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How to enhance operational performance and customer loyalty using BI

solutions for SMEs? A case study

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DEDICATIONS

I would like to express my deepest gratitude to my friends and family for their unwavering support and encouragement throughout my academic journey. Their love and support has been the driving force behind my successes and I am eternally grateful for their presence in my life.

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Abstract

In this study, our objective was to determine a way to implement a Business Intelligence (BI) solution within a European Small and Medium-sized Enterprise (SME) with the aim of improving customer loyalty and elevating operational efficiency. Through a phased, iterative process, data was collected and analyzed from the company's data warehouse and an unsupervised clustering model was developed using RFM analysis to segment customers. Additionally, the Analytical Hierarchical Process (AHP) method was utilized to evaluate the relative importance of these fields. Furthermore, the customer lifetime value (CLV) was calculated for each segment to gain a deeper understanding of customers. By implementing affordable and relatively simple BI solutions, SMEs can easily integrate them into their existing IT systems and overcome technical obstacles.

Dans cette étude, notre objectif était de déterminer une méthode pour mettre en place une solution d'Intelligence d'Affaires (BI) au sein d'une entreprise de petite et moyenne taille (PME) européenne, dans le but d'améliorer la fidélité des clients et d'optimiser les performances opérationnelles. Au travers d'un processus itératif et en plusieurs étapes, des données ont été collectées et analysées à partir des données de l'entreprise et un modèle de regroupement non supervisé a été développé à l'aide de l'analyse RFM pour segmenter les clients. De plus, la méthode de Processus Hiérarchique Analytique (AHP) a été utilisée pour évaluer l'importance relative de ces champs. En outre, la valeur de la durée de vie du client (CLV) a été calculée pour chaque segment pour obtenir une meilleure compréhension des clients.

Research topic

Business Intelligence (BI) is a set of methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information for business purposes. The main aim of this research is to explore the potential of BI as a tool for enhancing operational performance and customer loyalty within organizations. Operational performance and customer loyalty are critical factors for organizational success and competitiveness, and BI can provide valuable insights and support for organizations in these areas.

The research will focus on identifying the specific ways in which BI can be used to improve operational performance and increase customer loyalty. To achieve this goal, the research will explore several sub-questions:

What are the key performance indicators that organizations can use to measure operational performance and customer loyalty, and how can BI be used to analyze and track these indicators? Organizations can use various performance indicators to measure their operational performance, such as productivity, efficiency, and quality. BI can provide support in this area by providing real-time data and advanced analytics that allow organizations to monitor and analyze these indicators. Additionally, BI can be used to track customer loyalty indicators such as customer satisfaction, retention, and loyalty.

What specific BI tools and techniques can organizations use to improve operational performance and increase customer loyalty? There are various BI tools and techniques that organizations can

use to improve operational performance and customer loyalty. For example, data visualization tools can be used to present data in an easy-to-understand format, allowing organizations to identify patterns and trends that can improve their operations. Predictive analytics can be used to forecast future trends and identify potential problems, allowing organizations to make proactive decisions. Additionally, organizations can use BI to segment their customers and target

Research Question

How to enhance operational performance and customer loyalty

using BI solutions? A case study.

Problem statement

 Despite the potential benefits of Business Intelligence (BI) for SMEs there is a lack of understanding of how BI can be specifically used to improve operational performance and increase customer loyalty. This research aims to address this gap in knowledge by exploring the specific ways in which BI can be used to improve operational performance and increase customer loyalty within organizations. The research will also identify the key performance indicators that small organizations can use to measure operational performance and customer loyalty and explore the potential benefits and challenges of implementing BI in these areas. The research will provide valuable insights and practical guidance for organizations looking to improve their operational performance and customer loyalty through the use of BI.

Introduction

Business intelligence (BI) is an important tool for organizations of all sizes, but it can be particularly valuable for startups. BI refers to the technologies, processes, and practices used to collect, integrate, analyze, and present data to help businesses make better decisions. By providing startups with access to real-time, actionable data, BI can help them gain a competitive advantage, identify new opportunities, and make more informed decisions.

One of the key benefits of BI for startups is that it can help them quickly identify and capitalize on new trends and opportunities in their market. By collecting and analyzing data from a variety of sources, startups can gain a deep understanding of their customers, competitors, and the wider market, and use this information to develop new products, enter new markets, and better serve their existing customers.

Another important benefit of BI for startups is that it can help them track their performance and identify areas for improvement. By using BI tools to monitor key performance metrics and track their progress over time, startups can identify areas where they are excelling and areas where they need to improve. This can help them make more informed decisions about how to allocate their resources and prioritize their efforts.

Finally, BI can help startups save time and money by automating many of the tedious and time-consuming tasks involved in data collection, analysis, and presentation. By using BI tools, startups can automate the process of collecting and organizing data from multiple sources, and quickly generate reports and visualizations that provide valuable insights into their business.

1.Business Intelligence systems

A business can enhance its decision-making processes by utilizing one or more types of business intelligence solutions. A business typically uses four main business intelligence systems, namely reporting, analysis, monitoring, and prediction tools (Sabanovic, 2008). The reporting intelligence business systems put a lot of effort into creating documents that provide useful information about what has occurred. These give the firms details on their operations over a specific time period. The intelligence business analysis systems offer details on the causes of events (Vesset & McDonough 2007).

Business Intelligence (BI) plays a crucial role in the business world by providing valuable insights through the analysis of data. As stated by Sabanovic (2008) and Sabanovic & Søilen (2012), the intelligence business analysis systems collect and analyze data before presenting it, making it easy for business leaders to understand and interpret it. This is important because providing data without analysis is not useful.

There are several tools commonly used in BI systems, including spreadsheet analysis, ad-hoc query, and visualization tools. Spreadsheet analysis tools, as noted by Vesset & McDonough (2007), analyze data that are contained in spreadsheets and help to evaluate the entire organization or a specific unit of performance. For example, spreadsheet analysis tools can be used to track the number of hours that employees have worked. Ad-hoc query tools, as described by Vesset & McDonough (2007), are software that allows companies to develop specific data queries, such as the creation of a query for the number of items that have been sold within a specific period. Visualization tools, as explained by Negash & Gray (2008), are software that

accept raw data and create visualizations that business leaders can read and understand. An example is a tool that can create a graph comparing methods by which customers have been contracted within a specific time frame.

Another type of BI systems is monitoring tools, which allow businesses to monitor information and data in real time. As stated by Sabanovic & Søilen (2012), tools under this form of BI systems include dashboards, key performance indicators, and business performance management. According to Eckerson (2010), dashboard tools provide a central location where actionable and useful metrics are contained and represented graphically, making it easy for users. Key performance indicators (KPIs), on the other hand, measure the performance of a specific project within a company, such as return on investment.
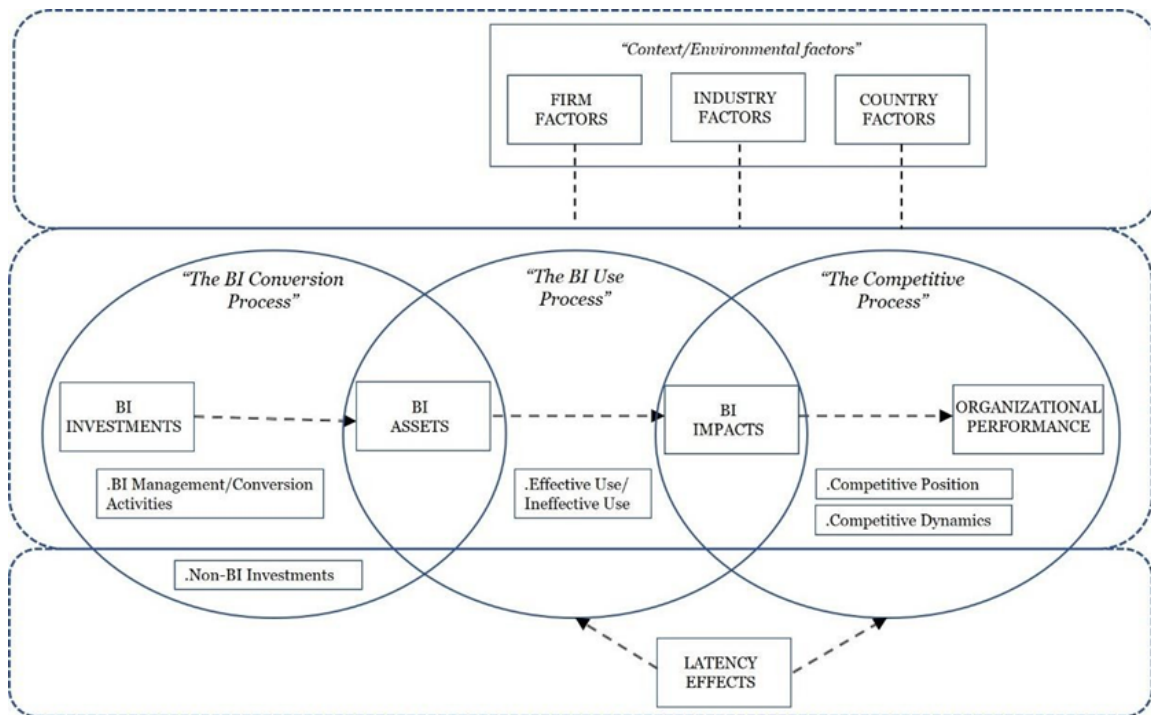

Figure 1. A Framework of How BI Creates Value (Trieu 2017)

Significance of the study

Moreover, this study is also important as it applies to a specific case study of a powerbank renting company. For example, the company could use BI to analyze customer data to identify patterns and trends in customer renting behaviors. This information could be used to improve operational performance by optimizing power bank inventory management and increasing efficiency in the powerbank distribution chain. Additionally, the company could use BI to track customer loyalty indicators and identify strategies for increasing customer loyalty, such as targeted marketing campaigns and personalized promotions. By implementing BI for operational performance and customer loyalty, the company could improve its competitiveness and profitability.

1.1 BI Components

One of the key components of BI is the Extract-Transform-Load (ETL) process, which is used to cleanse, transform, and restructure data. The data is then stored in a data warehouse or data mart, which are specialized databases designed for facilitating data analysis and knowledge discovery.

The data analyses are guided by the Key Performance Indicators (KPIs) of the organization. These KPIs vary from business to business, and they are used to measure the performance of the organization. After the data is analyzed, the results are presented to BI users using data visualization tools. These results can take the form of standard reports based on regular queries or on-demand reports that provide information about business performance and efficiency.

In summary, the key components of a BI solution include the ETL process, data warehouses or data marts, data analyses guided by KPIs, and data visualization tools for presenting the results of the data analyzes to BI users. Figure 2 can be used as an illustration to summarize these key components.
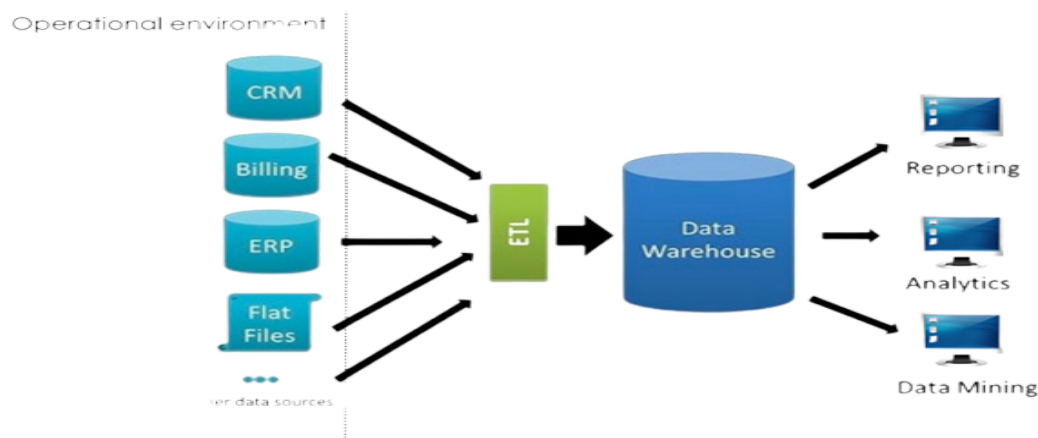
Figure 2 BI Components

1.2 BI Vendors

Business Intelligence (BI) solutions comprise multiple technological components that are used to collect, store, and analyze data. In the past, each BI component was built and delivered by specialized vendors, making it difficult for organizations to select the appropriate combination of components to meet their specific needs. This often required technical expertise that was not readily available in a business setting and also pushed up the overall implementation cost of a BI solution.

Nowadays, suppliers have developed BI components that can be easily integrated, which reduces the cost of implementation. However, there remains a need to identify a suitable strategy to integrate BI components with a company's existing systems. Some of the major players in the BI field are well-known names like Oracle, Microsoft, IBM, SAS, SAP, and Looker Studio (formerly Google Data Studio). In recent years, some smaller vendors like Qlik and Tableau have also gained popularity. Among the major suppliers of BI solutions, Microsoft, IBM, and Looker Studio offer BI products that cover the entire stack of BI components. Additionally, suppliers like Microsoft also deliver these BI components as part of their developer network license, at no extra cost.

1.3 BI Usage for SMEs

The implementation of Business Intelligence (BI) has become a common practice among large organizations, with many reporting a significant impact on profitability. However, adoption among small and medium-sized enterprises (SMEs) has been slower, as shown by McCabe's (2012) survey, which found that 33% of medium-sized companies were using BI solutions, with 28% planning to do so in the future. In contrast, only 16% of smaller organizations were using BI solutions and 16% planned to use them. Despite this slower adoption rate among SMEs, McCabe's (2012) survey indicates that there is an increasing awareness of the need for BI among these organizations.

Research by Horakova and Skalska (2013) also demonstrates that different departments and business units within a company make use of BI tools, with the major users being managers from sales, marketing, purchasing, finance, accounting, human resources and IT. This highlights that BI is not limited to top-level management and can benefit a wide range of business decision-making processes.

1.4 BI Solutions for SMEs

Small and medium-sized enterprises (SMEs) often adopt basic BI solutions that utilize spreadsheet software such as MS Excel in combination with a database, due to the cost and complexity of more advanced BI solutions (McCabe, 2012; Tutunea and Rus, 2012). However, these solutions lack the advanced data analysis and visualization tools that are necessary for effective knowledge discovery.

Another option for SMEs is to use Software as a Service (SaaS) BI solutions. This approach involves subscribing to a software application that is hosted in the cloud, rather than purchasing and installing it on a company's own servers. This allows companies to access and manage their data through an internet connection, with the service provider managing the data storage. A common use of SaaS BI is to provide insight into customer satisfaction for improved CRMs.

2. The role of BI in SMEs

Small and medium-sized enterprises (SMEs) play a significant role in the economy by creating jobs and driving innovation. However, when it comes to implementing Business Intelligence (BI) solutions, SMEs often face challenges such as limited resources and technical expertise. Furthermore, the cost and complexity of traditional BI solutions can be prohibitive for SMEs. Despite these challenges, many SMEs are recognizing the importance of BI in gaining a competitive edge and making data-driven decisions. As a result, there has been an upward trend in the adoption of BI solutions among SMEs, with more affordable options such as spreadsheet-based solutions and Software as a Service (SaaS) becoming increasingly popular. Despite facing unique challenges, the benefits of BI to SMEs can be significant, with the ability to analyze customer data, improve operational performance, and increase customer loyalty.

Furthermore, in today's dynamic business environment, competition is a major concern for small and medium-sized enterprises (SMEs). In order to effectively deal with competition, SMEs must be proactive and agile in their decision-making processes. One way in which SMEs can achieve this is through the adoption of competitive intelligence, a process of gathering information about competitors and using it to improve performance (Ponis & Christou, 2013). As a component of

business intelligence, competitive intelligence can provide SMEs with a competitive advantage. Furthermore, the use of business intelligence can aid SMEs in identifying and addressing competition challenges, ultimately helping them to navigate and succeed in a competitive market.

2.1 Challenges of BI adoption in SMEs

The adoption of Business Intelligence (BI) in small and medium-sized enterprises (SMEs) is a complex process that comes with a range of challenges. One of the main challenges is the cost of implementing a BI solution. SMEs often have limited budgets and resources, making it difficult for them to invest in expensive BI software and hardware. Additionally, the cost of maintaining and updating a BI system can also be prohibitive for SMEs.

1. Lack of technical expertise within SMEs. Implementing a BI solution requires a certain level of technical knowledge, and many SMEs may not have the in-house expertise to manage and maintain the system. This can lead to SMEs outsourcing the implementation and maintenance of the BI system, which can add to the overall cost of the project.

2. Data quality and availability. In order for a BI system to be effective, it needs to be fed with accurate and reliable data. However, many SMEs struggle with poor data quality and may not have the resources to cleanse and validate the data before it is fed into the system. This can lead to inaccurate or unreliable results, which can compromise the effectiveness of the BI system.

3. BI systems store and process large amounts of sensitive data, and SMEs may not have the necessary security measures in place to protect this data from unauthorized access or breaches. This can lead to data breaches and loss of sensitive information, which can have serious consequences for the SME.

4. Lastly, SMEs also face challenges when it comes to integrating BI with existing systems. Many SMEs may have existing systems that they rely on, and integrating a BI solution with these systems can be a complex and time-consuming process. This can lead to delays in implementation and may result in the BI system not being used to its full potential.

In conclusion, the issues can be boiled down to two basic causes: the expense involved and a lack of skill among the pool of available resources to manage complex BI tools. Even while these considerations are valid obstacles for SMEs to adopt BI solutions, they shouldn't work against SMEs' efforts to implement BI solutions. Finding affordable BI solutions is necessary to solve the budget problem. For instance, Microsoft's main product includes a typical BI solution. Companies owning an MSDN license can have access to Microsoft's Business Intelligence Solution for an SME: A Case Study 43 standard BI solution at no extra cost. Another alternative to traditional BI solutions is utilizing cloud-based platforms like Google Cloud Platform, which offers a comprehensive package of BI tools including data warehouses and dashboards. This type of platform often includes special pricing options for small and start-up businesses.

2.2 Advantage of early adoption of BI in SMEs

Adopting Business Intelligence (BI) early on in start-ups and small sized companies can provide a number of advantages. One major advantage is the ability to make more informed and data-driven decisions. By collecting and analyzing data, companies can gain valuable insights into their operations, customers and market trends. This can help them identify areas for improvement, make better predictions about future performance and ultimately make more strategic decisions.

Another advantage of early BI adoption is the ability to track Key Performance Indicators (KPIs) more effectively. By setting and monitoring specific metrics, companies can gain a clear understanding of how well they are performing in various areas and make adjustments as needed. This can help them identify bottlenecks and inefficiencies in their operations and make changes to improve performance.

Finally, BI can also help companies better understand their customers and their behavior. By analyzing data on customer demographics, buying habits and preferences, companies can develop more targeted marketing strategies and improve customer retention. By gathering insights on customer behavior, they can also identify areas where they can improve their products and services to better meet their customers' needs.

In summary, early adoption of BI in start-ups and small sized companies can provide a number of advantages such as improved decision making, better tracking of KPIs and deeper

understanding of customer behavior, thus enabling them to make more strategic decisions, optimize their operations and improve their overall performance

BI Solution	Advantages	Disadvantages
Cloud Computing	No need for implementing IT infrastructure. Cost effective as no technology equipment is required to buy and implement. Easy to access anywhere using the internet. No deployment needed. Support and maintenance plan available. Various features available.	Costly due to licensing, increasing storage, support and maintenance. Complexity of data protection, privacy. Loss of ownership over data. Security risk due to no ownership of data. Can be issued for large organizations with legacy systems.
Open Source	Editing and modification free of charge. Provides a certain level of support and help. Deployment of some commercial BIs such as Jasper, Panto, etc with a limited version is free.	Improvement required an IT experience. Configuration may take time as an organization's existing systems and needs.

SQL Server BI	Provide all BI services: Integration, Analytics, Data warehouse and Reporting.	Require a high level of knowledge and expertise.
	Integration from office applications is possible.	Compatibility issues with some systems.

Table 1 : Ayoubi, E., & Aljawarneh, S. (2018, October)

2.3 Impact of BIS on SMEs

According to a study by Gauzelin and Bentz (2017), the implementation of Business Intelligence Systems (BIS) in Small and Medium Enterprises (SMEs) has a significant impact on the operations of these companies. They found that BIS improves decision making at the managerial level by providing quality, timely, and accurate data. Furthermore, the deployment of BIS in SMEs has a positive effect on employees, customers, and other functions of the firm, as it leads to more efficient operations and an improved ability to meet customer needs. Additionally, BIS provides information on how to improve employees' individual performance through the necessary support and motivation, ultimately leading to improved company performance.
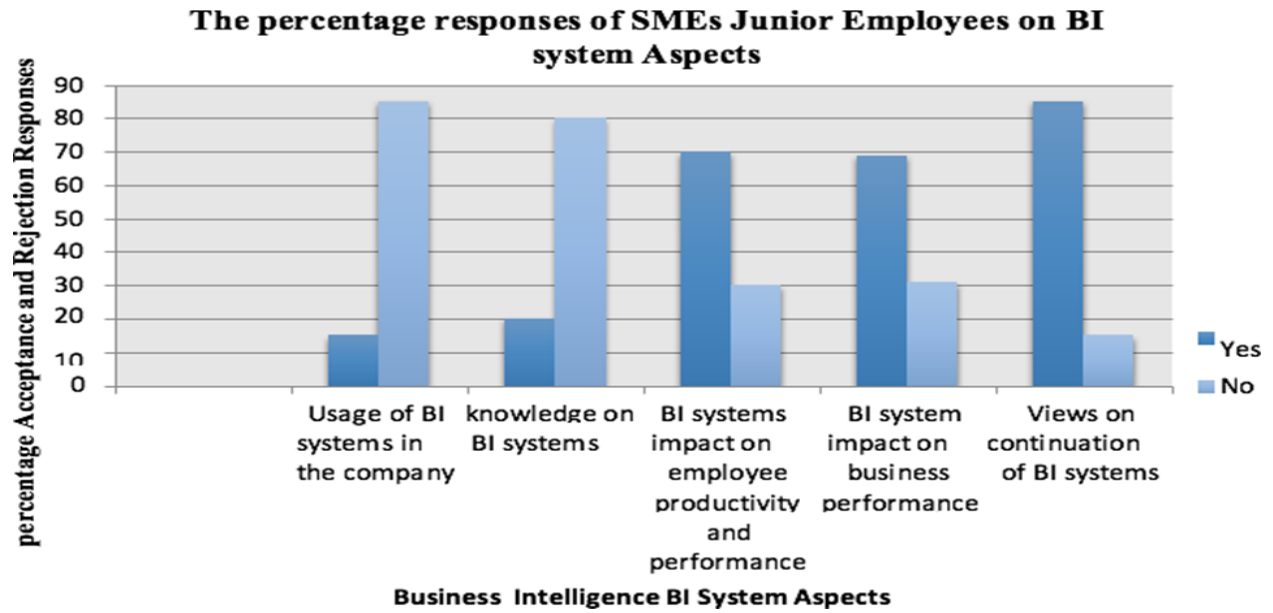
Figure 3 Gauzelin and Bentz (2017)

3. Drivers of Customer Loyalty

Business Intelligence (BI) plays a crucial role in driving customer loyalty by providing insights into customer behavior and preferences. This can be achieved through the collection and analysis of data on customer satisfaction, demographics, purchase history, and other relevant metrics (Parasuraman et al., 1988; Anderson and Sullivan, 1993; Andreassen and Lindestad, 1998a).

The marketing and service literature is rich with studies that have highlighted customer satisfaction as one of the key determinants of customer loyalty (Cronin, 2000; McDougall and Levesque, 2000; Chiou et al. 2002; Lin and Wang, 2006; Chi and Qu, 2008; Heskett and Sasser, 2010). Customer satisfaction is considered a strong predictor of behavioral variables such as customer loyalty, word of mouth, and repurchase intentions (Eggert and Ulaga, 2002). BI can help businesses identify patterns and trends in customer buying behaviors, allowing them to optimize inventory management, improve supply chain efficiency, and develop targeted marketing campaigns and personalized promotions that are more likely to drive customer loyalty.

By providing real-time monitoring of customer data, BI can help organizations identify and respond to changes in customer needs and preferences in a timely manner. For example, through the use of dashboards and key performance indicators (KPIs), businesses can track customer loyalty indicators, such as retention rates and repeat purchase rates, and make data-driven decisions to improve customer satisfaction. Additionally, the use of predictive modeling tools can help businesses anticipate future customer needs and preferences, enabling them to proactively adjust their strategies and offerings to better meet those needs.

In conclusion, BI plays a critical role in driving customer loyalty by providing organizations with the insights and tools they need to understand and respond to customer needs and preferences. By leveraging BI to analyze customer data, businesses can improve operational performance, develop more effective marketing strategies, and ultimately drive customer loyalty and retention.
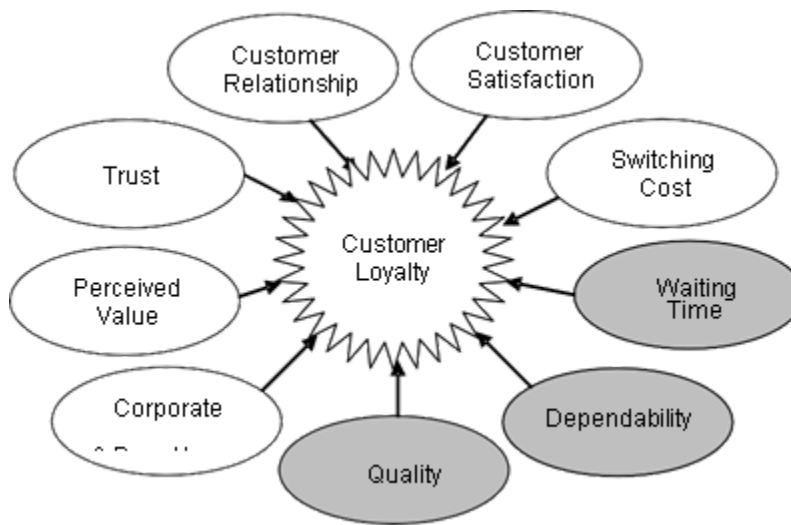

Figure 4 Kumar, V., Batista, L., & Maull, R. (2011)

The literature on organizational performance and its impact on customer loyalty has been extensively studied in recent years. Bielen and Demoulin (2007) found that waiting time has a significant influence on customer loyalty, particularly in service industries. They used "customer satisfaction with waiting time" as a construct to represent customers' post-experience evaluations related to cognitive and affective aspects of waiting. They found that long waiting times negatively affect customers' perceptions of service delivery, which in turn negatively impacts loyalty. Furthermore, reliability and dependability have also been identified as critical operations

elements in service quality studies (Zeithaml et al., 1990; Parasuraman, 1991; Heskett et al., 1994; Berry, 1995; Bloemer et al. 1999; Stank et al. 1999). Patterson and Marks (1992) and Lai and Yang (2009) also found a positive relationship between perceived dependability and user satisfaction. Studies have shown that various factors such as waiting time, reliability, and dependability are key drivers of customer loyalty as illustrated in Figure 1.

3.1 Customer lifetime value (CLV) and Customer Segmentation

Customer lifetime value (CLV) and customer segmentation are two important concepts that businesses can use to improve customer loyalty. CLV is a measure of the potential value that a customer will bring to a business over their lifetime. It is calculated by multiplying the customer's average purchase value by the number of purchases per year, and then multiplying that by the average customer lifespan. By understanding the CLV of their customers, businesses can identify which customers are most valuable to them and target their marketing and retention efforts towards those customers.

On the other hand, customer segmentation is the process of grouping customers into different segments based on their characteristics, behavior, and demographics. By segmenting customers, businesses can tailor their marketing and retention efforts to each segment, which can lead to improved customer loyalty. For example, if a business segments its customers based on their purchase history, it can identify which customers are most likely to make repeat purchases and target its retention efforts towards those customers.

One way that CLV and customer segmentation can be used together is through identifying high-value customer segments and then targeting retention efforts towards those segments. For example, a business may segment its customers based on their CLV and then target its retention efforts towards the segment of customers with the highest CLV. This could include offering personalized promotions and incentives, as well as providing excellent customer service to those high-value customers.

Another way that CLV and customer segmentation can be used together is through identifying low-value customer segments and then targeting marketing efforts towards converting those customers into high-value customers. For example, a business may segment its customers based on their CLV and then target its marketing efforts towards the segment of customers with the lowest CLV. This could include offering special discounts or promotions, as well as providing education and resources to help those customers understand the value of the business's products or services. (Khajvand, M., Zolfaghar, K., Ashoori, S., and Alizadeh, S. (2011)) demonstrated through a case study that by analyzing the CLV of segmented customer groups, they can improve their marketing strategies for each specific segment, which can have a positive impact on customer loyalty.

Overall, by understanding the CLV of their customers and segmenting them based on their characteristics, behavior, and demographics, businesses can improve their customer loyalty by targeting their retention and marketing efforts towards the most valuable customer segments. Studies such as (Gauzelin, S. and Bentz, H. (2017)) have also shown that businesses that adopt these strategies tend to perform better than those that do not.
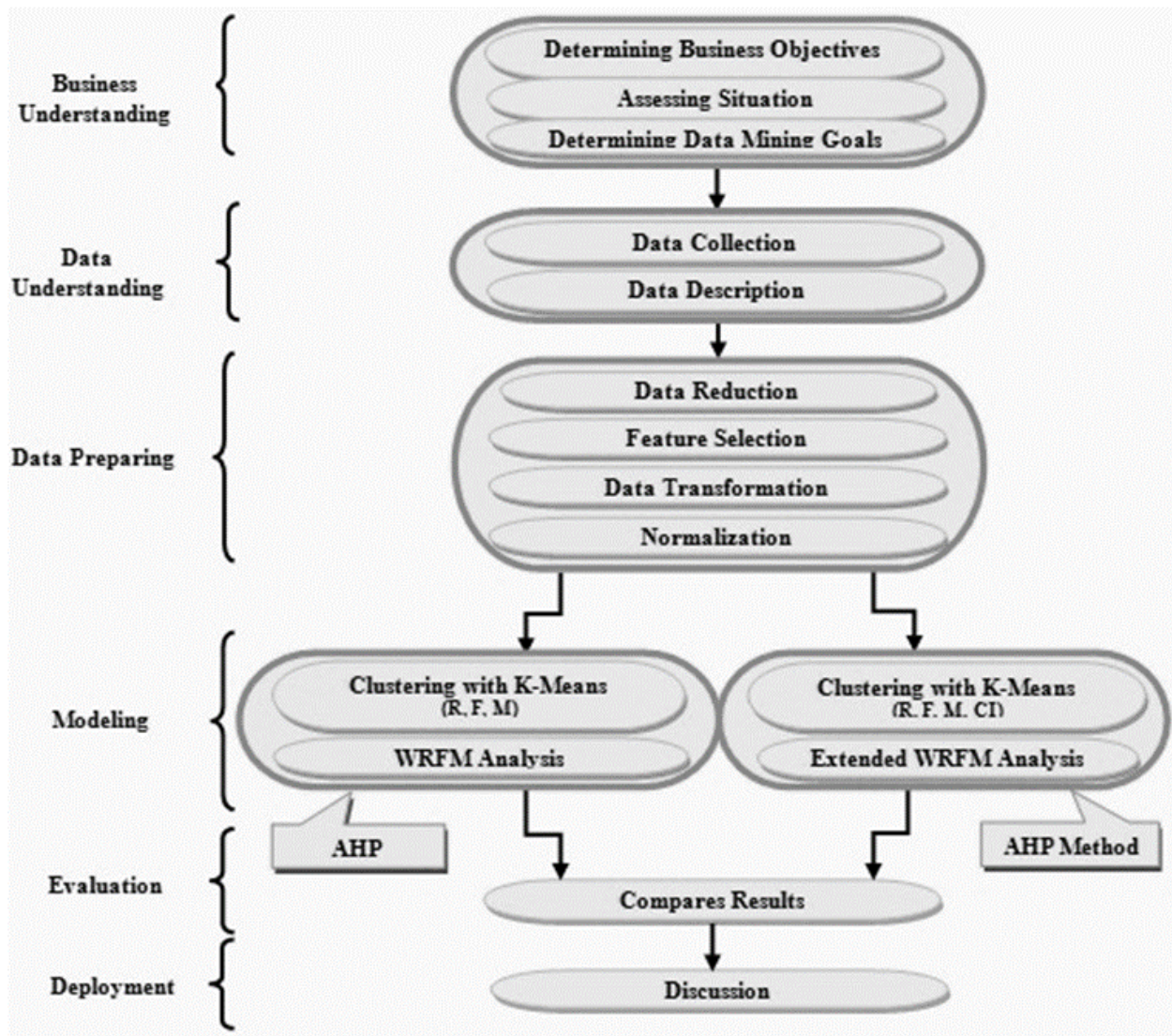
Figure 5 (Khajvand, M., Zolfaghar, K., Ashoori, S., and Alizadeh, S. (2011))

In their study, Khajvand et al. (2011) employed a combination of CLV and customer

segmentation analysis to improve their marketing strategies. The study utilized k-means

clustering techniques to segment customers and evaluate CLV for each segment. K-means is a

popular algorithm for clustering, which has been widely used in various fields such as data

mining, statistical data analysis and other business applications.

3.1.1 Types of Customer segmentation

There are many ways to segment customers, but here are the four main ones.
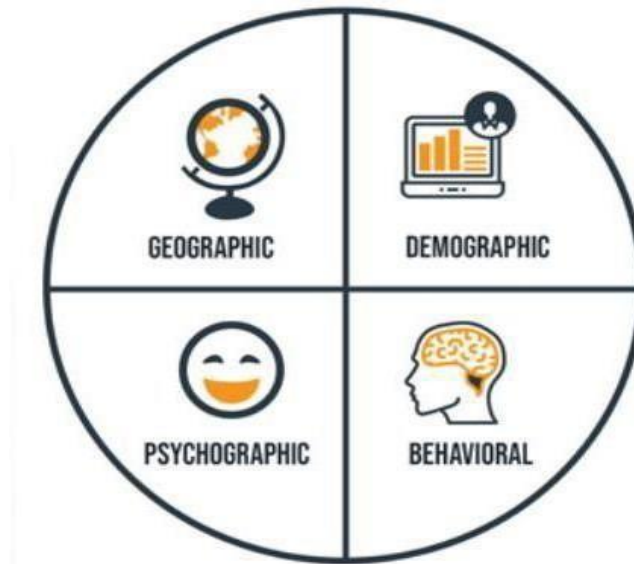

Figure 6 Types of Segmentation

Some other type of segmentation include :

1. **Value-based segmentation**: Customers are grouped according to their value. In this view, we are supposed to segment customers based on their financial attributes.

2. **Propensity-based segmentation**: customers are grouped according to propensity scores, such as churn scores, cross-sell scores, etc., which are estimated by respective (propensity) classification models.

3. **Loyalty segmentation**: includes studying the customer's loyalty status and identifying loyalty- based segments.

3.2 Unsupervised learning

Unsupervised learning is a method of machine learning in which models are not guided by a labeled dataset, but rather discover patterns within the data on their own. This process is similar to the way the human brain learns when presented with new information. In contrast to supervised learning, which utilizes input and output data for classification or regression, unsupervised learning aims to uncover the underlying structure of the data and group it into similar clusters, while also summarizing it in a concise manner. K-means is an example for an unsupervised learning model.

3.2.1 K-Means Classification

This method of grouping data utilizes a mathematical formula to separate a dataset into a specified number of clusters (K), based on the similarity of the data points within each group. The algorithm aims to create clusters that are as distinct as possible while still maintaining similarity within each cluster. The distance between each data point and the central point (centroid) of the cluster is calculated using the sum of squared distances. The centroid is determined by averaging all the data points in the cluster. The goal is to minimize variance within the clusters to ensure that the data points are as comparable as possible.
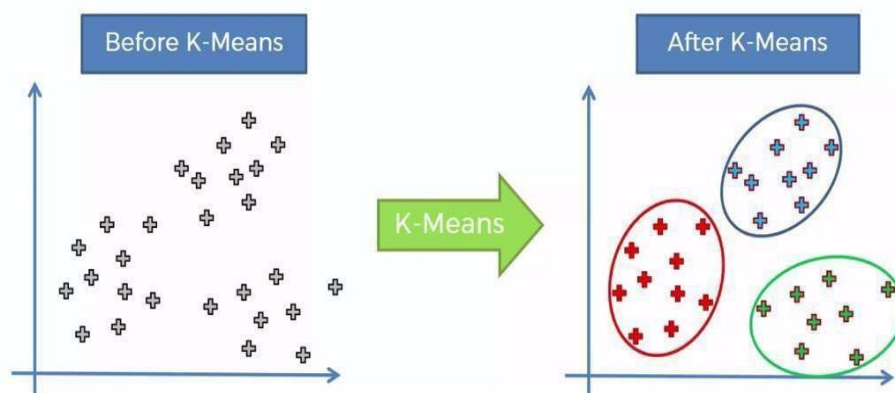
The K-means algorithm works as follows:

Figure 7 K-Means Cluster

- The K-means algorithm starts by randomly selecting the K number of data points as initial centroids.

- The distance between each data point and the centroid is calculated using a distance measure such as Euclidean distance.

- Each data point is then assigned to the cluster whose centroid it is closest to.

- The new centroids are calculated by taking the mean of all the data points in the cluster.

- The process of assignment and recalculation of centroids is repeated until the cluster assignments no longer change or a maximum number of iterations is reached.

- The final clusters and centroids represent the output of the K-means algorithm.

3.3 RFM Model

The RFM model is a customer value analysis method that was first proposed by Hughes in 1994 and has since become one of the most widely used methods in the industry. The model is based on the idea that customer value can be represented by three key variables: Recency, Frequency, and Monetary value.The advantage of the RFM model is that it allows for a more simplified analysis of customer value by using fewer criteria than other methods, which helps to reduce the complexity of the analysis. This makes it a popular choice for businesses looking to segment their customer base and make data-driven decisions about how to best serve and retain their customers.

The definitions of the RFM criteria are described as follows:

1. The recency variable, or R, measures the time elapsed since the customer's last purchase. This is considered a crucial factor as recent buyers are more likely to continue making purchases in the future.

2. The frequency variable, or F, evaluates the number of transactions made by the customer within a specific time frame. A higher frequency indicates a higher level of customer loyalty.

3. The monetary value variable, or M, measures the amount of money spent by the customer within a specific period of time. This criterion is also an important indicator of customer loyalty and potential value.

This approach allows for a more in-depth understanding of customer behavior and can aid in forecasting future behavior, which is essential for effective market segmentation. The main goal of RFM scoring is to provide a deeper understanding of customer value over time.
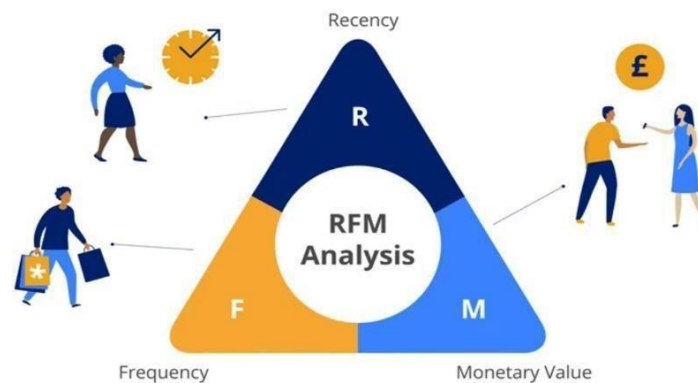

Figure 8 RFM Analysis

3.3.1 Weighted RFM model

Weighted RFM is a variation of the traditional RFM model, in which the importance or relative weight of each of the three criteria (Recency, Frequency, and Monetary) is assigned a different value. This allows for the customization of the model to better fit the specific needs of a company or industry. By assigning different weights to the criteria, companies can emphasize certain aspects of customer behavior that are more important to their business. For example, if a company values customer loyalty over monetary value, they can assign a higher weight to the frequency criteria. This customization allows for a more accurate representation of customer value and can lead to more effective marketing strategies.

3.4 Analytical hierarchical process (AHP):

In this study, a method called the analytical hierarchical process (AHP) is used to determine the relative importance of the RFM variables. Developed by Thomas L. Saaty in the 1970s, AHP is a useful tool for making decisions in complex situations where multiple variables or criteria are taken into consideration. It relies on the subjective experience and knowledge of the decision-makers to establish the priorities of the variables. Through a process of pairwise comparison, decision-makers assign values ranging from 1 to 9 to each variable, in relation to another variable, to determine the most important one. This is shown in Table 2.

Table 2: Levels of importance of variables

Level of importance	Description
1	Equally Important Preferred
2	Equally to Moderately Important Preferred
3	Moderately Important Preferred
4	Moderately to Strongly Important Preferred
5	Strongly Important Preferred
6	Strongly to Very Strongly Important Preferred
7	Very Strongly Important Preferred
8	Very Strongly to Extremely Important Preferred
9	Extremely Important Preferred

The three main steps of the Analytical Hierarchical Process (AHP) process are:

- Hierarchy development: The first step in the AHP process is the development of a hierarchical structure that represents the problem or decision at hand. This structure is composed of a goal, objectives and a set of criteria or alternatives.

- Pairwise comparison: The second step of the AHP process is to conduct pairwise comparisons between the elements of the hierarchy. This is done by comparing each element of the hierarchy with every other element in terms of relative importance or priority.

- Consistency and priority calculation: After the pairwise comparisons are made, the consistency ratio is calculated to check the consistency of the pairwise comparison judgments. The priorities of the elements of the hierarchy are then calculated based on the pairwise comparison judgments and their consistency ratio..

Table 3 : Example of the AHP Scale

Indicator	← →	Indicator
Recency	9 . 7 .5 . 3 . 1 . 3 . 5 . 7 . 9	Frequency
Monetary	9 . 7 .5 . 3 . 1 . 3 . 5 . 7 . 9	Frequency
Monetary	9 . 7 .5 . 3 . 1 . 3 . 5 . 7 . 9	Recency

To evaluate the results of the pairwise comparisons, consistency ratios are calculated to ensure

that the results are consistent and reliable. This can be done by comparing the consistency ratio to a predefined threshold value. If the ratio is below the threshold, the results are considered consistent and reliable, indicating that the pairwise comparisons were conducted effectively.

Calculating the ratio of CLV to CAC provides insight into the time frame required for a business to recoup its investment in acquiring a new customer. This ratio helps in evaluating the effectiveness of acquisition efforts and the overall financial performance of the business. Additionally, it highlights the importance of retaining and growing the value of existing customers, as opposed to solely focusing on acquiring new ones.

Figure 10 CLV formula

Average Purchase frequency =   No.of rentals / No. of unique customers

Average Customer Lifetime =   Sum of Customer's Lifespan / No. of unique customers.

Average Order value = Sum of revenue / No. of rentals

4. Theoretical framework

A theoretical framework for this study is built upon the existing literature on Business Intelligence (BI) and its relationship with customer loyalty. According to research by Parasuraman et al. (1988) and Anderson and Sullivan (1993), customer satisfaction is a key factor in determining customer loyalty. Additionally, studies have demonstrated that operational factors such as waiting time (Bielen & Demoulin, 2007) and reliability/dependability (Slack, 2004) have a significant impact on customer loyalty in service industries. These findings demonstrate that BI implementation in Small and Medium Enterprises (SMEs) can improve both operational performance and customer loyalty. The link between operational performance and customer loyalty is also highlighted in these studies.

Additionally, research on customer lifetime value (CLV) and customer segmentation has shown that by analyzing the CLV rank of segmented customer groups, refined marketing strategies can be developed for each segment (Khajvand et al., 2011)

In order to conduct this study, the k-means clustering method will be used for customer segmentation in order to assess CLV for each segment. K-means is a commonly used algorithm for clustering, and has been shown to be effective in various fields including data mining and business applications (Khajvand et al., 2011). This study will aim to investigate the impact of BI on customer loyalty by analyzing the relationship between CLV and customer segmentation in a specific industry or business setting.

In summary, the theoretical framework for this study is grounded in the literature on BI, customer satisfaction, operational factors and their impact on customer loyalty, as well as the application of CLV and customer segmentation analysis through a case study. The proposed methodology for this study will involve the use of the k-means clustering method to conduct customer segmentation and assess CLV in order to investigate the relationship between these factors and customer loyalty.

5. Research methodology

The methodology for implementing a BI solution varies depending on the size and IT budget of a company, as well as the company's level of expertise in the field. For larger organizations with a substantial budget, purchasing a comprehensive BI solution from a reputable vendor, including staff training and support, may be the best option. However, small and medium-sized enterprises may not have the resources to invest in such a solution.

This study suggests implementing a BI solution that constitutes of five stages as advocated by McGonagle (2007):

1. Planning

2. Data Collection

3. Data preparation

4. Modeling

5. Evaluation and deployment

The research will involve the collection of data from a power-bank renting company (Naki Power). Once the data has been collected, it will be cleaned and prepared for the next step, building the clusters. The developed clusters will be used to bridge the CRM system and the customer loyalty specific to the company needs.

Finally, the research will conclude with a discussion of the findings and recommendations for future research.

5.1 Planning

The case concerns a power-bank sharing company that employs a business model of renting power-banks to customers. The data extracted for the case consists of B2C business data from the company's data warehouse from July 2021 to July 2022 (1 year of data), all the selected customers in the sample are active and organizational customers.

The company uses Google Cloud platform to handle their cloud operations and hence, Google BigQuery Data warehouse. It allows users to easily import, export and query large datasets using SQL and provides various data visualization tools. BigQuery is a scalable, cost-effective and serverless solution for large-scale data analytics. It supports a wide range of data types and is widely used for data warehousing, business intelligence and machine learning applications.

It supports both star and snowflake schema. Star schema is a data modeling technique in which a central fact table is connected to multiple dimension tables through foreign keys. This design allows for easy aggregation and querying of data. On the other hand, snowflake schema is an extension of star schema where dimension tables are normalized to reduce data redundancy. In BigQuery, the use of star or snowflake schema allows for efficient querying and storage of large datasets.

The main goal is to segment customers based on their CLV and subsequently calculate the average CLV for each segment. By assigning a CLV rank to each segment, this study aims to provide guidance for formulating marketing strategies for the company.

5.2 Data collection

In this stage, we will focus on gathering and examining the relevant data that will be used for customer segmentation and determining CLV. This includes identifying and collecting data from various sources within the company, such as transactional data, and evaluating the quality of the data to ensure its suitability for the analysis.

The data used for this study comprises 165988 rows, representing battery rentals made by 111226 unique customers. The data was extracted from the company's data warehouse, and includes 51 fields.

5.3 Data Preparation

Data preparation is one of the most important and often time-consuming aspects of data mining projects. This phase involves four steps: Data reduction, feature selection, data transformation and normalization. Consistent with what was said in the planning phase, the data not relevant with the study is eliminated.

The primary focus of the analysis is on specific fields such as:

Table 4: Variables in the data set

Variable	Description
User_id	Unique customer identifier.
Rental_id	Unique identifier of the location.
Captured_amount	The amount that customers paid for the rental.
Created_at	Date the customer made a rental
Duration_trunc	The duration of the lease

In this study, the focus of customer segmentation is based on the customer lifetime value (CLV) and RFM methods. Therefore, the selected features for this analysis include the date of the customer's last purchase, the frequency of their purchases, the total amount of money spent by

the customer within a year, and the variety of products purchased by the customer. This final feature was chosen based on expert opinion. In the data transformation step, the data is modified so that it can be effectively used by data mining tools. The table below illustrates the transformed data.

Initial data	Transformed data
Last purchase date	Recency (type: number)
Count purchase	Frequency
Total money	Monetary: Total money/ count purchase

Table 5

Data normalization: The process of adjusting the data in order to bring all RFM values in the dataset to a common scale is known as data normalization. The Min-Max normalization method is used in this study to achieve this goal and increase the cohesion of the input types for easier analysis.

Normalization Formula

$$X_{normalized} = \frac{(X - X_{minimum})}{(X_{minimum} - X_{minimum})}$$

Figure 9 Normalization formula

Finally, the simple weighted sum of the normalized RFM values is used to obtain the CLV ranking, which allows for clear identification and comparison of customer segments.

5.4 Modeling

In this study, we will utilize a clustering method called K-means clustering, which is an unsupervised learning model, for customer segmentation. Two different approaches will be used for customer clustering. The first approach will involve using only RFM parameters for clustering, with K-means being the chosen method for customer segmentation. It is important to note that the number of clusters to be used in the K-means technique will be determined by the decision maker.

The Elbow method is used to determine the optimal number of clusters in k-means clustering. This method plots the value of the cost function produced by different values of k. As k increases, the average distortion will decrease and each cluster will have fewer instances and be closer to their respective centroids. However, the rate of improvement in average distortion will decrease as k increases. The value of k at which the rate of improvement slows down the most is referred to as the elbow, and is the point at which the clustering process should stop.
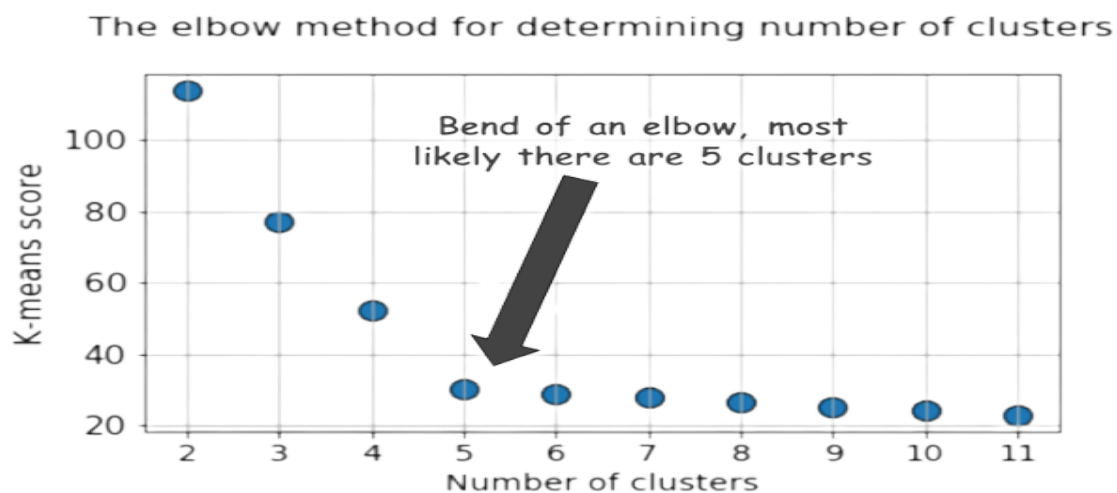

Figure 10 Example of an elbow method

Once the optimal k is decided, the model outputs k clusters, each cluster pertaining to a segment of customers.

5.5 Evaluation and deployment

Upon completion of the clustering process, distinct customer segments are identified, each corresponding to a specific cluster. These segments provide valuable insights into the rental behavior of customers, as determined through the RFM analysis.

By identifying specific customer segments through clustering, it is possible to develop tailored marketing strategies to target each segment with the aim of enhancing customer loyalty through retention.

Utilizing a CRM tool, such as Intercom, in conjunction with the customer segmentation results, allows for more efficient and targeted marketing efforts with the aim of enhancing customer loyalty through retention.

The evaluation phase assesses whether the proposed model meets the desired business objectives and determines its effectiveness. One of the primary objectives that can be achieved through this study is the development of effective marketing strategies. Based on the CLV rankings, various strategies can be formulated. These strategies should be developed by experts in the marketing department of the company. The implementation phase begins with the evaluation results and culminates in the implementation of the data mining results into the business operations. Further research can be conducted to determine the best ways to deploy the findings.

6. Results

6.1 Results of the RFM Analysis

Results of the RFM analysis

Recency (R) = Current date - Date of last customer rental

The lower the recency, the fresher the customer. Let's look at the distribution of customers according to recency.
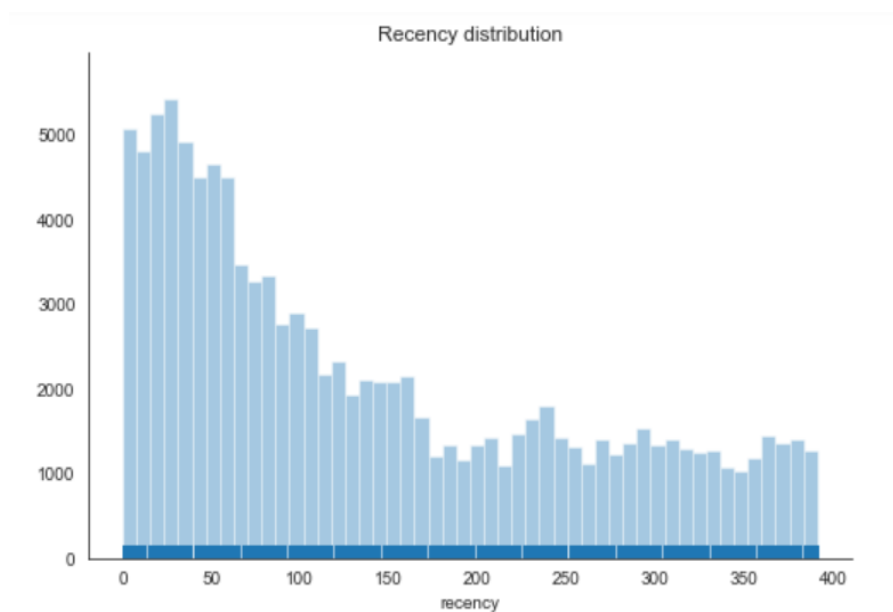

Figure 11 recency distribution

Here we can see that the histogram is skewed towards the left side and so this is a sign of a distribution that is a right angle distribution and also we can see that the rug plot is tight between 0 and 150. On this basis we can see that there is a high concentration of customers in the last 150 days, i.e. the last 4 months

Frequency (F): refers to the number of rentals in a given period.

$$\textbf{Fr}\acute{e}\textbf{quence} = \sum \textbf{\textit{Rentals}}$$

Let's look at the distribution of customers by frequency.
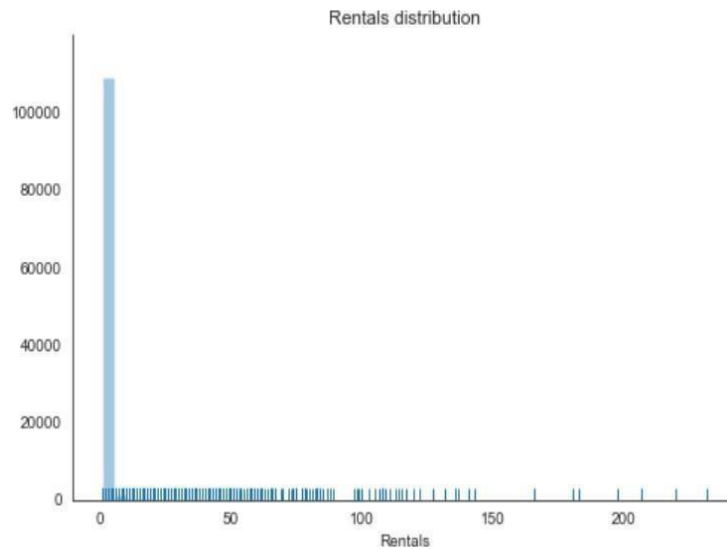
Figure 12 Rentals distribution

The results of this study suggest that the majority of customers only rent once. Therefore, it is crucial to prioritize high-value customers in order to retain them and prevent them from switching to competitors. Additionally, it is important to address any issues that may be causing infrequent renters to not utilize the company's services more frequently.

Monetary (M): is the total amount of money spent by the customer over the same period of time.

$$\textbf{Monetary} = \sum \textit{captured\_amount}$$

6.2 Segmenting Customers through RFM analysis

As mentioned above, first we have to identify the optimal K value for the given model, by using the elbow method. The results are as follows:
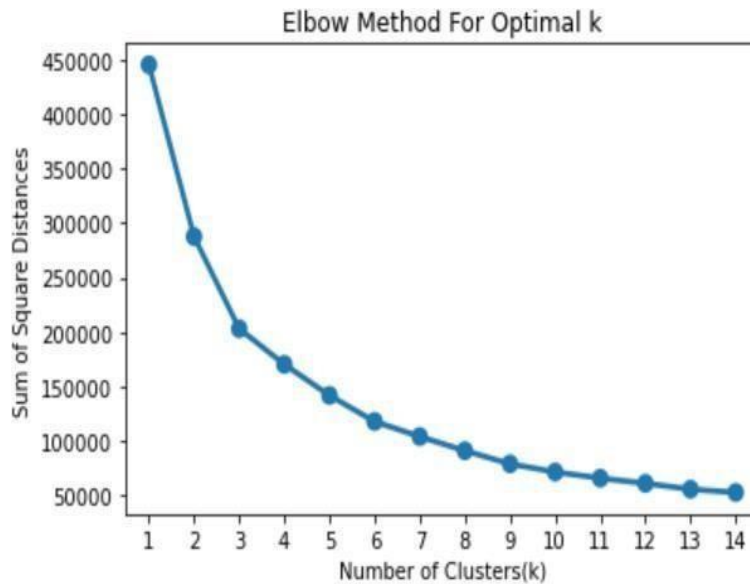
Figure 13 Elbow method results

As shown in the graph, the optimal number of clusters, as determined by the elbow method, is 3. However, for the purpose of this analysis and in line with the specific needs of the company, 5 clusters were chosen in order to provide a more detailed and tailored analysis.

The table below shows four clusters with their corresponding number of clients and the average recency, frequency and monetary values in each cluster.

Cluster	Rentals	Avg_rental_duration	recency	Monetary	R_rank_norm	F_rank_norm	M_rank_norm	RFM_Score	Users
0	1.446965	2.409805	36.365077	3.213187	80.171354	53.948033	68.938880	3.541770	37551
1	1.120220	1.843592	291.906063	1.232729	14.970405	47.198681	36.580010	1.421903	32607
2	1.121553	1.669827	113.418357	1.375046	49.945926	46.990007	41.893717	2.359602	39777
3	87.429907	5.255140	33.364486	70.235514	84.532710	99.924299	86.889720	4.447664	107
4	17.870777	12.129730	73.164696	23.985811	70.714949	95.229899	87.265034	4.049578	1184

Figure 14 Results of the cluster
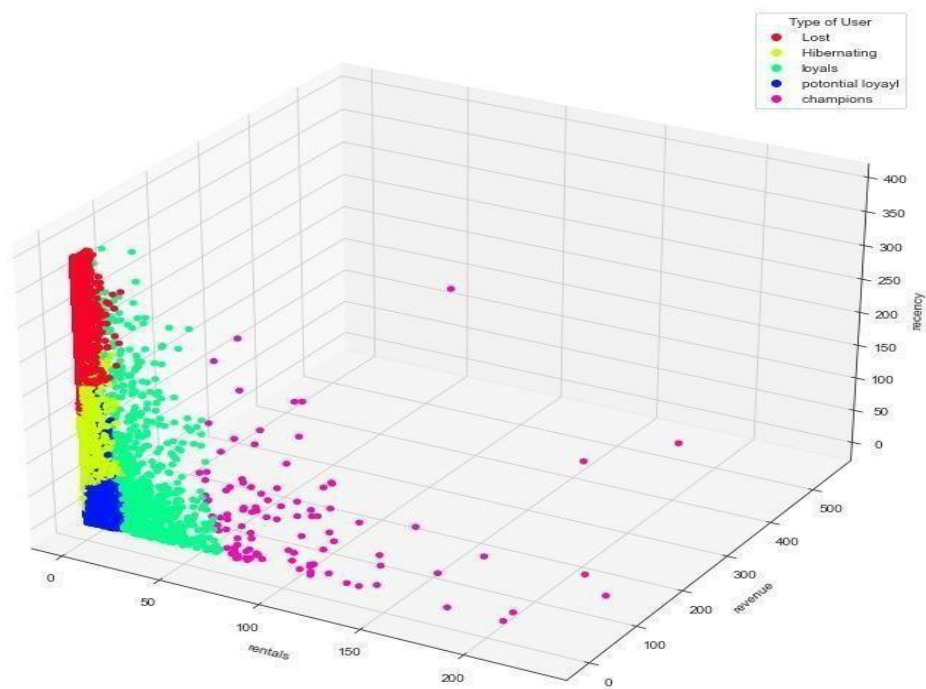
Figure 15 3D visualization of K means cluster

Definitions of the cluster :

Cluster 0: named as **Potential Loyal customers**

- Rented recently

- Total money spent although less, possibility of being a loyal customer.

Cluster 1: named as **Lost Customers**

- Last rental was approx 290 days ago (very long for this service)

- Relatively least money spent.

- Frequency is also observed to be low.

Cluster 2: named as **Hibernating customers**

- They haven't used the service for a while

- Few rentals

Will eventually become lost customers if appropriate action hasn't been taken.

Cluster 3: named as **Champions**

- Use the service most recently

- Use the service most often

- Spend the most

Cluster 4: named as **Loyal customers**

- Uses the service loyally.

- Spend as per their need and use the product for the highest duration..

It is important to note that the names assigned to each cluster should be adjusted by the marketing department of the company in order to align with the specific goals and objectives of the business. This will enable the development of targeted marketing strategies that are tailored to the unique needs of each segment.

Calculating CLV based on the formula mentioned previously,

Results :

Segments	CLV
Potential Loyal	0.09
Lost Customers	0.003
Hibernating	0.08
Champions	49.5
Loyal Customers	10.3

Table 6 CLV results

Each segment here specifies that the value of a customer of this segment is worth the amount mentioned in the table (calculated over a period of a year).

 Explanation of results:

Cluster	R	F	M	CLV rank
Potential Loyal	high	low	average	3
Lost Customers	low	low	low	5
Hibernating	average	low	low	4
Champions	high	high	high	1
Loyal Customers	high	average	high	2

Table 7 CLV rank

6.3 Benefits

Focusing on customer lifetime value (CLV) is an important aspect of any business strategy as it provides key insights into the long-term value of a customer to a company. Studies have shown that it can cost significantly more to acquire new customers than to retain existing ones. In fact, the cost of acquiring a new customer can range anywhere from 5 to 25 times more than retaining an existing customer. Additionally, the Pareto principle suggests that 80% of a company's profits will come from just 20% of its customers. This highlights the importance of understanding and maximizing the value of these loyal customers.

One of the key benefits of focusing on CLV is that it can help a business to prove its viability and sustainability. A high CLV indicates that the company's product or service resonates with customers and has a place in the market. This can be important when seeking investment or trying to convince stakeholders of the company's potential for growth. Additionally, understanding CLV can also help a company to get a clearer understanding of return on investment (ROI) for acquisition campaigns. When the long-term value of a customer is taken into account, the cost of acquiring that customer does not seem as high. On average, loyal customers are worth up to 10 times more than their first purchase and typically spend 33% more than new prospects. By understanding CLV, a company can better calculate the long-term revenue generated by its acquisition campaigns.

In summary, focusing on CLV is crucial for any business as it provides valuable insights into the long-term value of a customer and helps to inform decisions around customer acquisition, retention and marketing strategies.

Now that we know what CLV is and how it should be calculated, it's time to move on to the next step in the process: increasing customer lifetime value by implementing specialized marketing strategies.

Here are some examples:

1.   Offer a loyalty program to encourage repeat rentals.

2.   Create an "under-promise and over-deliver" policy - a strategy whereby service providers strive to deliver excellent customer service and satisfaction by going above and beyond what they have promised the customer or exceeding their expectations.

3.   Keep in touch with customers through registration letters and/or thank you letters.

4.   Send discount codes and other special offers.

5.   Use the funnel traffic from social media and create additional brand awareness.

Cluster	**Marketing Strategy**
Lost	Give them a reason to come back. Nothing entices people to rent like a good deal, so consider offering a special discount to inactive customers.
Hibernating	Use newsletters or messages to send a text or email promotion that says, "We miss you. Stop by this week to get 25% off your next rental."
Potential Loyal	Offer a referral program to improve net value and gain exposure to new prospects, who can then become loyal customers.

Loyal	Maintain relationships with these customers by offering them special deals. These offers can include cheaper or free rentals, early access to new services, etc.
Champions	Celebrate these customers by selecting the customer of the week or month and sending them emails or tagging them on social media.

Table 8 Marketing strategies

6.4 Discussion

In this section, we will summarize the implementation of the first iteration of a business intelligence (BI) solution within a European small and medium enterprise (SME). It is important to note that implementing a BI solution is an iterative process and requires a thorough understanding of the existing systems and the objectives and key performance indicators (KPIs) of the business. In addition, technical knowledge of BI concepts such as data warehousing, the extract, transform, load (ETL) process, and available data visualization tools is necessary.

In terms of implementation strategy, we have chosen to deliver BI in a top-down manner, with the first set of BI solutions rolled out to top-level managers. This approach allowed top-level management to better understand the benefits of BI and to be more supportive of a wider exploitation of BI within the company. To keep costs down and to make the solution more accessible to a wide range of end users, we have deliberately used only a limited set of BI tools.

One of the most popular and widely used BI tools is the Microsoft suite of BI tools, which can be used to support all aspects of business intelligence required in this project. Microsoft also provides tools for more advanced business data analysis such as creating data cubes and mining data for prediction analysis. Another popular option is the Google Cloud platform and its

BI tools, which offer a special package for start-up companies for a period of one year. The Google suite of BI tools, particularly Looker (Google Data Studio), can be easily used by most Excel users without much training, and there are several tutorials available to demonstrate how to use Looker and customer relationship management (CRM) tools like Intercom.

Our experience has shown that BI solutions empower SMEs to understand their current performance and evaluate it against the company's KPIs. While many SMEs understand the benefits of implementing BI solutions, they are often put off by the seemingly complex and expensive implementation process. Our experience has shown that affordable and relatively simple BI solutions exist and can easily fit into SMEs' existing IT solutions.

As BI solutions become more readily available, SMEs should possess a better understanding of their existing IT infrastructure before making any new investments. Implementing a BI solution involves various phases, and a good understanding of these phases is necessary for success.

In conclusion, implementing a BI solution can be a complex and challenging process, especially for small and medium-sized enterprises (SMEs) who often have limited IT budgets and expertise. However, by following a clear implementation strategy and making use of affordable and readily available BI tools, SMEs can overcome these barriers and reap the benefits of business intelligence. By understanding the company's objectives, KPIs and IT infrastructure, SMEs can select the appropriate BI tools and methodologies that best fit their needs. Furthermore, by utilizing data transformation and cleansing techniques, and designing data warehouses using dimensional modeling, SMEs can ensure that their data is high-quality and accurate. This will enable them to make data-driven decisions, improve their performance, and ultimately increase their competitiveness in the market. Additionally, government schemes such as funding and recruitment programs can also help SMEs to overcome technical barriers and

implement BI solutions. Overall, the implementation of a BI solution is a worthwhile investment for SMEs as it can provide them with a competitive edge and contribute to their long-term success.

7. Conclusion

In conclusion, the current study aimed to determine the impact of Business Intelligence (BI) on customer loyalty in Small and Medium Enterprises (SMEs) by utilizing the RFM model and K-means clustering method. The study first drew insights from existing literature on BI and customer loyalty, highlighting the prime determinant of customer loyalty being customer satisfaction as suggested by Parasuraman et al. (1988) and Anderson and Sullivan (1993). Furthermore, it was found that operational factors such as waiting time (Bielen & Demoulin, 2007) and reliability/dependability (Slack, 2004) also have a significant impact on customer loyalty in service industries.

The research methodology adopted an iterative, five-stage implementation process as advocated by McGonagle (2007), which includes Planning, Data Collection, Data Analysis, Data Distribution and Feedback. The data collected was then transformed and normalized using the Min-Max normalization method. The K-means clustering method was then employed to segment customers based on the RFM parameters of Recency, Frequency, and Monetary.

The Elbow method was used to determine the optimal number of clusters, and it was found that 5 clusters were the most suitable for the current study. Each cluster was then specific to a customer segment, giving insights into their rental behavior and providing a basis for deriving specific

marketing strategies to target them with the goal of increasing customer loyalty. The use of a CRM tool such as Intercom was also suggested to automate the process of targeting these customers.

The evaluation step assessed the extent to which the proposed model met business objectives, specifically in the development of marketing strategies. The study recommended that the cluster names be tailored by the marketing department of the company to align with their specific needs.

In addition, by measuring CLV against the cost of acquiring a customer (CAC), it was determined that it will take a certain amount of time to recoup the investment needed to gain a new customer, such as the cost of sales and marketing. It was also highlighted that customer acquisition is not cheap, and studies have shown that it costs more to acquire new customers than to retain existing ones. Therefore, by focusing on CLV, it can prove that a business is viable and sustainable and also give a clearer understanding of Return on Acquisition Spend (ROAS) on acquisition campaigns.

Overall, this study highlights the significance of BI implementation in SMEs and its impact on customer loyalty. The results of this study can be used as a guideline for making marketing strategies for companies and can be a valuable tool in determining customer value over time.

8. Literature Review

Title/author/Date	Data collection/methods (if any)	Relevance to research question	Analysis & Results	Conclusions
Title: Challenges and opportunities of adopting business intelligence in SMEs: collaborative model. In Proceedings of the First International Conference on Data Science, E-learning and Information Systems. **Author** : Ayoubi, E., & Aljawarneh, S. **Date** : October 2018	This paper doesn't include any data collection	This paper helped me understand the challenges SMEs could face in implementing BI solutions.	The proposed model suggests SMEs to use a shared BI application which will make the process of adopting BI easier and cost effective. The solution suggests multiple SMEs to use the same BI platform by using a shared data warehouse, which will allow them to overcome the cost problem	This paper concludes by suggesting a new method to implement BI solutions but not testing the solution and leaving it as future work..
Title : Business Intelligence Solution for an SME: A Case Study **Author**: Raghavendra Raj, Shun Ha Sylvia Wong and Anthony J. Beaumont **Date**: 2016	This paper collected data that was generated by an in-house field service management system of a UK based company called AGGORA	This paper exposed me to implement a research methodology of the data analysis part that helped me for my case study	This paper used the iterative, five-stage implementation process as advocated by McGonagle (2007) to implement a BI solution. This paper also used the transformations performed for an ETL process suggested by (Lacko, 2009):	With help of the case study, this paper explains the benefits of BI implementation, how an SME can reap the benefits of BI using the Microsoft BI suite: Microsoft SQL Server for data modeling and Power BI for data analysis and visualization.

Title : Estimating customer lifetime value based on RFM analysis of customer purchase behavior: Case study **Author** : Mahboubeh Khajvand,Kiyana Zolfaghar,SarahAshoori,Somayeh Alizadeh **Date :** 2011	The data from health and beauty company that manufactures shampoo, soaps and etc One year of data was extracted on purchase transactions, approximately 7,000 records, have been collected	The case study used an RFM analysis to identify purchasing behavior. The structure of this paper is based on CRISP methodology	This paper used a k-means clustering model to segment customers. Additionally, it used the AHP method to weigh the RFM variables to rank the CLV.	The paper used an RFM analysis to segment customers and calculate CLV. Clustering customers into different groups helps decision makers identify market segments more clearly and thus develop more effective marketing and sales strategies for customer retention.
Title : The Impact of Operations Performance on Customer Loyalty **Author**: Vikas Kumar, Luciano Batista and Roger Maull **Date**: September 2, 2010	The data in this study comprised monthly measurements of variables considered as proxies for demand, speed, quality, dependability, and customer loyalty in a four-year time frame, from 2003 to 2006, for the service of broadband installation to individual consumers.	This study developed the knowledge of drivers of customer loyalty which established the link between operational performance and customer loyalty.	Path Analysis was the main methodological framework used to depict the inter-relationships between the variables considered and, most importantly, to show the effect of the observed operations performance elements on customer loyalty.	The evidence provided by this study strongly points to the inter-relationship between three elements of operations performance: speed, dependability and quality.

Title : An examination of the impact of business intelligence systems on organizational decision making and performance: The case of France **Author** : Sophian Gauzelina and Hugo Bentza **Date**: 15 June 2017	The study started by recruiting 200 research participants who were categorized into SME managers and SME junior employees. The participants were drawn from 10 SMEs located in France. From each SME, 5 managers and 15 junior employees were randomly selected. A semi-structured interview that consisted of questions regarding various aspects of business intelligence was given to each participant	This study examined the implementation of Business Intelligence Systems (BIS) in Small and Medium-sized Enterprises (SMEs) and gathered perspectives from managers. The findings contributed to understanding how business performance can be improved through the implementation of BI solutions in SMEs through a result of semi-structured interviews.	This study was based on a qualitative descriptive approach. Semi-structured interviews were conducted on organizational members of SMEs to collect data on issues regarding BIS (Shields & Rangarjan, 2013). Emerging themes from these interviews are then discussed. The result of the study indicates that both the managers and junior employees of the SMEs interviewed are positive about the use of BIS in their companies.	The result of this study affirms that BIS has a far-reaching impact on the operations of SMEs. First, BIS facilitates the process of decision making at the managerial level by providing quality, timely and accurate data.

9. References

1. Ayoubi, E., & Aljawarneh, S. (2018, October). Challenges and opportunities of adopting business intelligence in SMEs: collaborative model. In Proceedings of the First International Conference on Data Science, E-learning and Information Systems

2. Kumar, V., Batista, L., & Maull, R. (2011). The impact of operations performance on customer loyalty. Service Science, 3(2), 158-171

3. Khajvand, M., Zolfaghar, K., Ashoori, S., & Alizadeh, S. (2011). Estimating customer lifetime value based on RFM analysis of customer purchase behavior: Case study. Procedia Computer Science, 3, 57-63.

4. Raj, R., Wong, S. H., & Beaumont, A. J. (2016). Business Intelligence Solution for an SME: A Case Study.

5. Gauzelin, S. and Bentz, H. (2017). An examination of the impact of business intelligence systems on organizational decision making and performance: The case of France.

6. Wu, Z., Zang, C., Wu, C., Deng, Z., Shao, X., & Liu, W. (2022). Improving Customer Value Index and Consumption Forecasts Using a Weighted RFM Model and Machine Learning Algorithms.

7. Trieu, V. H. (2017). Getting value from Business Intelligence systems: A review and research agenda. Decision Support Systems, 93, 111-124.

8. Llave, M. R., Hustad, E., & Olsen, D. H. (2018). Creating value from business intelligence and analytics in SMEs: Insights from experts.

10. Glossary of terms

Term	Definition
BI	Business Intelligence refers to the use of technology, processes and software to collect, integrate, analyze and present data in a way that helps business leaders make better decisions.
SMEs	Small and Medium-sized Enterprises are businesses that typically have fewer employees and less revenue than large corporations. They play a significant role in the global economy and are considered the backbone of many countries.
CRM	Customer Relationship Management is the process of managing interactions with customers and clients, including sales, marketing, and customer service. It helps businesses to build and maintain strong relationships with their customers.
CLV	Customer Lifetime Value is a prediction of the net profit attributed to the entire future relationship with a customer. It is used to determine the value of acquiring and retaining a customer.
KPIs	Key Performance Indicators are metrics used to measure and evaluate the success of an organization in achieving specific goals. They are used to track and monitor progress towards desired outcomes.
BIS	Business Intelligence Systems are systems designed to provide actionable insights and support decision-making in an organization. They are designed to process, analyze and present data in a meaningful way.
AHP	Analytical Hierarchy Process is a method for making decisions based on multiple criteria. It is used to determine the relative importance of different factors and to make trade-off decisions when there are conflicting goals.
RFM	Recency, Frequency, Monetary, is a customer segmentation technique used in marketing and e-commerce. It involves analyzing the recency, frequency and monetary value of customer transactions to identify and target the most valuable customers.
CAC	Customer Acquisition Cost is the cost of acquiring a new customer, including all expenses incurred in sales and marketing efforts. It is used to determine the efficiency of acquisition campaigns and to calculate the return on investment.