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Data visualization approach for business strategy recommendation using power BI dashboard

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Abstract
This research delivers an integrated Power BI dashboard to give projections, and future forecasting on sales, finance, marketing, and supply-chain. The dashboard enables organizations to make data-driven choices, optimize resource allocation, and future growth opportunities by leveraging the power of data analytics and visualization. The dashboard's sales forecasting function forecast future sales performance using historical sales data, market trends, and customer behavior patterns using real-time visibility into revenue estimates, conversion rates, and sales. Moreover, the dashboard delivers precise revenue, expense, and profitability estimates by utilizing different cutting-edge algorithms. By leveraging advanced algorithms, the dashboard provides accurate forecasts for revenue, expenses, and profitability. Data from a variety of marketing channels, such as social media, online campaigns, and customer interaction metrics are gathered by the marketing forecasting module for campaigns on customer acquisition, brand awareness, and lead generation by examining previous campaign performance and market trends. Supply chain forecasting section combines demand forecasting, inventory control, and production scheduling to forecast optimize inventory levels, streamline procurement, and boost overall supply chain efficiency by analyzing historical demand trends, supply chain interruptions, and market dynamics. Users can explore data from various perspectives and dimensions using the intuitive visualizations, interactive charts, and drill-down features provided by the Power BI dashboard. It can also link with many data sources, including CRM systems, financial databases, marketing analytics platforms, and supply chain management systems, and it allows real-time data updates. Overall, this initiative offers organizations a strong and centralized way to forecast sales, financial results, marketing impact, and supply chain requirements.

Keywords: SWOT, BCG, APAC, DAX, SQL

Introduction

Power BI is a powerful business intelligence tool developed by Microsoft that has gained significant popularity in various industries. It allows organizations to gather, analyze, and visualize data from diverse sources, enabling data-driven decision-making and providing valuable insights into business operations (Geetha Bhargava Mandava, 2018). With its user-friendly interface and robust capabilities, Power BI has become an essential tool for professionals across different domains. It gives businesses the ability to turn unstructured data into insightful dashboards, reports, and visualizations, enabling them to comprehend key business KPIs more thoroughly [1]. Power BI gives a comprehensive perspective of an organization's performance by combining data from several sources, including databases, spreadsheets, and cloud-based services [2]. Power BI's extensive and adaptable visualizations allow it to portray a whole page engagingly. The tool offers a wide variety of graphs, maps, charts, and other visual components that may be customized to meet individual requirements and design preferences. By combining different graphics, using color schemes, and creating simple navigation interfaces, users can produce aesthetically appealing and dynamic reports. Additionally, organizations may collect real-time data from numerous channels, including social media platforms, IoT devices, and web analytics tools, thanks to Power BI's ability to

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[1] https://learn.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-types-for-reports-and-q-and-a last visited on 13/6/2023
[2] https://www.tutorialspoint.com/power_bi/index.htm last visited on 14/6/2023

interact with a wide range of data sources. Businesses can discover early signals of market shifts, emerging customer preferences, and industry upheavals thanks to constant data monitoring and analysis, giving them a competitive edge. Additionally, to the Analytics window, one may also use DAX formulae to execute different algorithms (Alberto Ferrari et al., 2016) [13]. For statistical calculations, DAX offers a wide range of functions, including linear regression, logistic regression, etc. One can execute complex computations and get regression coefficients, R-squared values, and other statistical metrics by using DAX to create calculated columns or measures (Galiveedu Shoaib et al, 2022) [14].

By integrating Power BI, researcher can improve different applications and give consumers data insights without forcing difficulties among various platforms by taking advantage of its interactive and visual data exploration features (Amir Netz, 2017) [16]. Organizations can connect and combine data from diverse platforms, systems, and services by using these Power BI deployment options. They can obtain a single view of their data thanks to this connectivity, carry out cross-platform analysis, and provide valuable insights. Power BI is a flexible tool for integrating many platforms and getting a comprehensive understanding of company data because it can connect to both on-premises and cloud-based data sources and is integrated with other Microsoft services (Ashok Kumar Guntupalli, 2020) [15].

Scope of the study
The goal of this study is to explore and analyze numerous Power BI-related features with an emphasis on the program's capabilities, functionalities, and applications. The aim of the study is to give a thorough grasp of Power BI's capabilities, implementation options, and applicability to data analysis and visualization in a variety of business contexts. Moreover, the study restricted to Atliq Hardware, a consumer goods electronics company having operations in various countries in world.

Objectives of research
The main objective of the research aims
To solve different metrics of the company Atliq Hardware to make data-driven decisions and to increase their profitability in the year 2021 to predict the sales, inventory estimation, and management for the year 2022 and make a strategic decision regarding increasing overall profitability and management for the upcoming years.

To utilize and forecast business performance using different model for upcoming years and to perform the required analysis and come up with different findings for the top management.

To analyze and solve the business problems using SWOT analysis, BCG matrix, and Critical path methods in the supply chain. And minimize out spill of resources. And increase cost-effectiveness and reduce time. Different scenarios may apply in different views in the dashboards.

Why Power BI is preferred?
Power BI and Excel are both powerful tools for data analysis, but they have different strengths which are preferred in different scenarios [3]. Here are some reasons why Power BI may be preferred over Excel:

1. Scalability and Performance: Power BI is designed to handle large and complex datasets more efficiently than Excel.
2. Data Modeling and Transformation: Power BI provides robust data modeling capabilities, allowing users to create relationships between tables, define calculations, and build hierarchies. Power BI's Power Query Editor provides a user-friendly interface for data transformation, allowing users to clean, reshape, and combine data from multiple sources.
3. Visualizations and Interactive Reports: Power BI offers a wide range of visually appealing and interactive data visualizations, including charts, graphs, maps, and tables. These visualizations can be easily customized, linked, and filtered to provide dynamic insights and facilitate data exploration.
4. Real-time Data and Refresh Options: Power BI offers real-time data connectivity and refresh capabilities, allowing users to connect to live data sources and have their reports and dashboards updated automatically.
5. Collaboration and Sharing: Power BI provides a cloud-based platform, Power BI Service, which allows for easy sharing, collaboration, and distribution of reports and dashboards. Users can publish their Power BI creations to the cloud, share them with others, and collaborate in real time.

In summary, Power BI is preferred over Excel when dealing with large datasets, complex data modeling and transformation, interactive visualizations, real-time data, and collaborative analytics (Sunil Khilari et al., 2022).

Literature Reviews
Literature reviews provide a comprehensive overview of the current state of knowledge and understanding in the field related to future research. It allowed for the identification of key concepts, theories, methodologies, and findings that have been previously explored and documented by researchers and experts for analysis of data with different tools and techniques (S. Chandragandhi, 2022). Through the literature reviews, several important themes and trends emerged, shedding light on the existing gaps, challenges, and opportunities within the research domain particularly on dashboard application using power BI (Neha Yeramarus, 2021) [20]. It helped in gaining a deeper understanding of the subject matter, identify research methodologies and approaches employed by previous researcher and obtaining insights into the latest advancements and emerging trends in the field of analysis and visualization (Surlisa Widjaja, 2019) [18]. Overall, literature review served as a vital component of tthis research, providing a solid foundation of knowledge and informing the research process. It ensured that the research was built upon on the gap arising from existing scholarly work for further investigation, and generating new insights on the field of application of power BI (Amrit, 2021). The findings and insights derived from the literature review were instrumental in guiding the research's direction, contributing to its overall validity, and

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3   https://microsoft-business-applications.hcltech.com/power-bi/business-forecasting-with-power-bi/ last visited on 15/6/2023

positioning it within the broader academic and research landscape particularly in data visualization.

Rasmey Heang (2019) [3] pointed out that Power BI is a robust business analytics tool developed by Microsoft that has gained significant importance in the field of data analytics and business intelligence. Amrapali Bansal (2017) highlighted Microsoft's goal with Power BI, a business analytics service for visualizing and analyzing all of your data in one place, is to bring business intelligence to everyone. Vijay Krishnan (2016) [2] depicted data visualization and analytics being a tool in the management process, it is necessary to share the reports and dashboards in quick time for appropriate action. Power BI enables various options along with new dimension to share reports and dashboards to researches for real time analytical processes (Ajayan, 2017) [1]. BI is characterized as a framework which gathers, changes and shows organized information -3- from various sources. BI is a system and an answer that helps decision makers to comprehend the economic circumstance of the firm. BI is characterized as frameworks that gather, change, and present organized information from various sources lessening the required time to acquire significant business data and enable their efficiency use in management decision-making process (Den Hamer, 2004) [5], permitting dynamic enterprise information look, recovery, examination, and clarification of the necessities of administrative choices (Nofal and Yusof, 2013) [6]. As indicated by Tyson (1986), BI concentrates on gathering, process and present information concerning customers, contenders, the business sectors, technology, and products. Pirttimäki (2007) depicts BI as a procedure that incorporates a series of activities, being driven by the particular data needs of decision makers and the objective of achieving competitive advantage.

Methodology
The methodology used for creating a dashboard and performing calculations, the relevance of power query and Dax formulas for the purposes of data analysis using Power BI tool.

Data Acquisition
Power Query is a data connectivity and transformation tool in Power BI. It allows you to connect to various data sources, including databases, spreadsheets, cloud services, and web APIs. Power Query provides an intuitive interface to import, clean, and shape data before loading it into Power BI for further analysis (Monal D. Jadhav et al., 2022) [23].

Data Transformation
Power Query's data transformation capabilities enable you to cleanse, reshape, and aggregate data. You can perform tasks like data type conversion, splitting columns, removing duplicates, and handling missing values.

Data Modeling
In addition to data transformation, Power Query allows researcher to create relationships between tables and define calculated columns. These calculated columns can be used to derive new information or perform calculations based on existing data. Data Analysis Expressions (DAX) is a language used in Power BI for creating custom calculations and aggregations.

Visualization Design
Power BI offers a wide range of visualizations, including charts, graphs, maps, tables, and custom visuals. These visualizations can be added to a dashboard canvas, where from researcher can arrange and format them based on your design preferences.

Implementing results
DAX formulas are extensively used for implementing calculations in Power BI. By leveraging DAX functions, researcher can perform calculations such as sum, average, count, percentage, ranking, and time-based calculations. In Power BI, data analysis requires both Power Query and DAX. Power Query assists in the cleansing, structuring, and readiness for analysis of the data through data preparation and transformation.

Linking SQL to Power BI
This is crucial for leveraging the capabilities of both platforms and enabling effective data analysis and visualization. Here are some key reasons highlighting the importance of linking SQL to Power BI in our research. SQL is widely used for managing and storing data in any relational databases. By linking SQL to Power BI, researcher can establish a direct connection to SQL database, allowing researcher to access and analyze real-time data. Power BI provides powerful data transformation and modeling capabilities through its Power Query and DAX functionalities. By linking SQL to Power BI, researcher can use Power Query to shape and clean SQL data before loading it into Power BI. SQL databases are optimized for data storage and retrieval, making them well-suited for handling large datasets [4]. By linking SQL to Power BI, researcher can take advantage of SQL's performance benefits. SQL databases offer robust security features and data governance mechanisms. In this particular research, researcher use MySQL, Excel, and Power Bi as a tool for analysis and visualization. In this research snowflake schema is used [5].

Importance of facts and dimension table in Power BI
Facts Table: It Includes data that is numerical or quantifiable, also known as metrics or measures. It represents the main area of analysis and typically consists of transactional or event-based data. Quantitative data like sales figures, quantities, revenue, costs, or any other measurable data points are stored in facts tables.

Dimension tables: Dimensional tables offer descriptors or attributes that give the facts table context. They include quantitative or qualitative data. Product, customer, time, location, or any other pertinent dimension in the data are just a few examples of the attributes or characteristics included in dimension tables.

Importance of creating key measures in power bi:
By creating Key Measures, researcher can track and analyze crucial metrics, standardize reporting, enable comparative analysis, use visualizations, ensure flexibility, improve

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4 https://docs.devart.com/odbc/sqlserver/powerbi.htm last visited on 15/6/2023
5 https://www.biinsight.com/azure-sql-data-warehouse-and-power-bi/ last visited on 15/6/2023

performance, and carry out intricate calculations by creating key measures in Power BI.

Integration of dashboard to different pages in Power bi
The integration of dashboards into different pages in Power BI enhances data storytelling, organizes data logically, enables targeted analysis, provides enhanced interactivity, improves performance, allows for customized reporting, and streamlines collaboration. This integration empowers researchers to effectively analyze and present data, leading to better insights and informed decision-making.

Finance View
- **Revenue:** Calculating total revenue is essential for assessing the financial performance of an organisation. It involves summing up the sales or revenue generated from different products, services, or business units.
- **Gross Profit:** Gross profit is calculated by subtracting the cost of goods sold (COGS) from total revenue. It represents the profitability of a company's core operations before considering other expenses.
- Gross Margin: Gross margin is the percentage of gross profit relative to total revenue. It indicates the profitability of each dollar of sales and helps evaluate the company's pricing strategy and cost structure.
- Net Income: Net income represents the company's overall profitability after accounting for all expenses, including operating expenses, interest, and taxes. It is calculated by subtracting interest, taxes, and other non-operating expenses from operating income.

Marketing view
The marketing view in Power BI is crucial because it enables marketers to assess the success of their marketing initiatives. Marketing professionals can learn important information about the financial performance and profitability of their marketing activities by performing calculations such as net sales, gross margin, net profit, and net profit percentage.
Net Sales: Figuring out net sales gives marketers a clear understanding of the income produced by their marketing initiatives or campaigns. It accounts for any returns, discounts, or deductions and provides a true picture of the actual sales made.
Gross Margin: After removing the direct costs related to production or delivery, the gross margin is an important financial indicator that shows the profitability of each good or service offered. Marketers can assess the effectiveness of their price plans, cost control, and production procedures by measuring gross margin. It assists in locating places where changes can be made to raise profitability.
Net Profit: The overall profitability of a marketing campaign or the marketing function as a whole is represented by net profit. It subtracts from the revenue generated all costs, such as marketing charges, overhead, and other operating costs. Marketers can evaluate the financial sustainability and return on investment of their marketing efforts by calculating net profit.
Net Profit Percentage: The ratio of net profit to net sales, stated as a percentage, is known as net profit percentage. It gauges how profitable marketing initiatives are in relation to the money they bring in. A larger net profit margin denotes a more effective and successful marketing approach. Monitoring this measure over time enables marketers to

assess the success of their marketing initiatives and to allocate resources and set budgets intelligently.

Supply-chain View
This supply chain view is very important since it gives businesses the ability to examine and improve their supply chain processes. The performance of the supply chain can be evaluated and improved using key performance indicators (KPIs) like forecast accuracy, net error, and absolute error. Here is a list of their main points.

Forecast Accuracy
How closely the actual demand matches the researched demand is measured by a KPI called forecast accuracy. It offers information on how accurately demand forecasting works, which is important for efficient supply chain planning and inventory control. Organizations can determine areas where their research are accurate or need improvement by calculating forecast accuracy.

Net Error
A KPI that accounts for both overestimation and underestimation, net error measures the discrepancy between actual and expected demand. In the forecasting process, it represents the general bias or systematic mistake. Organizations can make the required adjustments and improve their forecasting models by understanding the direction and magnitude of the forecasting mistake through the calculation of net error. This KPI helps to reduce expensive inventory discrepancies and increase the precision of supply chain planning. Absolute error is a KPI that assesses the magnitude of the discrepancy between actual and anticipated demand. Absolute error sheds light on total forecasting accuracy and enables businesses to assess the effects of forecasting errors on the efficiency of their supply chains.

Results and Analysis
The results can be classified into four categories among different years namely 2018, 2019, 2020, 2021 & 2022. Moreover, the research also highlights region-wise and product-wise findings over different years for overall evaluation of organizational performance. In this research four regions are covered namely a) Asia Pacific and Asian countries (APAC) b) European countries (EU) c) Latin American countries (LATAM) and d) North American countries (NA). 2018 is considered as a base year as the company start its operation from year 2017 onwards.

Section A
Analysis of financial View

Table 1: Financial Performance

Year	Net sales In Millions & Billons	Gross Margin%
2018	$29.11M	37.43%
2019	$111.37M	41.20%
2020	$267.98M	37.10%
2021	$823.85M	36.49%
2022	$3.74 BN	38.08%

Source: author's calculation from company's financial statement

From table 1 it can be seen that from the year 2020 onwards percentage of Gross Margin has declined despite the Net Sales is increasing over the years. In the year 2020 the Net sales increased but the company suffer a huge loss. This loss is accounted for the pandemic situation that started from 2020 onwards. The highest profitable region in the year 2022 is Asia Pacific and Asian countries (APAC) region and the highest-profit earning country was India. In India, highest sold segment was the notebook and gaming laptops contributing a total profit of $619.25 million which was achieved during year 2022 (Ref Figure 1).
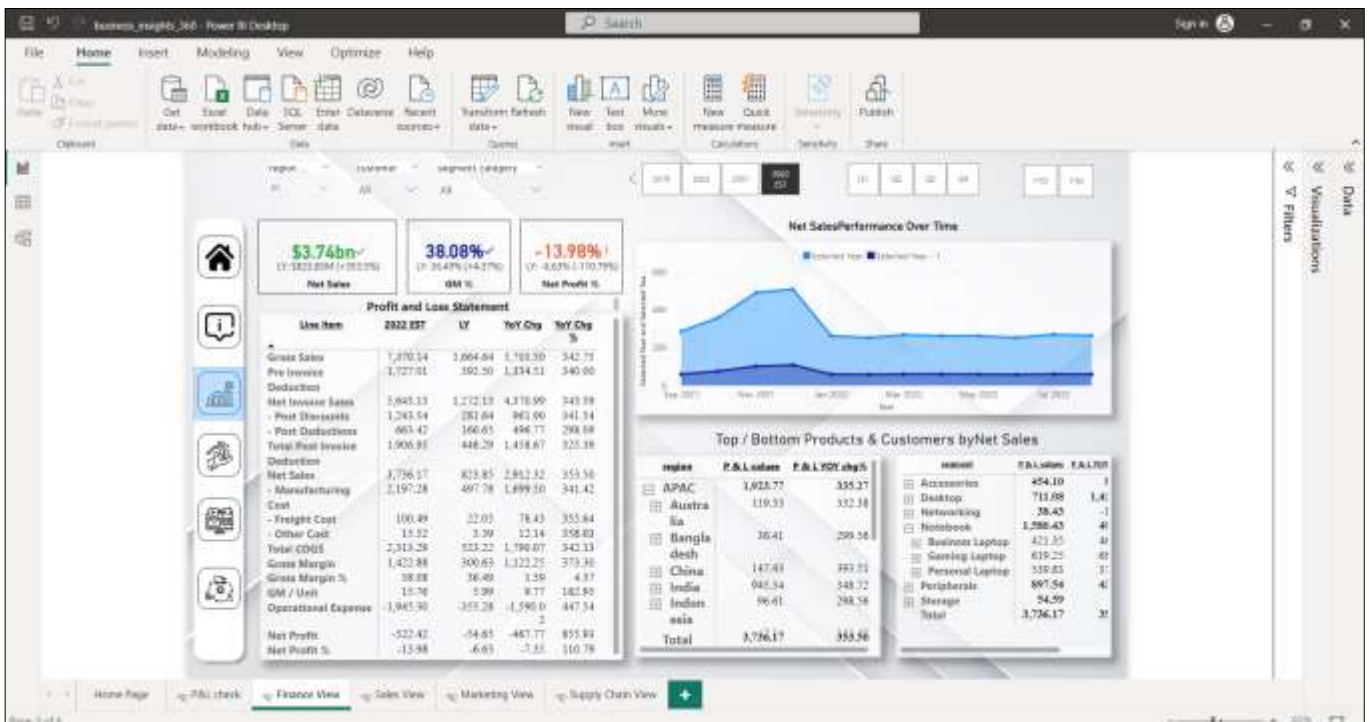

Fig 1: The financial view on the dashboard

Section B
Analysis of Sales View

From sales view sales performance, areas for development of future sales, maximize revenue performance and sales effectiveness etc. are being analyzed through Power BI tools. Among all the regions India and USA are the largest consumer segment for selling different types of products of Atlique hardware. The method used to represent sales performance data is called a scatterplot. The scatter plot functionality in Power BI allows researcher to visually explore and analyze the correlation or pattern between two numerical variables. It helps in identifying trends, outliers, clusters, or any relationship between the variables. The sales view shows customer performances in different regions and product segments along with budget spent on different costs and placement of goods (Ref Figure 2).
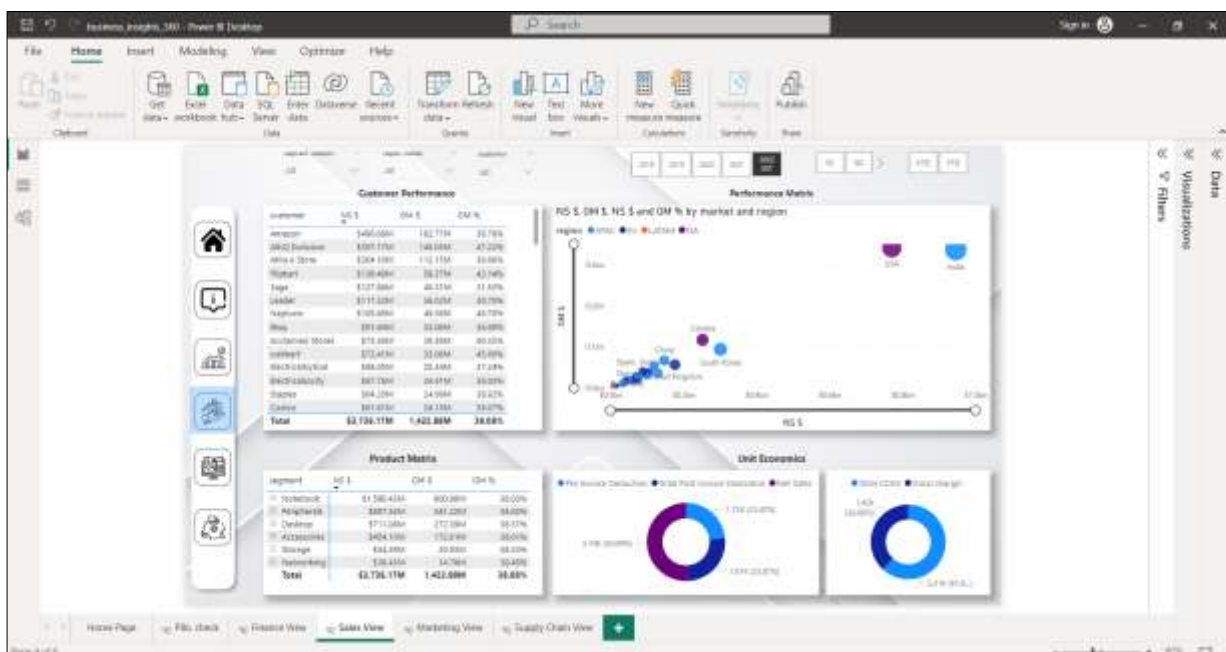

Fig 2: The financial view on the dashboard

Section C
Analysis of Supply Chain View
This supply chain view is very important since it gives businesses the ability to examine and improve their supply chain processes. The performance of the supply chain can be evaluated and improved using key performance indicators (KPIs) like forecast accuracy, net error, and absolute error. Here is a list of major thrust points: The calculation of

forecast accuracy can be done using various formulas. One commonly used formula is the Mean Absolute Percentage Error (MAPE). The MAPE formula calculates the average percentage difference between the actual values and the forecasted values. MAPE = (1/n) * Σ(|(Actual - Forecast)/Actual|) * 100, Where: n=represents the number of data points or observations, Actual is the actual value, and Forecast is the forecasted value (Ref Figure 3).

Fig 3: MAPE view on the dashboard

The formula has been designed in such a way that whenever any key matrices are selected it will change accordingly to it.

Table 2: Forecast Accuracy

Measures	2018	2019	2020	2021	2022 Predicted Year
Forecast accuracy	80.31%	86.45%	72.99%	80.21%	81.17%
Net Error	NA	637.48K	491.6k	-751.7k	3472.69k
Absolute Error	813.7k	1547.78K	5743.2k	9780.74k	-6899.04k

Source: Author's calculation based on company's data.

The forecast accuracy can be seen as 81.17% (Ref Table 2). Power bi calculates only 4 months of accuracy based on the algorithm. This measure can be increased by achieving more data on the target. And also, the model can predict remaining quarters based on the past 4-month quarters.

Policy Prescription
By implementing these policy prescriptions based on the SWOT analysis and BCG Matrix, the Atliq company can enhance its competitive position, optimize performance in different regions, and work towards sustainable growth and profitability [6].

SWOT Analysis of Atliq for Indian Market:
Strengths: Major strength area of the organization are Strong brand reputation and recognition. Diversified product portfolio. Skilled and experienced workforce. Established distribution channels. Access to advanced technology and resources.

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6   https://www.bcg.com/about/overview/our-history/growth-share-matrix visited on 14/6/2023

Weaknesses: Major weakness area are Lack of market penetration in specific regions. Limited understanding of local market dynamics. Ineffective marketing and promotional strategies. Inadequate customer support and after-sales services.

Opportunities: Major opportunities are growing consumer demand for the company's product range. emerging markets with untapped potential. potential for strategic partnerships and collaborations. adoption of innovative marketing and sales techniques. expansion into new product categories or market segments.

Threats: Major threat area are intense competition from local and global competitors. economic instability and market fluctuations. regulatory and legal challenges in different regions. shifting consumer preferences and trends. And potential supply chain disruptions.

BCG Matrix Analysis of Atliq for Indian Market
Based on the BCG Matrix analysis, the company can categorize its business units (regions) into four quadrants:
Star: Regions with high market share and high growth potential. These regions should be prioritized for investment and expansion to maintain and enhance their dominant market position. Strategies could include aggressive marketing, product innovation, and strengthening distribution networks.
Altiq's online retail platform can be categorized as a "Star" in the BCG Matrix. With a significant market share and robust growth potential, the online platform has emerged as a dominant player in the Indian e-commerce space. It benefits from the growing trend of online shopping and the increasing digital adoption among consumers. Product Segments such as Notebooks, Desktop and peripherals are the highest sold segment in India across the years

Question Mark: Regions with low market share but high growth potential. These regions require careful assessment and investment decisions. Strategies may include market research to understand customer needs, targeted marketing campaigns, and strategic alliances to gain market share.

Atliq's computer appliances division, including products like accessories, & storage, can be considered as "Question Marks." While these products have a relatively low market share, they operate in a high-growth segment. The division has the potential to capture a larger market share by focusing on product innovation, aggressive marketing campaigns, and expanding distribution channels.

Cash Cow: Regions with high market share but low growth rates. While these regions generate stable revenue, they require efficient cost management to maximize profitability. Strategies should focus on optimizing operations, streamlining processes, and exploring cost-saving measures. Chroma's consumer electronics retail stores can be classified as "Cash Cows" in the BCG Matrix. These physical stores have a strong market share and generate stable revenue. However, the growth rate in this segment may be slower due to market saturation and increased competition. Atliq should focus on efficient cost management, optimizing store operations, and enhancing customer experience to maximize profitability.

Dog: These regions may have limited potential for profitability. Strategies may involve reevaluating market viability, considering exit or divestment options, or implementing turnaround plans to improve performance. Atliq's IT products, such as Networking segments and computer peripherals, can be considered as "Dogs" in the BCG Matrix. This division operates in a highly competitive market with a low market share and limited growth potential. Atliq should carefully evaluate the viability of this division and consider strategic decisions such as product diversification, partnerships, or exit strategies.

Policies recommendation

Based on evaluation of SWOT and BCG Matrix the following policy prescription are very much essential. These are to preserve its leadership position and take advantage of the developing e-commerce market, Atliq should keep investing in technological developments, improving the user experience, and expanding the product offering for the online retail platform (Stars). Atliq should concentrate on product innovation, market analysis, and aggressive marketing strategies for the computer appliances business (Question Marks) in order to develop market share and take advantage of the significant growth potential. Atliq should give operational effectiveness, cost optimization, and customer-centric initiatives a priority for the retail outlets selling consumer electronics (Cash Cows) in order to maximize profitability in the established market and pull other segments in the high net sales and high gross margin quadrant.

Limitation of power BI in forecasting

Power BI offers basic forecasting methods such as linear regression and exponential smoothing. While these methods are useful for simple forecasts, they may not capture complex patterns or account for external factors that can impact the forecast accuracy. It may not offer more advanced forecasting techniques such as ARIMA, SARIMA, or machine learning algorithms. These techniques are often required for more accurate and sophisticated forecasts that account for seasonality, trends, and other complex patterns in the data. Moreover, it's forecasting heavily relies on historical data to predict future trends. If the historical data is incomplete, inconsistent, or does not adequately capture changes in the business environment, it can result in less reliable forecasts.

Conclusion

Last but not least, the Power BI dashboard offers a potent tool for data analysis and visualization, allowing businesses to gather insightful information and make wise choices. Power BI can be incredibly useful in a loss-making firm to grasp the fundamental causes of financial difficulties and pinpoint opportunities for development. Key performance indicators, financial data, and trends may all be tracked more easily thanks to the usage of Power BI, which enables the production of interactive and dynamic visualizations. Power BI assists in locating trends, correlations, and potential root causes of the loss by examining many aspects of the business operations, including sales, finance, marketing, and supply chain. Power BI offers a thorough view of the business' performance by integrating many data sources, including financial data, customer data, and market data. This enables thorough analysis and the discovery of chances for revenue growth, cost savings, and operational efficiency.

For a business that is losing money, Power BI's forecasting skills are very useful. Power BI can forecast upcoming sales, expenses, and financial performance by using advanced analytics methods including linear regression, time series analysis, and predictive modeling. As a result, management is better equipped to take preventive actions, modify plans, and allocate resources wisely in order to stop the loss and increase profitability. Additionally, the Power BI dashboard's ability to dive down into particular areas, product categories, or customer groups offers a detailed perspective of the business' performance. This enables focused interventions and corrective measures and assists in identifying areas that are underperforming.

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