The Role of Financial Technology in Sovereign Wealth Fund Investments - A Case Study of the Norwegian Pension Fund

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Abstract: The study is to investigate how financial technology affects investments made by sovereign funds as well as how it can lead to new investment opportunities for funds, such as non-traditional markets. By examining its investments from 2014 to 2023, the Norwegian Pension Fund was chosen as the research sample. The research was based on the following hypothesis: Financial technology has contributed to enhancing the efficiency and sustainability of the Norwegian Pension Fund's investments by improving analysis and investment strategies, increasing returns, and reducing financial risks thanks to the use of artificial intelligence and big data analysis in making investment decisions. The most important results of the research are: Financial Technology has made the Norwegian Pension Fund more adaptable to global financial challenges and more effectively achieve its investment objectives. Here are the main conclusions about the impact of financial technology in the management of this fund: a) Financial Technology has helped improve the efficiency of investment processes by automating operations and reducing operational costs. Artificial intelligence and big data are used to analyze markets and make decisions faster and more accurately. b) By using data analysis tools, the fund can identify potential risks in the markets faster, allowing for better and more informed investment decisions. This helps protect the fund's money from sharp financial fluctuations.

1 INTRODUCTION

One of the biggest innovations that has altered the structure of the global financial system in the last ten years is fintech. Fintech includes a range of developments, such as blockchain, digital finance, artificial intelligence, and electronic payment systems, that are intended to enhance financial services. Fintech is essential for sovereign wealth funds that oversee government assets in order to foster economic growth and guarantee long-term financial stability since it increases returns and improves efficiency and transparency. Sovereign wealth funds can improve their capacity to evaluate markets and make investment decisions backed by precise, up-to-date data by implementing these technologies. Big data and artificial intelligence are two examples of technologies that can improve risk management and predict market moves, allowing funds to react to changes in the global economy faster. Additionally, using blockchain technology increases trust in financial transactions by offering a high degree of security and transparency. To put it briefly, fintech helps sovereign wealth funds achieve their objectives of diversifying their assets and raising financial returns in a more transparent and sustainable way by boosting efficiency and creativity in their investments.

2 A SIMPLE CONCEPTUAL FRAMEWORK

2.1 Financial Technology

Because of its capacity to leverage contemporary technical processes and procedures to broaden the scope of offering banking and financial services and goods, innovative financial technology has emerged as one of the most promising sectors globally. [1] Many innovative banking and financial applications and solutions have emerged as a result of the world's remarkable advancements in information and communications technology. These have a positive impact on the national economy by increasing the efficiency of financial services and spreading their reach [2].

2.1.1 Financial Technology Goals

The importance of financial technology can be summarized through the following points:

1) Reduced Cost. Financial technology aims to lower existing costs so that more people, particularly businesses and individuals not served by banks, can access financial services [3].
2) Greater Privacy. Since every bank has distinct needs from other banks, financial technology services and products are tailored to the individual preferences of clients. This can be accomplished through a variety of channels [4].
3) Comparison. Customers can evaluate numerous banks and businesses in terms of financial services and costs thanks to financial technology services and products [5].
4) Diffusion. Since financial technology products and services can cater to clients who are not local, they might be cross-border.

2.1.2 Characteristics of Financial Technology

Financial technology has many characteristics that can be summarized in the following points [6]:

1) A collection of information in the financial industry, including banking and financial approaches, methods, and procedures, is known as financial technology.
2) The primary industry in which technology is applied through banking services is the banking sector.
3) The most crucial tool that financial institutions utilize to accomplish their objectives is financial technology.
4) Because technology businesses use algorithms to process transactions in a matter of minutes, financial technology services are known for their speed.
5) Financial Technology services are carefully designed according to the needs of customers, as Financial Technology companies focus on user requests when designing products.
6) The banking business is more adaptable and helps the Islamic banking sector and financial market grow thanks to the usage of financial technology.

2.1.3 Financial Technology Areas

Digital Payments is the most cutting-edge area of financial technology. Transferring money from one payment account to another by a digital device such as a computer, smartphone is known as a digital or electronic payment. This definition covers payments made with credit, debit, and prepaid cards as well as bank transfers and mobile money [7].

In Digital Lending; lenders utilize digital data to make informed credit choices and create intelligent consumer involvement by offering loans that are applied for, issued, and managed through digital channels [8]. Digital Insurance on the other hand involves automating procedures in order to increase speed and efficiency and transforming all insurance services offered to clients by insurance companies into digital services [9].

Digital Finance enable all citizens to access financial services using contemporary technology is known as digital finance. Given the increasing usage of mobile phones, digital banking is a crucial instrument for financial inclusion programs since it offers enormous opportunity to expand basic services and enhance financial inclusion [10].

2.2 Sovereign Wealth Funds

The phenomenon of sovereign wealth funds, which came into being in the middle of the twentieth century, is a modern and ancient phenomenon at the same time. However, it did not receive the same level of attention as it does now because of the amount of discussion surrounding it and the differing opinions of various parties regarding its role and position in the global financial system. Sovereign wealth funds are defined as special investment funds with specialized uses that are often held by the government. In order to accomplish financial goals, these funds maintain and manage assets. They also invest in overseas financial assets as part of their investment strategy. These assets are retained as part of the profits from commodities, privatization, and balance of payments surpluses. [11]

2.2.1 History of Sovereign Wealth Funds

Although they have existed for more than a century, the number of sovereign wealth funds has significantly expanded since 2000. Non-federal US government funds created in the middle of the 19th century to finance particular public services were the first sovereign wealth funds. Therefore, the first state in the US to implement such a program to finance public education was Texas. For elementary and secondary schools, the Texas Permanent School Fund (PSF) was established in 1854, while for universities, the Permanent University Fund (PUF) was established in 1876. According to the stipulations of

the 1845 Treaty of Annexation between the Republic of Texas and the United States, the state retained ownership of the public lands that were given to the Permanent University Fund. Although the Texas Fund was first financed by a state government appropriation, it also purchased public lands concurrently with the establishment of the Permanent University Fund. The Kuwait Investment Authority, a commodity-based sovereign wealth fund founded in 1953 using oil earnings before Kuwait gained independence from the United Kingdom, was the first sovereign wealth fund created by a sovereign state. Numerous estimates place the Kuwaiti fund's current value at approximately $600 billion [12].

2.2.2 Types of Sovereign Wealth Funds

There are many types of sovereign wealth funds and their classification criteria differ, and we will present some of them below:

- Stabilization Funds. The purpose of stabilization funds is to shield the local economy and the government budget from the risk of external shocks brought on by changes in commodity prices. This is because commodity prices, particularly those of oil, are prone to significant fluctuations, exposing nations whose economies rely heavily on the export of these materials to severe disruptions. As a result, these funds will keep governments from borrowing money from both domestic and foreign sources. Stabilization funds' assets are very liquid because its primary function is to maintain the national budget; in an emergency, the fund can quickly liquidate these assets. This is what distinguishes the stabilization fund from other funds such as savings and investment funds.
- Savings Funds. Commodity-rich nations frequently establish savings funds in order to preserve a portion of their resource wealth for future generations. In order to benefit future generations, savings funds aim to turn present resource wealth into renewable financial assets across decades-long investment horizons. Additionally, these monies aid in the fight against Dutch disease, which is a consequence of over-exploitation of natural resources. Income from natural resources can be kept from being spent by investing it in a sovereign fund, which stops the price of products, services, and currency from rising.
- Development Funds. In order to improve the nation's GDP and allocate resources to projects with economic and social importance, particularly infrastructure projects, a development fund is intended to support industries and assist in financing social and economic projects. It is evident that these monies have surfaced in oil and Southeast Asian nations.

2.2.3 The Assets in which Sovereign Funds Investment

In order to provide financial stability, sovereign funds make investments in a range of assets with the goal of generating a long-term, sustainable financial return. Global and local stock markets and bonds are among the assets that sovereign funds invest in. Some funds prefer to allocate a larger portion of their portfolio to stocks due to the higher returns that equities offer, while bonds offer more security and stability [13]. Because these investments are seen as long-term but offer steady and sustained earnings, sovereign funds also make investments in infrastructure projects and commercial and residential real estate globally. Certain funds make investments in fundamental commodities like oil and gas as well as metals like gold and silver, which helps shield sovereign funds from changes in financial market prices [14], while some funds invest in alternative assets that include capital funds, investment in start-ups, and private equity. These assets are usually high-risk, but they provide the potential to achieve High returns [7].

Table 1: Assets that sovereign funds.

Assets	Percentage
Common stock	30%
Fixed Income and Treasury Bonds	20%
Infrastructure	10%
Alternative Assets	10%
Real Estate	15%
Strategic Investments	10%

From Table 1, we note that 30% of sovereign funds' investments were in stocks, 20% in bonds, and 15% in real estate. The investment rate in infrastructure reached 10%, and in alternative assets also 10%. In strategic investments, it was 10%.

2.2.3 Geographical Diversification of Sovereign Wealth Fund Investments

In addition to lowering the risks associated with political and economic volatility and boosting growth prospects by utilizing a variety of investment environments, the goal of geographical

diversification for sovereign wealth funds is to disperse the fund's assets widely across nations and regions of the world rather than concentrating on a single market or economy. Table 2 shows that sovereign wealth funds have a large and predominant presence in foreign markets. However, they have begun to pay attention to local markets (mostly Asian sovereign wealth funds). According to Table 3, the regions most targeted by sovereign wealth fund investments are North America, Europe, Asia, and the Middle East [15], as the United States, India, Britain, China, Singapore, and Australia are among the countries that most attract sovereign wealth fund investments, as these six countries acquired three-quarters of the funds' investments in 2017, given that the markets of the countries that established these funds do not absorb the huge financial surpluses accumulated from oil revenues, services, and goods, and sovereign wealth fund funds are often invested in American bonds and then European bonds, despite their low returns, but they are low-risk due to the strength of the economies of those countries and their enjoyment of political stability and clarity of financial systems.

Table 2: Foreign investment assets vs. domestic investment.

Investment	Percentage
Foreign Investment	89%
Domestic Investment	11%

Table 3: Geographical diversification of sovereign fund investments.

Geographical diversification	Percentage
Europe	20%
Asia	17%
North America	46%
Latin America	2%
Middle East	3%
Africa	2%

3 DATA AND HYPOTHESIS

3.1 Hypothesis

Based on the practical aspect of the research, the research hypothesis was reached, financial technology has contributed to enhancing the efficiency and sustainability of the Norwegian Pension Fund's investments by improving analysis and investment strategies, increasing returns and reducing financial risks thanks to the use of artificial intelligence and big data analysis in investment decision-making.

3.2 Sector and Data

3.2.1 Sector

For the purpose of determine the objectives of the research, the research sample was determined as the Norwegian Pension Fund, and the extent to which financial technology contributed to developing the fund's returns was studied by analysing the fund's investments for the years from 2014 to 2023.

3.2.2 Data

The applied aspect is divided into three axes as follows:

A) The first axis. Overview of the Norwegian Pension Fund and its objectives.
   1) The Norwegian Government Pension Fund.
   2) According to performance metrics that place the fund in the top tier, Norway is regarded as one of the world's most developed nations and one of the biggest producers and exporters of oil. It also follows a mixed economic model that respects market principles while giving the state a significant role in the economy. Norway's economic structure is characterized by relative diversity, with the services sector accounting for more than 60% of the country's GDP and the hydrocarbon sector contributing no more than 51% of total exports , while the percentage of oil tax revenues in public revenues does not exceed 37%, which makes the Norwegian economy less linked to the oil sector and thus less vulnerable to external shocks, as the fund invests oil revenues in stocks, bonds and real estate on the one hand, and on the other hand it works To finance the budget deficit by 4%
   3) The Fund's objectives are as follows [16]:
      - The Preserving and extending Norway's petroleum riches for future generations is the primary goal of the Government Pension Fund Global (GPFG).
      - The Fund seeks to give the Norwegian government a steady and sustainable revenue stream so that it can fund public services and the welfare state throughout the nation.
      - Guard against the detrimental impacts of resource wealth, such inflation and economic volatility, on the Norwegian

economy. By closely monitoring the money and restricting political access to them, the Fund accomplishes this.

B) The second axis. Analysis of the Norwegian Pension Funds's investments: In this section we will analyze the total market value of the fund and the market value by investment type as well as the development of the annual returns of the Norwegian fund.

Table 4: Total market value of the fund's investment.

Year	Total market value (billion dollars)	% change	Year	Total market value (billion dollars)	% change
2014	858	-	2020	1,275	11.06%
2015	845	(15.15%)	2021	1,399	9.72%
2016	873	3.31%	2022	1,262	(9.79%)
2017	1,038	18.90%	2023	1,552	22.97%
2018	953	(8.81%)			
2019	1,148	20.46%			

Based on the fund's annual reports, Table 4 shows the total market value over the years under study. Using the analysis, we find that there is a development in the market value of the fund's investments, as it decreased in 2015 by (15.15%), and in 2016 the market value increased to 3.31%, and in 2017 it increased by 18.90%, but it decreased in 2018 by (8.81%) and increased in 2019 by 20.46%, and in 2020 it also increased by 11.06%, and reached 22.97% in 2023. This indicates the development of the market value of the fund's investments and the increase in its investment in stocks and the increase in the entry of technology led to a significant and noticeable development. The market value by investment type was as follows:

Table 5: Market value by investment type (billion dollars).

Year	Real Estate Invest-ments	Fixed Income Investments	Equity Invest-ments	Infrastructure Investments
2014	19	313	525	0
2015	27	301	517	0
2016	28	299	545	0
2017	27	320	691	0
2018	28	292	633	0
2019	31	304	813	0
2020	32	315	928	0
2021	35	356	1,007	2
2022	34	346	880	1
2023	30	421	1,100	2

From Table 5, we note that the market value of the fund's investments in real estate amounted to (19) billion dollars in 2014 and will become (30) billion dollars in 2023. Stocks had the largest share in terms of market value, amounting to (525) billion dollars in 2014 and developing in 2023 to (1,100) billion dollars, followed by fixed income represented by bonds, where the market value in 2014 amounted to (313) billion dollars, and the market value of fixed income investments in 2023 became (421) billion dollars.

The annual return of the Norwegian sovereign fund can be shown in Table 6.

Table 6: Fund return rates development.

Year	Annual return	Year	Annual return
2014	7.58	2020	10.86
2015	2.74	2021	14.51
2016	6.92	2022	(14.11)
2017	13.66	2023	16.14
2018	(6.1)		
2019	19.95		

Table 7: Fund return rates asset class.

Year	Real Estate Investments	Fixed Income Investments	Equity Investments	Infrastructure Investments
2014	10.42%	6.88%	7.9%	0
2015	9.99%	0.33%	3.83%	0
2016	0.78%	4.32%	8.72%	0
2017	7.52%	3.31%	19.44%	0
2018	7.53%	0.56%	(9.49)%	0
2019	6.84%	7.56%	26.02%	0
2020	0.08-%	7.46%	12.14%	0
2021	13.64%	(1.93)%	20.76%	4.15%
2022	0.07%	(12.11)%	(15.36)%	5.12%
2023	(12.37)%	6.13%	21.25%	3.68%

From Table 6, we note that the annual return was recorded in 2014 (7.58), then declined in 2015 to (2.74), then rose again in 2017 to (13.66), but recorded a strong decline in 2018 (-6.1). The reason for this is the decline in the stock market, as stock prices fell in many major markets, in addition to fluctuations in oil prices, which had a negative impact on returns related to investment in oil-related companies. After that, it recorded an increase in 2019 to (19.95). The fund also recorded a significant decline in 2022, reaching (14.11-), as 2022 witnessed a significant increase in inflation rates, which prompted many banks to raise interest rates sharply to combat inflation, in addition to geopolitical tensions and the conflict in Ukraine, which had a significant

impact on the markets, in addition to the rise in oil prices, which negatively affected global economies. The annual return by investment type during the period from 2014 to 2023 was as follows:

From Table 7, we note that the fund achieved a volatile annual return on its stock investments, as it witnessed a decrease in 2018 to (-9.49%) due to the decline in stock markets, and also decreased in 2022 to (-15.36%) due to the rise in inflation rates, and reached 21.25% in 2023. Fixed income was also volatile and decreased in 2021 and 2022, respectively (-1.93%) (-12.11%) . The market value of real estate investments also witnessed a decrease in 2023 (-12.37%), while the market value of infrastructure investments had started in 2021 and was high (4.15%).

The Norwegian fund is one of the largest individual investors in stocks around the world, as the five largest holdings in its portfolio are concentrated in the technology sector, led by Apple, as shown in Table 8.

Table 8: The fund largest stock holdings.

Company Name	Country	Share (Billion USD)
Apple	United States	33.2
Amazon	United States	14.1
Alphabet	United States	16.1
Nvidia	United States	12.2
Meta	United States	9.3
ASML	Netherlands	7.8
TSMC	Taiwan	7.8
Nestle	Switzerland	9.3
Microsoft	United States	30.8

C) The third axis. Relationship statement: The role of financial technology in increasing the Norwegian Pension Fund’s investments is explained. Fintech has significantly impacted the Norwegian Pension Fund’s investments in several key aspects, helping to improve its performance and management over the past years. Here's how fintech is impacting the fund's investments:

1) Increase returns through algorithmic trading To increase the speed and effectiveness of asset trading, the Norwegian fund has depended on algorithmic trading tools powered by artificial intelligence. Because of its ability to react swiftly to changes in the market, this kind of technology has allowed the fund to lower execution costs and boost returns. The fund's reports indicate that these technologies have contributed to higher annual returns in recent years, particularly during the financial catastrophe associated with the Corona outbreak. One of the biggest returns in the fund's history, 19.9%, was produced in 2021, partly as a result of the application of technology to enhance financial market investment procedures.
2) Risk Management Using Technology: To forecast worldwide financial trends and reduce risks, the Norwegian fund employed sophisticated risk analysis models built on big data and artificial intelligence. The fund's overall return during the 2020 Corona crisis was 10.9%. By effectively managing risks and avoiding significant exposure to certain sectors that were negatively impacted, like travel and energy, the fund was able to minimize losses brought on by market volatility. This illustrates the useful role that financial technology plays in portfolio management.
3) Investing in global technology companies: The fund will make significant investments in major tech firms that have profited from the industry's explosive rise, like Apple and Microsoft. Over the years, investing in these businesses has produced substantial returns for the fund; its holdings in technology companies, which make up around 7.7% of its whole portfolio, have greatly aided in generating good returns.
4) Instant performance reporting using digital platforms: The Fund depended on cutting-edge digital technologies that gave shareholders real-time access to performance information, boosting trust and transparency. By offering precise and timely information on the performance of the portfolio, this technology helped to strengthen the bond between the Fund and investors.
5) Moving towards emerging markets: By using fintech technology to get access to emerging markets via cutting-edge digital trading platforms, the fund has been able to diversify its holdings, and boost returns from markets that were previously inaccessible.

4 CONCLUSIONS

By relying on the results, we obtained and the hypothesis proven in the research, we reach the following conclusions:

- Fintech has made the Norwegian Pension Fund more adaptable to global financial challenges

and more effectively achieve its investment objectives. Here are the main conclusions about the impact of financial technology in the management of this fund:

- Fintech has reduced operating expenses and automated processes, which has increased the efficiency of investing processes. Big data and artificial intelligence are used to assess markets and make decisions more quickly and precisely.
- The fund can make better and more informed investment decisions by employing data analysis techniques to more quickly identify possible market hazards. This shields the fund's assets from abrupt changes in the market.
- Fintech promotes transparency by improving the clarity and accessibility of investment information. New technologies can be used by funds such as the Norwegian Pension Fund to boost public and investor trust.
- By giving the fund access to new markets and non-traditional asset classes like cryptocurrency or crowdfunding, fintech presents fresh chances to diversify its assets.
- Fintech depends on swiftly evaluating vast volumes of data, which improves the Fund's capacity to make defensible judgments based on current, validated facts.

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