CHAPTER I INTRODUCTION

1. Introduction

In December 2019, an epidemic of unexplained pneumonia was discovered, and it was subsequently found that COVID-19, a new coronavirus that spreads swiftly, was to cause (WHO-b, 2020). The WHO declared a worldwide emergency on January 30, 2020, due to the severity of the situation (WHO-d, 2020). The global number of recorded cases rapidly increased, causing the WHO to proclaim the virus a Covid-19 pandemic on March 11, 2020. (WHO-c, 2020). The global number of reported cases and deaths continues to grow after more than six months. As of July 19, 2020, the WHO has verified 14,043,176 claims in 216 countries, with 597,583 fatalities (WHO-c, 2020).

The first instance of the COVID-19 virus was identified in Pakistan on February 26, 2020. Beginning on March 15, the number of new cases in the country began to rapidly increase due to an inflow of people returning from a pilgrimage in Iran across the Taftan Border. The unexpected implementation of a lockdown in Pakistan also contributed to the virus's spread. Many migrants returned home, causing overcrowding and making it more difficult to maintain social distancing precautions (World Bank, 2020b). Between March 15 and 25, 2020, the number of reported cases in Pakistan climbed from 53 to 1078. (DAWN, 2020). The number of cases has risen dramatically across the country. There have been 265,083 cases reported in Pakistan since about July 20, 2020, with 5599 fatalities reported (COVID-PAK, 2020). Most confirmed cases, 42.63 % (113,007), are in Sindh, with Punjab accounting for 34.02 % (90,191).

Pakistan's overall economic growth decreased to (-) 0.47% in 2019–20 after only 1.9% the year before, which was already dismal. Long-standing problems were made worse by COVID-19, particularly in the service sectors and industries. Due to the drop in import demand from Pakistan and the developing states, the textile sector, particularly the exporters, faced challenges. Numerous textile industry shipments were left on the ocean's surface and later returned because, during the Pandemic, no state wanted to import them until things were back to normal. Working capital management concerns in the workplace was also a worry for exporters. Moreover, small businesses, especially contract workers, have struggled as the power supplied dried up, leaving one another without commodities or necessary supplies (Finance-PAK, 2020).

A report from the Pakistan Bureau of Statistics examines the performance of Pakistan's textile industries before the epidemic (PBS-2019). According to the research, exports in Pakistan's textile industry increased steadily from 2016 to 2019, with an excellent performance in the first half of 2019. Domestic output also increased slightly throughout this period, with a 1.2 % in 2019 compared to the previous year. Besides a drop in 2020 due to the COVID-19 Pandemic, Pakistan's textile exports have improved. Textile exports in Pakistan climbed from $13.6 billion in 2015 to $17.2 billion in 2019, before decreasing to $14.5 billion in 2020, according to the Federal Bureau of Statistics.

Several studies look at the administration of large and small businesses during times of crisis. Due to their small size and limited resources, small and medium enterprises (SMEs) suffer more than large corporations, according to

the research (Eggers, 2020). He performed a scholarly review of 69 articles that looked at SMEs during previous crises and recommended ways to address economic barriers in the funding, strategy, and institutional environment. Another survey, done in August 2020, on over 2,200 SMEs from 5 European countries (France, Italy, Germany, Spain, and the UK), that most of the analyzed SMEs saw income declines. The reduction was around 30-33 % in Italy, the UK, and Spain., but significantly less in France and Germany, 27 % and 23 %, respectively (Dimson et al., 2020). According to Kalemli et al. (2020), a comprehensive study of 17 countries has estimated that the failure rate of small and medium enterprises (SMEs) has risen by nearly 9 % due to the ongoing Pandemic. Service industries such as hospitality, arts & entertainment, recreation, and education are among the hardest hit.

Abbas et al. (2013) outline the factors influencing a firm's financial performance—short-term leverage: using short-term debt to fund the firm's activities. High levels of short-term leverage might enhance the firm's risk of financial hardship since it may not have the means to pay off its obligations when they become due. Long-term leverage uses long-term debt, such as loans or bonds, to fund the firm's activities. High levels of long-term leverage might raise the firm's risk of financial hardship since it may not have the means to pay off its obligations in the long run. Growth refers to the rate at which a company expands and increases its sales and earnings. High evolution may favor financial performance since it suggests the organization is increasing and earning more money. The number of employees can determine a firm size, the value of assets, or the sales volume. Larger

businesses may be better able to create earnings and achieve financial success. Risk is the uncertainty and potential loss connected with the firm's activities. High levels of risk can have a detrimental influence on financial performance since the company may encounter unanticipated losses or issues. Taxation: The amount the business must pay can influence its financial performance. High tax rates can impair a company's profitability and financial performance. Tangibility: refers to the extent to which the firm's assets are physical rather than intangible (such as intellectual property or goodwill). Firms having a higher share of physical assets may be better able to create profits and achieve financial success. Liquidity: refers to the firm's capacity to satisfy its short-term commitments when they come due. High levels of liquidity can assist the company in avoiding financial difficulties and improving its financial performance. Non-debt Tax Shield: refers to the tax advantages that a company can obtain by employing specific financing methods, such as leasing or preferred stock, rather than borrowing. These tax breaks can help the company's bottom line.

Many ways to measure business success include; Revenue Growth: This is the most common way to measure business success, and it involves tracking the amount of money a business earns over a specific period. Customer Satisfaction: Happy customers are the lifeblood of any business, and measuring customer satisfaction through surveys and feedback can help a company improve its offerings and retain customers. Employee Satisfaction: Happy employees are more productive and motivated, which can lead to improved business performance. Measuring employee satisfaction through surveys and feedback can help a business

improve its work culture and retain talent. Profitability: Profitability measures the amount of money a company earns after all expenses are accounted for. This is a crucial measure of success, as it indicates whether a business is sustainable in the long run. Social Impact: Measuring a business's social impact involves assessing its contributions to society, such as through charitable donations, sustainability efforts, and community involvement. Personal Fulfillment: The owner's fulfillment is another way to measure success. Running a successful business can be personally fulfilling, and this can be measured through individual goals and achievements (Forbes, 2017).

1.2 Research Authenticity

Several previous studies examining differences in company financial performance in the crisis era are shown in Table 1.1.

Table 1. 1 Previous Studies

No	Author & Year	Research Objectives	Method	Findings
1	Kabir, M. R., & Bin Saleh, O. (2020).	This study aims to determine how the COVID-19 epidemic has influenced the FP of listed companies in Bangladesh.	Data: Chittagong Stock Exchange and the annual reports of the sample's listed companies. The sampling technique: The sample size of 142 pairs of sample companies listed on the CSE was determined using "Randomized Block Sampling." Data analysis: PS t-Test.	The results indicate that the influence of COVID-19 has affected various sectors such as cement, power and energy, textile, pharmaceuticals, and ICT, resulting in a significant decrease in their earnings. The banking sector has also experienced a revenue decline, although it is not statistically significant.

No	Author & Year	Research Objectives	Method	Findings
2	Devi, S., Warasniasih, N. M. S., Masdiantini, P. R., & Musmini, L. S. (2020).	This research examines how the COVID-19 epidemic has affected the financial performance of companies listed on the Indonesia Stock Exchange.	Data: 214 companies were selected as research samples and distributed proportionally among nine sectors or 49 subsectors. The study's population consisted of firms listed on the IDX in 2019 and kept their registration status until the second quarter of 2020 when secondary data was obtained. The financial reports for these companies were retrieved from the official IDX website— the data analysis technique: Wilcoxon Signed Rank Test.	The findings show that the COVID19 Pandemic increased leverage and short-term ratios while decreasing liquidity and profitability ratios in public companies. Notably, no discernible variation was detected in the liquidity and leverage ratios. However, a substantial change in public companies' profitability and short-term activity ratios during the COVID-19 epidemic was discovered. The consumer products industry had an increase in liquidity, profitability, and short-term activity ratios, but the leverage ratio fell. In contrast, liquidity and profitability ratios fell in the property, real estate, building construction, banking, commerce, services, and investment sectors.
3	Widarti, W., Desfitrina, D., & Zulfadhli, Z. (2020)	To enhance an organization's financial performance through effective and efficient operations that improve productivity. In the wake of the Pandemic, the life cycle of micro, small, and medium enterprises is focused on survival, aiming to boost the organization's financial performance and productivity.	The study concentrated on Indonesian micro, small, and medium enterprises (MSMEs). The research utilized both descriptive and verification methods, and structural equation modeling (SEM, Lisrel) was employed as the primary analysis tool.	According to the findings, the business process life cycle influenced the FP of MSMEs during the epidemic.

No	Author & Year	Research Objectives	Method	Findings
4	Yusvensia Jesica Anggun Febriant ikaTri Joko Prasety oFitra Dharma (2021)	Analyze the comparison of the financial performance and value of manufacturing companies before and during the COVID-19 pandemic	Data: financial statements for the 2019-2020 period. The sampling technique: purposive sampling and obtained a sample of 108 manufacturing companies listed on the IDX. Data analysis: Wilcoxon signed-rank	There is no decrease in leverage ratios, activity ratios, firm value during the COVID-19 pandemic, while profitability and liquidity ratios have increased during the COVID-19 pandemic. Judging from the results of the different test activity ratios, there were significant differences, while the ratios of profitability, liquidity, leverage, and firm value did not experience significant differences.
5	Wijayan to & Seno (2021)	to prove the difference in financial performance between companies in the Food and Beverages, Tobacco Manufacturers, Pharmaceuticals, Cosmetics and Household, and Houseware Sub-Sectors during the Covid-19 pandemic.	Variable Measurement: Financial performance using the ratio of Return on Assets (ROA) and Return on Equity (ROE). The sampling technique: purposive sampling Sample size: 44 companies Data collection: documentation techniques. Data source: company's financial statements, annual reports, summary of IDX listed companies, and the IDX Facts Book. Data obtained from the Indonesia Stock Exchange. The data analysis technique: Multivariate Analysis of Variance (MANOVA).	The financial performance of the Cosmetics and household, Food and Beverages, and Tobacco Manufacturers sub-sector companies decreased during the Covid-19 Pandemic. The Houseware and Pharmaceuticals sub-sector achieved a significant increase during the Covid-19 Pandemic. There is a significant difference between the financial performance of the Cosmetics and household, Food and Beverages, Houseware, Pharmaceuticals, and Tobacco Manufacturers sub-sector companies listed on IDX before and during the Covid-19 Pandemic.
6	Bulur, M., Özceyla n, E., & Çetinka ya, C (2022).	To analyze the economic effects of the New Coronavirus pandemic based on yearly comparisons on the textile sector in Bursa and Gaziantep, Turkey.	A questionnaire was applied on 241 companies from Bursa and 182 companies from Gaziantep. The obtained data were analyzed via IBM SPSS (Statistical Package for Social Sciences) 25.0	According to results, in both cities despite the pandemic effect, disrupted logistics activities and its negative effects on the economy, and monthly operation capacity, monthly turnover, monthly domestic sales, monthly export average, monthly

No	Author & Year	Research Objectives	Method	Findings
			software by means of, frequency, percentage, average, standard deviations, T-test, and One way ANOVA tests.	exporting country, the average number of monthly employees increased in 2021 compared to 2019. These show that despite the participants' negative opinions related to economic impacts, most of the criteria developed on the textile sector in Bursa and Gaziantep.
7	Fitri, W. N., Andriani, W., & Ananto, R. P. (2023)	To prove the difference in the financial performance of infrastructure companies listed on the Indonesian Stock Exchange before and during COVID-19.	Sampling for this study was performed using a targeted sampling technique, resulting in a sample of 31 infrastructure companies. This research used secondary data from annual reports provided by the IDX website. Data were processed using SPSS software version 25 and hypothesis tests were performed using the standard Kolmogorov-Smirnov test and Wilcoxon signed rank test	As a result, we found a significant difference before and after Covid-19 in current ratios, short-term ratios, total debt, total asset turnover ratio, net profit margin, and rate of return on investment. Furthermore, there were no significant differences in indebtedness and debt turnover before and during Covid-19. Most businesses suffered losses during the COVID-19 pandemic
8	Budiantara, M., Paramitalaksmi, R., & Rihadani, F. (2023).	To test banks company on the Indonesia Stock Exchange (IDX) using CAR, ROA, NPL, Serta BOPO variables to find out whether there are differences in performance between before as well as after the Covid-19 pandemic in the period 2019–2021or not.	Data: 44 bank company listed by IDX (Indonesian Stock Exchange). Method: comparative quantitative methods, with difference test analysis tools Paired Simple T-Test and Sign-Wilcoxon.	The results are the ratio of CAR, ROA and NPL showed a significant difference, while the BOPO ratio did not show any significant differences in 44 banking company that listed on the IDX before as well as during the Covid-19 pandemic's period.

This study is unique because it analyses the financial performance of Pakistan textile firms before and during the Pandemic. Unlike other studies; According to Kabir & Saleh (2020), The study contains the companies of Bangladesh and their results indicate that the influence of COVID-19 has affected various sectors such as cement, power and energy, textile, pharmaceuticals, and ICT, resulting in a significant decrease in their earnings. The banking sector has also experienced a revenue decline, although it is not statistically significant. The study results of Devi et al (2020) shows that the consumer products industry had an increase in liquidity, profitability, and short-term activity ratios, but the leverage ratio fell. In contrast, liquidity and profitability ratios fell in the property, real estate, building construction, banking, commerce, services, and investment sectors. According to (Widarti et al., 2020) the findings, the business process life cycle influenced the financial performance of MSMEs during the epidemic. There is no decrease in leverage ratios, activity ratios, firm value during the COVID-19 pandemic, while profitability and liquidity ratios have increased during the COVID-19 pandemic (Yusvensia Jesica et al., 2021). The financial performance of the Cosmetics and household, Food and Beverages, and Tobacco Manufacturers sub-sector companies decreased during the Covid-19 Pandemic. The Houseware and Pharmaceuticals sub-sector achieved a significant increase during the Covid-19 Pandemic (Wijayanto & Seno, 2021). According to (Bulur et al., 2022). results, in both cities despite the pandemic effect, disrupted logistics activities and its negative effects on the economy, and monthly operation capacity, monthly turnover, monthly domestic sales, monthly export average, monthly exporting country, the

average number of monthly employees increased in 2021 compared to 2019. As a result, we found a significant difference before and after Covid-19 in current ratios, short-term ratios, total debt, total asset turnover ratio, net profit margin, and rate of return on investment. Furthermore, there were no significant differences in indebtedness and debt turnover before and during Covid-19. Most businesses suffered losses during the COVID-19 pandemic (Fitri et al., 2023). The (Paramitalaksmi, & Rihadani, 2023) results are the ratio of CAR, ROA and NPL showed a significant difference, while the BOPO ratio did not show any significant differences in 44 banking company that listed on the IDX before as well as during the Covid-19 pandemic's period.

My research is a comparative approach which is examining the FP of Pakistan textile firms between before and during the covid-19 Pandemic. While in the previous studies, most of the research were perform on the Indonesian companies that are listed on IDX. But one research is containing the companies that are listed on Bangladesh stock exchange and the another research was perform on the basis of textile industries in Turkey. All the previous researches checkout the company's performance during the covid except (Wijayanto & Seno, 2021). This study checks out the company's performance before and during the covid-19 pandemic as like my research but it's done in Indonesia, with Indonesian industries which are listed on IDX. While my research is based on the Pakistan textile industries. All the previous studies show a slightly decrease in company's performance during the covid-19 Pandemic.

The purpose of this study is to answer the research questions.

1.3 Research questions

The following are the research questions;

a) How was the FP of firms in Pakistan's textile industry before and during the Pandemic?

b) Is there any significant difference in the FP of textile firms in Pakistan before and during the Pandemic?

1.4 Research objectives

To understand the effect of Vovid-19 on the firm performance which can be explained by:

a. Differences in ROA Before and During the Pandemic

b. Differences in ROE Before and During the Pandemic

c. Differences in TATO Before and During the Pandemic

1.5 Significance of the research

The following are some of the expected benefits of this research:

1. **Theoretical Contribution**

   a) Provide scientific evidence to compare the FP in Pakistan's textile firms before and during the Pandemic.

   b) This research's empirical findings about the pandemic conditions and a firm's FP are expected to be relevant to the scientific community.

2. **Practical Contribution**

    a) For management, the findings of this study should help by offering empirical facts on how the Pandemic affects the business's FP.

    b) For investors, the findings of this study should help by offering empirical facts about the company's financial performance during the Pandemic, which will assist them in making monetary judgments in a dangerous situation.

1.6 Literature Review

1.6.1 Financial performance

A company's FP is measured using a range of financial statistics and indicators. Financial analysts and investors evaluate a company's FP utilizing various tools and methodologies, such as financial statements, ratios, and other quantitative measurements. FP is typically assessed over a specific duration, such as a year or a quarter. It might be conducted to evaluate the performance of similar firms in the same sector or the company's prior success. Analysis of a company's financial performance can give insight into its financial situation and anticipate its future success.

By analyzing various factors such as production capability, logistics and sales systems, product range, production capacity, technological and scientific potential, and financial capacities, the growth potential of the textile sector can be enhanced through resource-saving technology. This can assist in determining the

best sales and production strategy and techniques, along with examining the organizational structure of managers, employees, and staff (Gagnon et al., 2018).

Business sustainability, an essential aspect of financial management, has recently received increasing attention. While maximizing shareholder wealth is typically the main goal for a company, it is necessary to recognize that continuous growth and progress, as proposed by Smith's "invisible hand" theory, is not possible with limited resources. While profit can drive a company's sustainable growth, it should not be pursued at any cost. Financial management has explored the correlation between a legitimate business and long-term financial performance, particularly in assessing a company's future growth. Corporate executives may undeniably improve a company's economic success. Nonetheless, they may require a thorough understanding of the capacity for long-term sustainable development, notably the influence of intangible capital (IC) on sustainable growth. (Xu, J. and B. Wang, 2018).

Prospective investors frequently analyze a firm's financial performance when determining which shares to invest in. Financial assistance appeals to investors to sustain and increase financial performance, and the firm must effectively fulfill its goals. Financial performance is an essential indicator of how well a company meets its objectives (Sadalia et al., 2019).

Lucato et al. (2017) quantitative survey approach is used in the research methodology. The authors surveyed SMEs in the Brazilian textile sector to gather information on their environmental and financial performance. The study asked about SMEs' ecological management policies and systems and financial

performance measures like sales, earnings, and return on investment. The authors evaluated the survey data using statistical analysis and investigated the link between SMEs' environmental and FP.

A range of internal and external factors might impact a company's FP. Internal factors include technical applications, innovation, operational management, human resources, and property rights structures. On the other hand, external factors include the socioeconomic environment, legal environment, credit environment, competition in the industry, and regulatory and business compliance, among others (Centobelli et al., 2019). The capacity of a corporation to create returns from numerous resources determines its profitability. Managers are concerned with the company's operational state, profitability, and, most crucially, the net profit margin. (Gartenberg et al., 2019).

According to Coccia (2018), entrepreneurs and national innovation systems collaborate to advance technological progress. Although there are various theories on technological innovation, it is generally promoted by entrepreneurs or governments to bring about changes in organizational forms and management methods that can impact the environmental and financial performance of firms. Xu et al. (2019) also found that implementing environmentally friendly production practices can lead companies to develop innovative green technologies. However, technological advancement can impact an organization's environmental and financial performance positively and negatively.

Financial performance is an essential factor in a company's success and substantially impacts how it handles its operations (Wiklund & Shepherd, 2005).

Good financial performance enables the development of corporate functions such as R&D and production, whereas bad financial performance can stifle such growth. Researchers used metrics such as ROA, ROE, ROI, EPS, market value added, and net sales growth to evaluate financial performance. These indicators can be determined quantitatively as well as qualitatively. Quantitative approaches are known for their precision but need a large sample size, which may be time-consuming and costly. Qualitative measurements, typically obtained through surveys, have also been shown to effectively predict financial performance (Hult et al., 2008). In research by Homburg et al. (202), a sample of companies had their return on sales (ROS) examined using quantitative and qualitative methodologies, and a substantial positive connection was discovered between them. Similarly, Harris (2001) revealed a significant relationship between qualitative and quantitative financial performance measurements such as ROI and sales growth.

1.6.2   Measurements for Financial Performance

Measurements for financial performance refer to measuring and assessing a company's financial condition and success. ROA, ROE, revenue, net income, ROI, cash flow, and other metrics may be included. Metrics include profitability, liquidity, turnover, stability, control, financial, and efficiency ratios. These measures and ratios also give a comprehensive overview of a firm's FP and assist management in making decisions about the firm's future direction (Wallstreetmojo, 2020).

Liquidity Ratio's

a) A financial ratio that compares a company's current assets to its current liabilities seems to be the current ratio. It is calculated by dividing the current assets by the current liabilities. The ratio evaluates a firm's capacity to repay short-term commitments with short-term assets. A ratio of one or above implies that the company's current assets exceed its current liabilities.

The following is the current ratio formula:

$$\text{Current ratio} = \frac{Current\ Asset}{Current\ Liabilities}$$

Source: Wallstreetmojo (2020)

b) The quick ratio is a financial ratio that measures a firm's capacity to meet its most liquid assets to fulfill its short-term commitments. It is calculated by deducting inventory from current assets and dividing it by current liabilities.

The formula for the Quick ratio is as follows:

$$\text{Quick ratio} = \frac{Current\ Assets - inventories}{Current\ Liabilities}$$

Source: Wallstreetmojo (2020)

c) The cash ratio is a financial statistic that assesses a company's capacity to satisfy relatively brief obligations using cash and cash equivalents. It is computed by dividing a firm's cash and cash equivalents by its current liabilities. The ratio measures a company's capacity to repay short-term loans without selling inventory or other resources.

The following is the cash ratio formula:

Cash ratio $= \frac{Cash\ and\ cash\ equivalance}{Current\ Liabilities}$

Source: Wallstreetmojo (2020)

d) The operating cash flow ratio is a financial statistic that assesses a company's capacity to produce cash from operations. It is computed by dividing the operational cash flow of a firm by its current obligations. The ratio measures a firm's capacity to repay short-term loans with cash earned by core operations.

The formula for the operating cash flow ratio is as follows:

Operating cash flow ratio $= \frac{Operating\ Cash\ Flow}{Current\ Liabilities}$

Source: Wallstreetmojo (2020)

Leverage Ratios:

a) The debt ratio is a financial measurement comparing a firm's total debt to its assets. It represents the percentage of a company's assets funded by debt. A greater debt ratio indicates that debt is financing more of the company's assets, which might suggest a higher level of financial risk. It is computed by dividing total debt by total assets.

The debt ratio is calculated as follows:

Debt ratio $= \frac{Total\ Debt}{Total\ Assets}$

Source: Wallstreetmojo (2020)

b) The debt-to-equity ratio is a financial measurement comparing a firm's total debt to its equity. It indicates the amount of a firm's funding provided by

debt and equity. A greater debt-to-equity ratio indicates that debt accounts for a larger amount of the firm's funding, which might imply a higher level of financial risk. It is computed by dividing the total debt by its shareholders' equity.

The following is the debt-to-equity ratio formula:

$$\text{Debt to equity ratio} = \frac{Total\ Debt}{Total\ Shareholder's}$$

Source: Wallstreetmojo (2020)

c) The interest coverage ratio is a financial measurement that assesses a company's capacity to pay its debt's interest charges. It is determined by dividing operating income by interest expenditures. The ratio reflects weather a company's earnings are sufficient to pay its interest expenditures.

The formula for the operating cash flow ratio is as follows:

$$\text{Operating cash flow ratio} = \frac{Income\ From\ Operations}{Interest\ Expense}$$

Source: Wallstreetmojo (2020)

d) The debt service coverage ratio is a financial metric that assesses a company's capacity to repay its debts. It is computed by dividing operating revenue by total debt service, including principal and interest payments. The ratio reflects whether a firm's cash flow is sufficient to meet its debt commitments.

The formula for the debt service coverage ratio is as follows:

$$\text{Debt service coverage ratio} = \frac{Income\ From\ Operations}{Total\ Debt}$$

Source: Wallstreetmojo (2020)

Efficiency / activity ratios

a) The inventory turnover ratio is a financial measurement that assesses a company's efficiency in inventory management. It is computed by dividing the cost of goods sold by the average inventory value. The ratio illustrates how frequently a firm sells and replaces inventory over a specific period. The formula for the inventory turnover ratio is as follows:

Inventory turnover ratio $= \dfrac{Cost\ of\ Goods\ Sold}{Average\ Inventory}$

Source: Wallstreetmojo (2020)

b) The accounts receivable turnover ratio is a financial measurement that indicates how efficiently a firm collects its receivables. It is determined by dividing credit sales by accounts receivable. The ratio illustrates how frequently a firm collects its accounts receivable over a specific period. The formula for the accounts receivable turnover ratio is as follows:

Accounts receivable turnover ratio $= \dfrac{Credit\ Sales}{Accounts\ Receivable}$

Source: Wallstreetmojo (2020)

c) The total assets turnover ratio is a financial measurement that assesses a company's ability to generate income from its resources. It is computed by dividing the company's net sales by its total assets. The ratio measures how well a firm uses its assets to create revenue. The formula for the total assets turnover ratio is as follows:

Total assets turnover ratio $= \dfrac{Net\ Sales}{Total\ Assets}$

Source: Wallstreetmojo (2020)

Profitability Ratios:

a) The gross profit margin is a financial measurement that compares a company's revenue to its cost of goods sold to determine its profitability. It is computed by deducting the cost of products sold from sales and dividing the result by total revenue. The ratio is the percentage of revenue left after subtracting the cost of products sold.

The formula for the gross profit margin ratio is as follows:

Gross profit margin ratio $= \frac{Sales - Cost\ of\ Goods\ Sold}{Sales}$

Source: Wallstreetmojo (2020)

b) The operating profit margin is a financial measurement that gauges a firm's profitability from its fundamental business activities. It is computed by dividing the operational profit by the net sales. The ratio is the percentage of revenue that remains after subtracting operational expenditures.

The formula for the operating profit margin ratio is as follows:

Operating profit margin ratio $= \frac{Operating\ Profit}{Net\ Sales}$

Source: Wallstreetmojo (2020)

c) The net profit margin is a financial measurement that evaluates a firm's profitability after all expenditures, including taxes and interest, have been deducted. It is computed by deducting tax and interest from operational profit and dividing the result by net sales. The ratio is the percentage of income that remains after all costs are deducted.

The formula for the net profit margin ratio is as follows:

Net profit margin ratio $= \dfrac{Operating\ Profit\ -Interest\ -\ Tax}{Net\ Sales}$

Source: Wallstreetmojo (2020)

d) EBITDA margin is a financial measurement that calculates a company's earnings before interest, taxes, depreciation, and amortization (EBITDA) as a percentage of total sales.

EBITDA = Operating Income (EPIT) + Depreciation + Amortization

The formula for the EBITDA margin ratio is as follows:

EBITDA margin ratio $= \dfrac{EBITDA}{Net\ Sales}$

Source: Wallstreetmojo (2020)

Because it removes non-operating expenditures such as interest and taxes and non-cash items such as depreciation and amortization, the EBITDA margin ratio is a valuable tool for measuring a company's operational profitability. This enables investors and analysts to concentrate on the company's operational success and efficiency in producing income from core businesses.

e) The return on equity is a financial measurement that compares a company's net income to its shareholder equity to determine its profitability. Divide net income by shareholder equity to get it.

The formula for the return on equity ratio is as follows:

Return on equity ratio $= \dfrac{Net\ Income}{Shareholder\ Equity}$

Source: Wallstreetmojo (2020)

f) The return on assets is a financial measurement that compares a company's net income to its total assets to determine its profitability. It is computed by dividing net income by total assets. The ratio represents the proportion of the return on assets earned by a company.

The formula for the return on assets ratio is as follows:

$$\text{Return on assets ratio} = \frac{Net\ Income}{Total\ Assets}$$

Source: Wallstreetmojo (2020)

g) Return on investment is a profitability ratio that compares the return on investment to the cost of the investment. It is computed by dividing an investment's net profit by the cost of the investment. ROI may be beneficial in measuring investment efficiency and comparing the profitability of various investment options.

The formula for the Return-on-Investment ratio is as follows:

$$\text{Return on Investment ratio} = \frac{Net\ Profit}{Cost\ of\ Investment}$$

Source: Wallstreetmojo (2020)

Market Value ratio:

a) The book value per share is a financial measurement that estimates the shareholder equity amount per stock share. It is computed by dividing shareholder equity by the total number of shares outstanding. The ratio represents the per-share value of a company's common equity.

The formula for the book value per share is as follows:

Book value per share ratio $= \dfrac{Shareholder\ Equity}{Total\ Shares\ Outstanding}$

Source: Wallstreetmojo (2020)

b) The dividend yield ratio is a financial measurement that calculates the return on investment for a firm's shareholders. It is computed by dividing the annual dividend per share by the company's current market price per share. The dividend payout ratio denotes the proportion of return paid to shareholders by a company's dividend.

The formula for the dividend yield ratio is as follows:

Dividend yield ratio $= \dfrac{Dividing\ Per\ Share}{Share\ Price}$

Source: Wallstreetmojo (2020)

c) Earnings per share (EPS) is a metric used to evaluate a company's profitability per share. It is calculated by dividing the company's net income by the number of shares outstanding. The ratio shows a firm's profit per share of outstanding common stock.

The formula for calculating earnings per share is as follows:

Earnings per share ratio $= \dfrac{Net\ Income}{Number\ of\ Shares\ Outstanding}$

Source: Wallstreetmojo (2020)

d) The price-earnings ratio is a financial measurement that compares the current stock price of a firm to its earnings per share. It is computed by dividing the share price by the corporation's earnings per share. The ratio is

the amount of money investors are ready to spend for every dollar of earnings.

The formula for the price-earnings ratio is as follows:

Price-earnings ratio $= \dfrac{Share\ Price}{Earnings\ Per\ Share}$

Source: Wallstreetmojo (2020)

Financial ratios are essential for evaluating a firm's financial position and may be used to make investment decisions or evaluate potential business associates. However, these ratios must be seen in the context of the market and economic situations (Cubesoftware, 2023).

The following are the financial ratios;

1) The Contribution Profitability Ratio is a metric used to quantify how much sales income surpasses the variable expenses of providing the goods or services offered. It is determined by eliminating variable expenditures from sales and dividing them by sales.

   The formula for the Contribution Profitability Ratio is as follows:

   Contribution Profitability Ratio $= \dfrac{Sales - \text{variable expenses}}{Sales}$

   Source: Cubesoftware (2023)

2) The Operating Margin is a financial measurement that evaluates a company's operating income as a proportion of its revenue to determine its profitability. It is computed by dividing operational profit by sales.

The following is the Operating Margin formula:

Operating Margin Ratio $= \dfrac{Operating\ Profit}{Total\ Sales}$

Source: Cubesoftware (2023)

3) The Pretax Margin Ratio is a leverage metric that evaluates a company's profitability before taxes are paid. It is computed by dividing earnings before taxes by sales.

The formula for the Pretax Margin Ratio is as follows:

Pretax Margin Ratio $= \dfrac{Earning\ Before\ Tax}{Sales}$

Source: Cubesoftware (2023)

4) The Price-to-Book Ratio is a financial metric that compares the market value of a firm's shares to its book value, which is the entire value of its assets, excluding liabilities. It is computed by dividing the share price by the book value per share.

The formula for the Price-to-Book Ratio is as follows:

Price-to-Book Ratio $= \dfrac{Market\ Price\ Per\ Share}{Book\ Value\ Per\ Share}$

Source: Cubesoftware (2023)

5) The Dividend Payout Ratio is a financial indicator that calculates the percentage of a company's earnings that are distributed to its shareholders as dividends. It is determined by dividing total dividends paid by net income.

The Dividend Payout Ratio is calculated as follows:

$$\text{Dividend Payout Ratio} = \frac{Dividents\ Paid}{Net\ Income}$$

Source: Cubesoftware (2023)

6) The EBITDA Multiple is a financial metric used to estimate a company's worth. It compares the company's business worth to its EBITDA. It is determined by dividing the Enterprise value (EV) by the EBITDA.

The EBITDA Multiple ratios are calculated as follows:

$$\text{EBITDA Multiple Ratio} = \frac{EV}{EBITDA}$$

Source: Cubesoftware (2023)

7) The SaaS Magic Number is a profitability measure used by SaaS firms to assess the effectiveness of their sales and marketing operations.

The formula for the SaaS Magic Number ratio is as follows:

$$\text{SaaS Magic Number ratio} = \frac{[4*(QRR[X] - QRR[X-1])]}{(Sales + Marketing\ Expenses[X-1])}$$

Source: Cubesoftware (2023)

8) The Hype Factor Statistic is a financial measurement measuring the hype surrounding a firm's stock. It is computed by dividing the capital raised by the recurring revenue each year (ARR).

The formula for the Hype Factor Ratio is as follows:

$$\text{Hype Factor Ratio} = \frac{Capital\ Raised}{ARR}$$

Source: Cubesoftware (2023)

9) The Burn Multiple is a financial indicator commonly used to assess a company's cash flow and runway, especially for startups. It determines how

long a firm may continue to operate before running out of funds. It is determined by dividing the company's net burn by its net new ARR.

The formula for the Burn Multiple ratios is as follows:

Burn Multiple ratios $= \frac{Net\ Burn}{Net\ New\ ARR}$

Source: Cubesoftware (2023)

10) The Interest Coverage Ratio is a financial measurement that calculates a company's capacity to pay interest on outstanding debt. It is determined by dividing earnings before interest and taxes (EBIT) by interest.

The formula for the Interest Coverage Ratio is as follows:

Interest Coverage Ratio $= \frac{EBIT}{Interest}$

Source: Cubesoftware (2023)

11) The Fixed Dividend Coverage Ratio is a financial measurement that assesses a company's capacity to pay fixed dividends to its shareholders. It is computed by dividing the firm's net income by the required dividend distribution.

The formula for the Fixed Dividend Coverage Ratio is as follows:

Fixed Dividend Coverage Ratio $= \frac{Net\ Income}{Required\ Divident\ Papout}$

Source: Cubesoftware (2023)

12) The Debt-to-Assets Ratio is a financial measurement that calculates the proportion of a firm's profits that are funded by debt. It is computed by dividing total debt by total assets. This ratio reveals a firm's level of financial risk and how much of its assets are financed by debt.

The formula for the Debt-to-Assets Ratio is as follows:

Debt-to-Assets Ratio $= \frac{Total\ Debt}{Total\ Assets}$

Source: Cubesoftware (2023)

13) The Shareholder-Equity Statistic is a financial measurement that calculates the percentage of a firm's assets financed by shareholder equity. It is determined by dividing shareholder equity by total assets. This ratio represents the percentage of a company's assets owned by its shareholders.

The formula for the Shareholder-Equity Ratio is as follows:

Shareholder-Equity Ratio $= \frac{Total\ Shareholder's\ Equity}{Total\ Assets}$

Source: Cubesoftware

14) The Debt-to-Capital Ratio is a financial measurement that determines how much of a company's capital structure is financed by debt. It is computed by dividing total debt by total capital. This ratio reflects how much of a company's capital structure is devoted to debt financing.

The calculation for the debt-to-capital ratio is as follows:

Debt-to-Capital Ratio $= \frac{Total\ Debt}{Total\ Capital}$

Source: Cubesoftware (2023)

15) The Fixed Charge Coverage Ratio is a financial measurement that assesses a company's capacity to cover fixed charges like interest and lease payments

with operating income. It is computed by dividing earnings before interest and taxes (EBIT) by the total of fixed and interest costs.

The formula for the Fixed Charge Coverage Ratio is as follows:

$$\text{Fixed Charge Coverage Ratio} = \frac{EBIT}{Fixed\ Charges + Interest\ Expenses}$$

Source: Cubesoftware (2023)

16) The Long-Term Debt-to-Capitalization Ratio is a financial measurement that compares a firm's long-term debt to its overall capitalization. It is determined by dividing long-term debt by long-term debt plus equity.

The formula for Long-Term Debt-to-Capitalization Ratio is as follows:

$$\text{Long-Term Debt-to-Capitalization Ratio} = \frac{Long-Term\ Debt}{Long-Term\ Debt + Equity}$$

Source: Cubesoftware (2023)

17) Total Debt-to-Capitalization Ratio is a financial measurement that compares a company's total debt to its entire capitalization. It is determined by dividing total debt by total debt plus equity.

The formula for Total Debt-to-Capitalization Ratio is as follows:

$$\text{Total Debt-to-Capitalization Ratio} = \frac{Total\ Debt}{Total\ Debt + Equity}$$

Source: Cubesoftware (2023)

18) The Times Interest Earned Ratio is a financial measurement that assesses a company's capacity to pay interest on outstanding debt. It is computed by dividing profits before interest and taxes (EBIT) by the entire amount of debt interest due.

The formula for the Times Interest Earned Ratio is as follows:

$$\text{Times Interest Earned Ratio} = \frac{EBIT}{Total\ Interest\ Payable\ On\ All\ Debt}$$

Source: Cubesoftware (2023)

19) The Operating Leverage Ratio is a financial measurement that evaluates the extent to which fluctuations in sales revenue impact a company's operating income. The contribution margin is divided by net operating calculated by looking at this number.

The formula for the Operating Leverage Ratio is as follows:

$$\text{Operating Leverage Ratio} = \frac{Contribution\ Margin}{Net\ Operating\ Income}$$

Source: Cubesoftware (2023)

20) The Financial Leverage Ratio is a measurement that evaluates how much debt a firm uses to fund its operations. It is determined by dividing the percentage change in earnings per share by the EBIT.

The following is the Financial Leverage Ratio formula:

$$\text{Financial Leverage Ratio} = \frac{\%\ change\ in\ EPS}{\%\ change\ in\ EBIT}$$

Source: Cubesoftware (2023)

21) The Total Leverage Ratio is a financial measurement that evaluates a company's total level of financial risk due to its usage of debt financing. Total debt is divided by profits before interest, taxes, depreciation, and amortization (EBITDA).

The formula for Total Leverage Ratio is as follows:

$$\text{Total Leverage Ratio} = \frac{Total\ Debt}{EBITDA}$$

Source: Cubesoftware (2023)

22) The Fixed Asset Ratio is a financial measurement that calculates the percentage of a company's fixed assets, such as property, plant, and equipment. It is computed by dividing net fixed assets by long-term funds.

The formula for the Fixed Asset Ratio is as follows:

$$\text{Fixed Asset Ratio} = \frac{Net\ Fixed\ Assets}{Long\ Term\ Funds}$$

Source: Cubesoftware (2023)

23) The Current/Fixed Asset Ratio is a financial measurement that evaluates a company's capacity to satisfy short-term commitments with current assets while meeting long-term obligations with fixed assets. It is determined by dividing current assets by fixed assets.

The formula for the Current/Fixed Asset Ratio is as follows:

$$\text{Current/Fixed Asset Ratio} = \frac{Current\ Asset}{Fixed\ Assets}$$

Source: Cubesoftware (2023)

24) The Proprietary ratio is a financial measurement that calculates the percentage of a firm's assets funded by its shareholders' equity. It is determined by dividing shareholders' equity by total assets.

The following is the Proprietary Ratio formula:

$$\text{Proprietary Ratio} = \frac{Shareholders'\ Equity}{Total\ Assets}$$

Source: Cubesoftware (2023)

25) The Capacity Ratio is a financial measurement that assesses a company's capacity to employ its fixed assets to produce sales revenue efficiently. It is computed by dividing the actual time worked by the allocated time.

The formula for the Capacity Ratio is as follows:

$$\text{Capacity Ratio} = \frac{Actual\ Time\ Worked}{Budgeted\ Time}$$

Source: Cubesoftware (2023)

26) The Efficiency Ratio is a financial measurement that assesses a company's ability to use its assets to generate sales revenue efficiently. It is computed by dividing the expected time worked by the actual time worked.

The formula for the Efficiency Ratio is as follows:

$$\text{Efficiency Ratio} = \frac{Expected\ Time\ Worked}{Actual\ Time\ Wroked}$$

Source: Cubesoftware (2023)

27) The Activity Ratio is a financial measurement that assesses a firm's capacity to transform its assets into cash or sales revenue. Examples of such ratios are inventory turnover ratios, accounts receivable, and accounts payable turnover ratios. It is determined by dividing actual production in time by planned time.

The formula for the Activity Ratio is as follows:

$$\text{Activity Ratio} = \frac{By\ Actual\ Output\ Measured\ In\ Time}{Budgeted\ Time}$$

Source: Cubesoftware (2023)

28) The Working Capital Turnover Ratio is a financial measurement determining how well a firm uses its working capital to

produce sales revenue. It is computed by dividing net annual sales by average working capital.

The formula for the Working Capital Turnover Ratio is as follows:

$$\text{Working Capital Turnover Ratio} = \frac{Net\ Annual\ Sales}{Average\ Working\ Capital}$$

Source: Cubesoftware (2023)

29) The Accounts Payable Turnover Ratio is a financial measurement that evaluates how quickly a firm pays its bills. It is determined by dividing net annual credit sales by average accounts receivable.

The formula for the Accounts Payable Turnover Ratio is as follows:

$$\text{Accounts Payable Turnover Ratio} = \frac{Net\ Annual\ Credit\ Sales}{Average\ Accounts\ Receivable}$$

Source: Cubesoftware (2023)

30) The Days Sales in Inventory Turnover Ratio is a financial measurement that calculates the average number of days it takes a firm to sell its inventory. It is determined by dividing the average inventory balance by the daily product cost.

The formula for Days Sales in Inventory Turnover Ratio is as follows:

$$\text{Days Sales in Inventory Turnover Ratio} = \frac{Average\ Inventory}{Cost\ Of\ Goods\ Sold\ Per\ Day}$$

Source: Cubesoftware (2023)

31) The Operating Efficiency Statistic is a financial ratio that assesses a company's ability to generate sales revenue while incurring operating expenditures. It is computed by dividing the operational expenditures and

cost of goods sold by net sales. The greater the ratio, the more effectively
the firm uses its operational expenditures to create sales revenue.

The formula for the Operating Efficiency Ratio is as follows:

$$\text{Operating Efficiency Ratio} = \frac{Operating\ Expenses\ +\ Cost\ Of\ Goods\ Sold}{Net\ Sales}$$

Source: Cubesoftware (2023)

1.6.3 Factors Affecting the Company's Performance

Multiple elements can affect a company's financial performance, including
sales growth, employee performance, cash availability, tangibility, business risk,
and corporate governance (Safarova and Yana, 2010). Capital structure, exports,
R&D expenses, leverage, and liquidity can influence a company's competitiveness
as measured by its financial performance (Akben-Selcuk and Elif 2016). However,
capital structure is unique for attaining great financial results because of all the
factors that might influence a company's performance (Brigham and Houston,
2015). This demonstrates the crucial role that capital structure plays in companies'
performance.

A company's performance refers to its overall achievement in meeting the
strategic objectives set out in its vision, mission, and strategy. The management's
effective utilization of available resources largely determines the company's
performance. According to (Hery, 2017), measuring company performance
involves evaluating the success level of its business activities against predetermined
criteria and standards. This process also determines whether the company's success

level aligns with its targets, allowing for continuous improvement and eliminating irregularities.

According to (Irfani, 2020), the leverage ratio assesses a company's ability to meet its debt commitments by using its net revenues and equities as security. In general, this ratio aims to assess a company's ability to satisfy short- and long-term financial commitments. This ratio is instrumental in determining the proportion of capital originating from loans or debt. As far as assessing a company's financial situation is concerned, this ratio holds significant importance because it can reveal the source of funding that a company employs to support its operations or activities, whether it be its capital or borrowed funds (Heij et al., 2020; Kyissima et al., 2020)

The strength of a company's ability to compete and remain viable within its industry is reflected in its age. As a company's establishment duration increases, so does its expected superior performance, typically characterized by increased sales and company assets. Investors frequently consider a firm's age when making investment selections since it informs them of the degree of investment prospects the company is likely to have. The value of the company's assets reveals its capacity to sustain its operations and commercial activities, such as future corporate development (Rahmawati, 2017; Younis & Sundarakani, 2020).

The difference in business risk between small and large businesses can be ascribed to firm size. A corporation's total assets, revenues, average sales level, and average total assets define its size. Generally, companies are classified into three sizes: small, medium, and large (Wati, 2019). The number of personnel employed

in carrying out operational tasks, total assets possessed, and income produced all contribute to a firm's size. Additionally, the number of outstanding shares within a specific period can also indicate the size of a company (Corvino et al., 2019; Younis & Sundarakani, 2020).

1.6.4 Relationship Between Environment Change and Company's Performance

It is essential to consider the link between environmental changes and company success. Environmental changes can significantly impact a company's operations, leading to changes in its implementation. Customer preferences and technology, for example, can influence a company's success and, as a result, its financial performance. Consumer preferences and technology can significantly impact a company's performance.

Chen (2020) highlights the contribution of considering customer preferences and technological advancements when boosting market performance in the digital economy. According to the report, firms must understand and adjust to shifting consumer demands and the most current technological developments to remain competitive. Companies that adopt new technologies and respond to shifting consumer preferences may improve their efficiency, increase customer satisfaction, and ultimately enhance their financial performance.

1.7 Hypothesis

H1: There is a significant difference between the ROA of firms in the textile Industry before and during the Pandemic.

H2: There is a significant difference between the ROE of firms in the textile Industry before and during the Pandemic.

H3: There is a significant difference between the TATO of textile industry firms before and during the Pandemic.

1.8 Conceptual and Operational Definition

a**.** Return on Assets

FP refers to a firm's achieving financial goals using specific financial metrics. In this study, FP was measured using the ROA and ROE. ROA is defined as the ratio of net profit to total assets. This ratio demonstrates the company's potential to earn a net profit after tax by utilizing its total assets. Bontis et al. (2000) research demonstrates the utility of ROA as an indication of FP, among other things. The formula for ROA is as follows:

$$\text{Return on assets ratio} = \frac{Net\ Income}{Total\ Assets}$$

b. Return on Equity

ROE is also used to assess performance in business. ROE demonstrates a company's capacity to generate a net profit using its capital. The research shows the usage of ROE as a performance measure in finance (Wang & Chang, 2005). The formula for ROE is as follows:

$$\text{Return on Equity ratio} = \frac{Net\ Income}{Shareholder\ Equity}$$

c. Total Asset Turn Over

TATO is a financial statistic that indicates how effectively a company's assets are used to produce income. It is computed by dividing the entire

revenue of a firm by the total assets of the company (Sunjoko & Arilyn, 2016).

TATO is calculated as follows:

Total Asset Turnover ratio $= \frac{Sales}{Total\ Assets}$

A high TATO ratio implies that a firm effectively uses its assets to create revenue, whereas a low ratio may indicate that the company is not using its assets properly.

1.9 Research Methods

This work used comparative research to identify differences and similarities between two or more groups and businesses (Buallay, A. 2020). A comparative study in the context of financial performance may involve comparing the financial performance of different organizations using various economic indicators, like ROA and ROE. This study approach seeks to identify trends and patterns in the FP of numerous businesses and comprehend the variables that contribute to financial success. It was analyzed in this study utilizing ROA and ROE (Batool & Sahi, 2019; Ahmed et al., 2020; Ali et al., 2020; Syafii et al., 2020) and Total Asset Turnover - TATO (Nurlaela et al., 2019; Afriani et al., 2020).

1.9.1 Research type

This is a comparison study, especially one aimed at determining the mean difference between 14 listed firms on the Pakistan Stock Exchange.

1.9.2 Research variable

- Return on Assets

- Return on Equity

- Total Asset turnover

1.9.3 Population and Sampling Techniques

The population of this study consists of 14 textile companies that list on the

Pakistan Stock Exchange.

Table 1.2. Research Population

No	Code	Company Name
1	SAPT	Sapphire Textile Mills Ltd
2	BTL	Blessed Textiles Ltd
3	GATM	Gul Ahmed Textile Mills Ltd
4	HUSI	Husein Industries Ltd
5	KTML	Kohinoor Mills Ltd
6	NML	Nishat Mills Ltd
7	FZCM	Fazal Cloth Mills Ltd
8	CRTM	The Crescent Textile Mills Ltd
9	ILP	Interloop Ltd
10	ARUJ	Aruj Industries Ltd
11	ANL	Azgard Nine Ltd

No	Code	Company Name
12	ADMM	Artistic Denim Mills Ltd
13	ANTM	AN Textile Mills Ltd
14	AHTM	Ahmad Hassan Textile Mills Ltd

The sample is determined purposively. Requirements to be a research sample are listed on the PSX consecutively from 2019 and 2020, and the company's financial statements are published.

1.9.4 Data Collection Technique

Data will be collected from the document containing information relevant to research needs. The firm's financial statements, annual reports, listed company summaries, and the Pakistan Stock Exchange will be used to gather research data. The statistics required for this research are as follows: profit after tax, total assets, shareholder's equity, and total sales.

1.9.5 Data Analysis Technique

Data analysis techniques include descriptive and inferential analysis. The descriptive analysis describes the data, both descriptive data regarding sample companies and descriptions of research variables and research findings. Inferential analysis was performed using Paired Sample t-Test and Wilcoxon Signed rank test.

a. Paired sample t-test

The PS t-test is a statistical procedure for comparing the means of two related or dependent samples. Based on specific matching criteria such as time, place,

or subject, each observation in one sample is paired with a corresponding observation in the other in this test.

The PS t-test is used to see if there is a significant difference in the means of the paired samples. In scientific research, this test is widely used to compare the efficacy of two techniques or assess an intervention's before-and-after impacts.

The PS t-test presumes that the differences between the number of pairs are typically scattered. Furthermore, the paired differences must be independent and of constant variance.

The procedure for testing involves calculating the differences between the paired observations and then calculating the mean and standard deviation of these differences. The t-test statistic is then determined by dividing the significant different by its standard error. The t-test has flexibility equal to the number of pairings minus one. Finally, the t-test statistic is compared to a crucial value from the t-distribution to see if the difference in means is statistically significant.

b. Wilcoxon Signed-Rank Test (WSR test)

It is a non-parametric statistical approach for testing the hypothesis that the median of a paired sample equals a given value. It is used when the assumptions of the paired sample t-test, such as normality and equal variances, are not met.

The WSR test is used to evaluate if there is a statistically significant difference between the medians of two matched samples. This test is commonly used in research studies to compare the effectiveness of two treatments or evaluate an intervention's before-and-after effects.

The WSR test assumes that the differences between several pairs are symmetrically scattered around the median. The test also assumes that the paired observations are independent and have a continuous distribution. The WSR test technique consists of the following steps:

1. Determine the differences between the two observations.

2. From smallest to most lavish, assign rankings to the absolute values of the discrepancies.

3. Calculate the sum of the positive differences and the total of the negative differences.

4. Calculate the test statistic, the lesser of the two rank sums.

5. Determine the test statistic's crucial value using the Wilcoxon Signed-Rank Test table or statistical software.

6. When comparing the test statistic to the crucial value, reject the null hypothesis if it is less than or equal to the critical value.