sales %
Hshirt	215	43.52%	215	43.52%
H/Pants	136	27.53%	351	71.05%
Belt	56	11.34%	407	82.39%
H/T shirt	33	6.68%	440	89.07%
Cott	30	6.07%	470	95.14%
Salwar	15	3.04%	485	98.18%
Tie	8	1.62%	493	99.80%
Jacket	1	0.20%	494	100.00%
Total Increase	494	100.00%		

### 3. Size Contribution in three Products (Which makes 82% increase in sales Of Sales)



## Recommendations Given

- Collecting customer details during billing.
- Increase/decrease of stock of products for current year based on last 2 years sales.
- Database of all the customers with their product basket details.
- Maintaining a real time dashboard and decreasing lead time.
- Consider focusing on products and sizes which contribute to maximum sales Volume.

# Driving Sales for an Artisan Pizzeria

## | Jagannadha Rao Vasu A | RETAIL

12

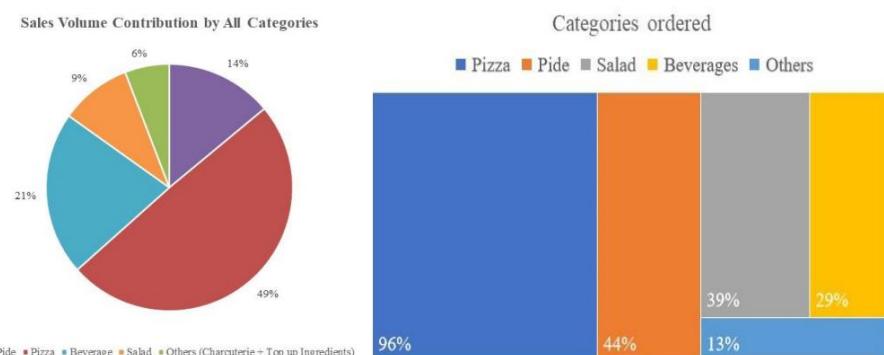
Business problems were the Optimization of the menu was required, Lesser foot traffic, Need to improve seating comfort.

### Analysis done

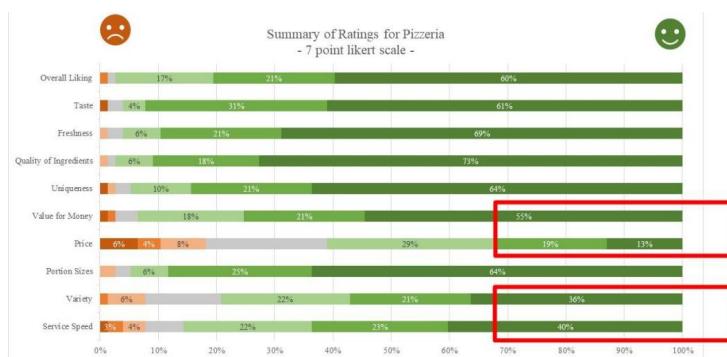
#### 1. Sales and trends to develop sales strategy.



#### 2. Menu structure to develop product and Assortment strategy.



#### 3. Brand study to develop branding and communication strategy.



### Recommendations Given

- Achieving Sales target by means of Promotions and Offers.
- Expand the menu for more food options and inclusion of hot and cold beverages.
- Leverage food quality across all brand touchpoints, i.e., digital assets, social media advertising and in-store communication.

# Designing a Robust Digital Accounting and Analytics Scheme to Identify Areas of Daily Losses for a local Café | Sai Shyam | RETAIL

13

Business problems were Optimization of purchases was required and that the written mode of data entry and manual calculations were being followed.

# Analysis done

1. Daily purchases data tabulation and analysis.

- ## 2. Pareto analysis of purchase.

Daily Summary	Date	12/23/2022	12/24/2022	12/26/2022	12/27/2022	12/28/2022	12/29/2022	Total for the Month
	Day of the Week	Friday	Saturday	Monday	Tuesday	Wednesday	Thursday	
	Sale	₹25,820.00	₹12,795.00	₹15,268.00	₹22,411.00	₹21,774.00	₹19,788.00	₹571,191.00
	Purchase Cost	₹18,193.00	₹24,251.00	₹19,993.00	₹32,329.00	₹21,639.00	₹15,210.00	₹667,011.00
	Day's Profit (Loss is -ve)	₹7,627.00	₹-11,456.00	₹1,275.00	₹-9,918.00	₹135.00	₹4,578.00	₹-95,820.00

- ## 2. Cafe Dashboard



## **Recommendations Given**

- Acquiring a smaller space in another location to ease out operational overload.
  - Shifting the existing additional employees in the main cafe to the new one.
  - Increase profits by reducing use of single-use paper & plastics cups, plates, and spoons.
  - Bulk purchase of non-perishables and long shelf-life provision on a certain day.
  - Strategy for cafe to supply snacks and food to the college during important days.

# Price Prediction and Demand Forecasting for an Industrial Scrap Trading Company

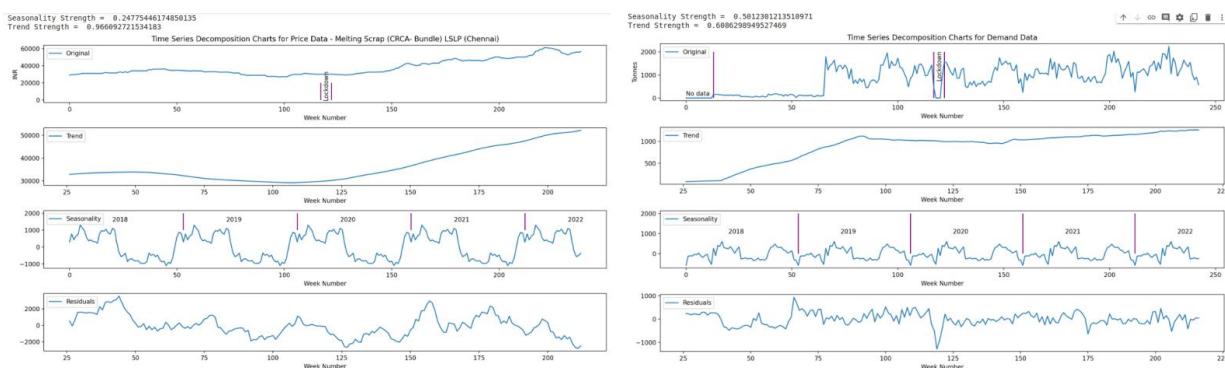
14

| Cherian K George | **INDUSTRY**

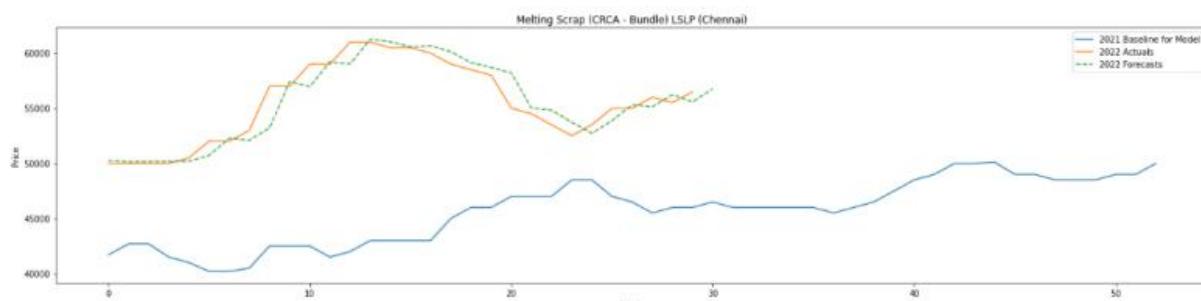
The Business problem in this project is that the **Company operates largely in the unorganized sector and therefore effective capture of data is limited.**

## Analysis done

### 1. Time series decomposition of Price and Demand Data.



1. Measuring strength of Trend and Seasonality.
2. Prediction and Forecast of price using ARIMA.



```
Melting Scrap (CRCA - Bundle) LSLP (Chennai) (p:2 d:1 q:1 RMSE: 11770.9389)
Predicted value for next week : 56750.23096379077
Parameters generated
x1      159.605505
ar.L1    0.835586
ar.L2    -0.120011
ma.L1    -0.758594
sigma2   477376.517541
```

### 4. Ratio Analysis of Financial Data.

## Recommendations Given

- Reduce number of defaulting customers by deciding advance percentage.
- Diversifying customer base.
- Speculation and Warehousing through Profit sharing partnership with storage houses.
- Increase operations in high price locations and capture unfulfilled demand.
- Record evaluation, delivery location for transactions, and customer ranking parameters.
- Monitor signals of Market, Geopolitical and Global economic events.

# Implementing a Data centric information system at a Manufacturing Industry

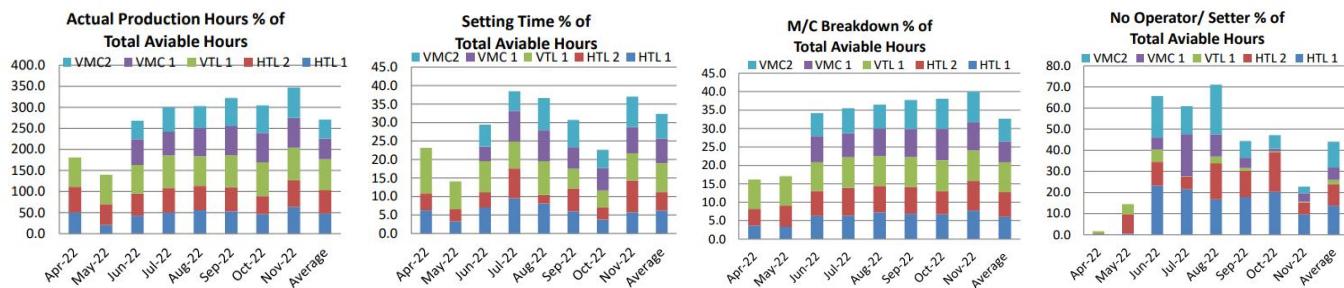
15

Subramaniam Mohan | **INDUSTRY**

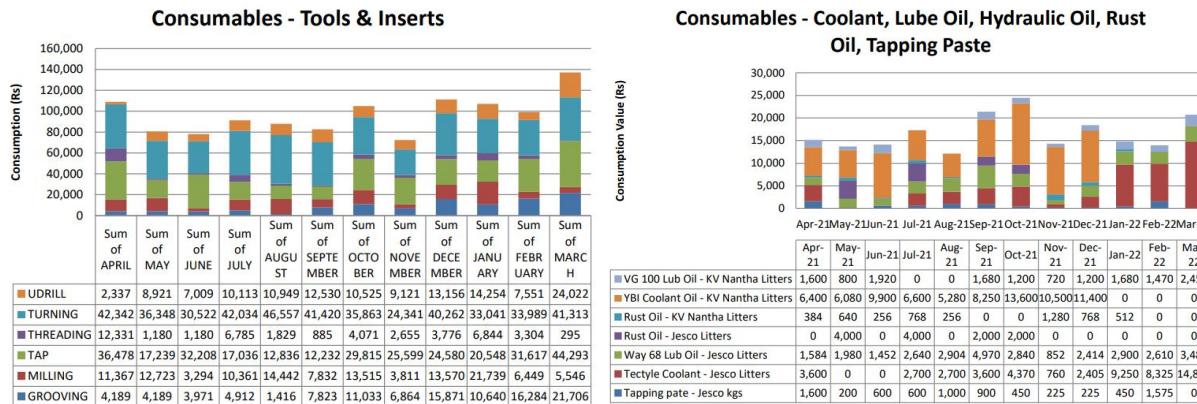
The Business problems identified in this project were that **There was no target, lack of focus in data management and Operational issues at both company and machine end.**

## Analysis done

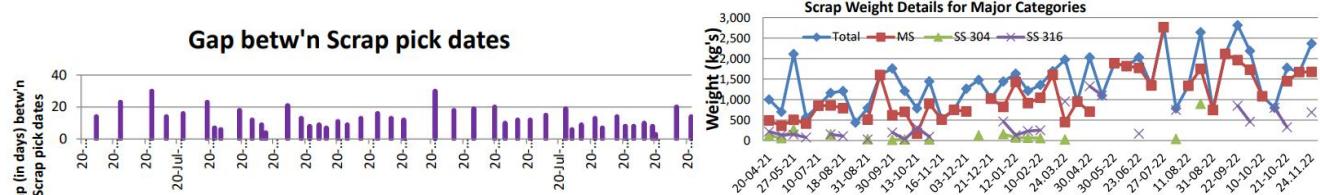
### 1. Analysis of Machine centered Parametric analysis.



### 2. Consumables - Cost and consumption parametric analysis.



### 3. Scrap Analysis.



## Recommendations Given

- Reinforce open communication on technical issues for a healthy growth.
- Consensus based process modifications instituted, measured and analyzed to establish the effectiveness of process improvement.
- Design of high level dashboard for Supply chain (Client, Firm, Outsourcing vendors) (b). Production planning and performance tracking (c). Machine utilization and downtime with remedy measures (d). QA/ QC Tracking and Non-Compliance Report management (e). Tools, Consumables, Gigs and Fixtures management (f). Scraps and housekeeping Management

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# OUR TEAM AT BDM CAPSTONE PROJECT

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## DR. AADITYA CHANDEL

**Dr. Aaditya Chandel** works as a research scientist equivalent at IIT Madras' Department of Aerospace Engineering, specializing in rotor aerodynamics in wind gust environments, mainly applicable to UAVs, MHAVs and rotorcraft applications. He earned a PhD from IIT Madras' Department of Mechanical Engineering and has published in reputable journals. He is also an instructor for the BDM Capstone Project course at the IITM BS Degree in Data Science program. He is also in charge of international outreach for NPTEL+ masterclasses, a Government of India project working along with Dr. Ashwin J. Baliga.

Dr. Chandel also founded "QkRes Technologies and Research Services," a startup when associated with Nirmaan, a pre-incubation cell at IIT Madras. He is passionate about impactful research and is also interested in entrepreneurship, business development, and adding value to the unorganized business sector.



Aaditya Chandel, PhD



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## DR ASHWIN J BALIGA

**Dr. Ashwin J. Baliga** is an Assistant Professor of Marketing and Sales at IESEG School of Management, Paris Campus, France and has a PhD in B2B Marketing from IIT Madras. He was the recipient of the "IIT Madras Institute Research Award" for the exemplary research work done and received " Sri N Kannan Prize " for the Best PhD Thesis in Marketing at the 59th Convocation IIT Madras. Ashwin has published in Journal of Business Research, Journal of Business & Industrial Marketing, Journal of Personal Selling and Sales Management, International Journal of Mineral Processing and Harvard Business Publishing as well. His thesis is on service failure and recovery in B2B markets. He also does research in tech usage in sales, mental health of B2B salespeople, B2B customer reacquisition, relationship reactivation, buyer-supplier relationships etc.



[Ashwin J. Baliga](#)



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## RAJAN RANJITH KUMAR

**Rajan Ranjith Kumar** is a Doctoral Student at the Department of Management Studies (DoMS), Indian Institute of Technology Madras (IIT Madras). He is also an instructor for the Business Data Management course for the Online BS degree program at IIT Madras. His research interests span several areas related to quality management, industry 4.0, operational excellence, and systems thinking. Rajan has contributed to scholarly articles and research in these domains. Rajan's work contributes to advancing the understanding of Quality Management practices and their application in the rapidly evolving landscape of Industry 4.0.

He is also a certified Lean Six Sigma practitioner, 5S Lead auditor and also conducts workshops on Simulation using Arena and Value Stream Mapping.



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## LAKSHMI SUPRIYA

**Lakshmi Supriya** is a Content writer and Graphic Designer at NPTEL, IIT Madras. She holds a Bachelor's degree in Architecture and has 3+ years of work experience in Architecture, Graphic design, Social media and Content writing. She is passionate about teaching and has conducted workshops, both online and offline. She maintains a presence as "The Curious Conversationalist" on LinkedIn and WordPress, earning recognition as a "Top voice in Writing" and "Top Voice in Graphic Design". She is also a self-published poet with two books, "Musings by a Spearhead" and "Petals and Thorns: Love and a little Heartbreak."



## NOTE BY SURAJ SRIVASTAVA

This book is a pivotal step in the journey of students who pursue the Capstone Project and is designed and formatted in such a way, to bridge the gap between theory and practice, equipping students with the skills to tackle real-world business problems through data.

Diverse range of business sectors are featured, both organized and unorganized, to showcase a spectrum of analysis and approaches. The Capstone Project is not just about data analysis; it's about shaping the future decision-makers who will lead businesses to success with informed strategies through internship and placements that will pave the way for their professional journey.

Here's to creating a transformative educational adventure.

**Suraj Srivastava**  
Head - Industry Relations & Career Services  
CODE, IIT Madras, BS Degree Program





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BS DEGREE PROGRAM