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Abstract

The Global Financial Crisis occurred in 2007-2008 and was the most significant since the Great Depression. This thesis explores the reaction of public technology companies and, more specifically, the industries of Information Technology (IT) Services and Business Software & Services to the Global Financial Crisis. This study analyzes the patterns of successful companies that help them recover quickly from crises and set up long-term growth. The identified patterns apply to product and service IT companies during future financial crises.

All 28 companies from this study are traded on one of three stock exchanges: NASDAQ, NYSE, and AMEX. Financial statements are considered as the primary source of historical data.

Unlike other studies, this thesis proposes a quantitative approach to the evaluation of the capacity of a company to react to a financial crisis and analyses the main strategic priorities to minimize the consequences of the crisis.

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# 1. Introduction

## 1.1. Problem Statement and Historical Perspective

The recent decades have known a couple of financial crises, starting from the Asian financial crisis of the late 90s, the dot-com bubble of the early 2000s, the Great Recession of 2008, and the stock market crash due to Covid-19 pandemic instability. Those financial crises had far-reaching consequences on global business, affecting companies of all sizes and industries.

Financial crises bring various challenges for businesses. Among the others, the most common consequence is the economy's contraction. In addition, companies must deal with reduced customer spending due to global uncertainty and increased saving behavior. Consequently, this leads to reduced revenues or even insolvency.

Understanding and reusing the patterns in the future is the main argument for analyzing crises from a historical perspective. Even though financial crises and economic recessions are difficult to predict in advance, they don't happen in a vacuum. Instead, they are typically characterized by multiple factors that showcase similar properties across the eras.

A historical perspective provides valuable data to assess the efficiency of different responses to previous crises. In addition, the success and failure cases of managing financial crises and recovering from those provide valuable insights about strategies for present and future economic downturns.

A historical viewpoint provides additional insight into understanding the changing role of financial institutions, such as central banks, over time.

The Global Financial Crisis provides precious insight into the reaction of IT Services and Business Software & Services companies because fewer such public companies existed during the previous crises. On the other hand, the following pandemic-related crises are also less valuable due to their recent nature and limited capacity to evaluate long-term growth since then.

## 1.2. Literature Overview and Motivation of Study

Companies' reaction to financial crises has been studied from various perspectives, often concluding with contradictory results. Considering the limited available studies of companies' responses from IT Services and Business Software & Services industries, it's crucial to analyze the existing studies and conduct a more specialized one.

Many studies are dedicated to analyzing the impact of crises in different geographies. The USA has been at the epicenter of the Global Financial Crisis. American finance and vehicle manufacturing companies have been hit the most, often facing bankruptcy. The role of bank lending in such circumstances was studied by Ivanisha et al., 2010 [1]. The impact on European companies was especially significant in Greece, Italy, Spain, and Ireland. Lane et al., 2012 [2] studied the role of EU institutions in minimizing the consequences of the crisis. Emerging markets were initially less impacted by the Global Financial Crisis due to their minor exposure to the global financial system. However, companies from Brazil, India, and China were still affected by the slowdown in global demand, as presented by Didier et al., 2012 [3].

The crisis particularly hit financial firms. Banks recorded substantial losses, and consequentially faced new strong regulations, as studied by Acharya et al., 2009 [4]. The global financial crisis was characterized by a major housing market crash that resulted in significant losses for real estate and construction firms and a decrease in home prices, as studied by Case et al., 2009 [5]. The crisis hit manufacturing companies, particularly vehicle manufacturing, which resulted in decreased employment within the industry, as studied by Barker, 2011 [6].

Companies applied different approaches to R&D investments during the crisis. In electronics and manufacturing, it was typical for companies to cut R&D investments. At the same time, other companies continued investing in R&D, considering it a critical strategy for long-term survival and growth, as studied by Paunov et al., 2012 [7].

Sales decrease strongly during crises, so companies often reduce expenses on sales and marketing. At the same time, some research suggests that maintaining or increasing sales and marketing expenditures contributes to better performance in the long run, as studied by Srinivasan et al., 2005 [8].
During a crisis, financial metrics shrank enormously for most companies. Thakor, 2015 [9] analyzed the causes and effects of the Financial Crisis of 2007-2009.
Lack of research on the impact on technology companies, contradicting results from different studies, and the scarcity of precise quantitative approaches are the primary motivations for this thesis.

### 1.3. Research Objectives

This thesis has two research objectives, which are substantial for a deeper understanding of the reaction of technology companies to financial crises.
The first objective of the thesis is to conduct a detailed analysis of IT service and product companies before, during, and after the crisis. This analysis will identify the critical patterns of technology companies that help build resilience strategies in response to economic downturns.
The second objective is to introduce a quantitative methodology of evaluation of the capacity of a company to react to the financial crisis based on historical data about the Global Financial Crisis.

## 2. Methodology

The quantitative evaluation methodology consists of 4 main stages, see Image 1.
In the first stage, companies are considered complex systems, and their dynamic depends on various parameters. They are quantitatively evaluated based on indicators from three strategic groups:

- Financial health
- Business development potential
- Diversification of business

The reaction of a company to the financial crisis is evaluated in the second stage through the capacity of a company to recover from the situation and to ensure sustainable growth in the long term.

In the third step, company indicators are evaluated by their capacity to contribute to the optimal reaction to the financial crisis. This evaluation sets the industry benchmark for public companies from Information Technology Services and Business Software & Services industries.

Finally, strategic priorities for a given company are identified by comparing its indicators to the industry benchmark.

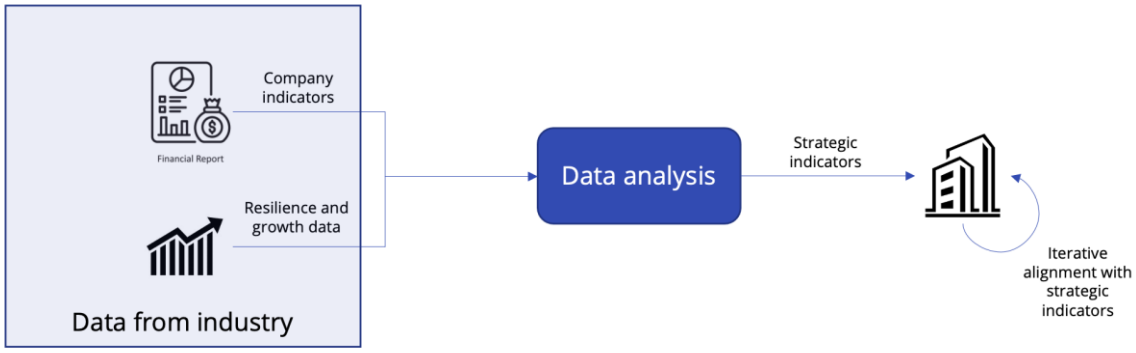


Image 1. Methodology overview

## 2.1.Financial Health Indicators

Financial indicators represent the main aspects of the company's business and can be classified according to the three groups from the balance sheet:

- Income statement
- Balance sheet
- Cash flow

Financial ratios and their classification can be found in Table 1.

| Group | | Indicator |
|---|---|---|
| Income | statement | Total revenue, $ mln |
| | | Return on equity, % |

| | |
|---|---|
| | Gross profit margin, % |
| | Operating margin, % |
| | Net profit margin |
| | Interest coverage rate |
| Balance sheet | Current ratio |
| | Debt-to-equity ratio |
| Cash flow | Cash flow margin |
| | Free cash flow |
| | Free cash flow to revenue |

Table 1. Financial indicators

2.2. Indicators of business development potential

We consider two primary indicators of business development: R&D investments and Sales & Marketing investments, see Image 2. Even though the same amount of investment may generate different outcomes for two organizations, those parameters still indicate the company's commitment to business development activities.

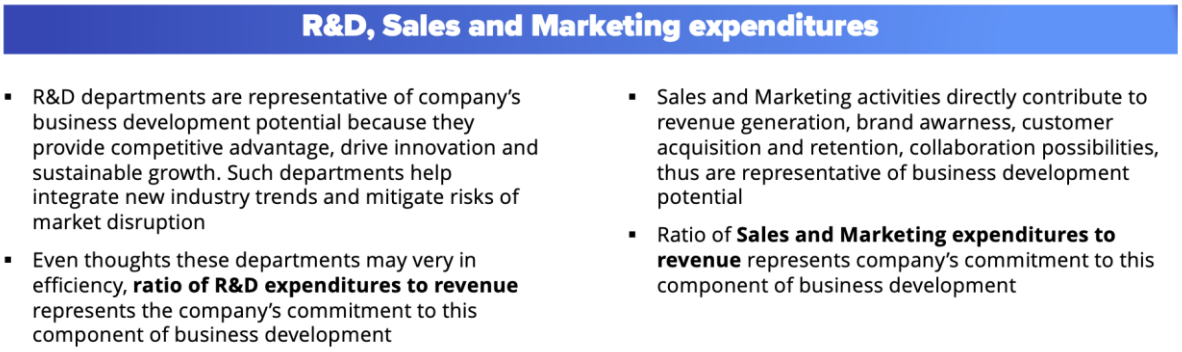


Image 2. Groups of indicators of business development

### 2.3. Business Diversification Indicators

Business diversification is an essential aspect of the business that helps average the risks associated with the revenue streams, employees, industries, or business models. Below are four diversification criteria that we consider:

1. The *foreign revenue ratio* measures the fraction of revenue generated from abroad. A geographically diversified customer portfolio averages out the negative impact of the financial crisis
2. From the revenue attribution perspective, *geographic presence* measures the number of continents the company is active in. Another indicator of geographic diversity that ensures that foreign revenue is not concentrated within the same foreign country
3. The *customer industries* criterion measures the number of industries that the company's customers are active. Financial crisis impacts industries with different severity, so diversity in this respect averages out the negative impact
4. The *service revenue ratio* measures the fraction of revenue generated from services. Companies may generate income from products and services and have complex business models. Financial crises have different impacts based on a given business model, and diversification concerning this criterion helps average the risks overall

### 2.4. Reaction to Crisis

A good measure of the company's reaction to the crisis has to be defined based on the following principles:

1. Quantitatively characterize the company's dynamics with time
2. Represent the company's capacity to recover from the crisis (resilience) and grow sustainably (growth)
3. Remain complementary to each other and as little correlated as possible
4. Minimize outliers of company evaluation

Resilience, defined as the required weeks to recover from crisis and growth within 15-year intervals, are the two criteria that capture a company's reaction to crises and can be evaluated quantitatively, see Image 3.

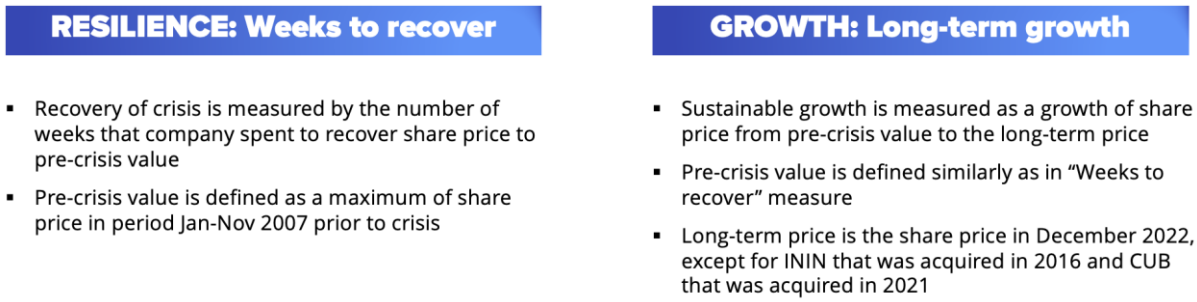


Image 3. Measures of Reaction to the Crisis

### 2.5.Data analysis

Historical quantitative company indicators for the study were taken from the financial statements. Despite the standard format, not all indicators were reported in financial statements [10].

The share price was analyzed through Google Finance API [11]. This is a practical tool that enables quick analysis of data through spreadsheets. Missed data points are not numerous but were completed through the service Barchart [12].

Pearson's correlation measures the relationship between a given company indicator and the respective reaction to the crisis. A significance test may be computed in the future for the vast number of entries.

Obtained results are valuable to prioritize strategic initiatives for a company's successful recovery from the crisis.

## 3. Results

In this chapter, we first analyze the outcomes of the evaluation. This analysis is followed by case studies of more and less successful companies concerning the most important criteria. Finally, this chapter is concluded with a highlight of managerial conclusions.

## 3.1. Resilience

### 3.1.1. Summary of Key Findings

Negative values of resilience in Table 2 can be interpreted as follows: strong values of company indicators contribute to the decrease in the required weeks to recover, which is a positive indicator of resilience.

We observe that Sales and Marketing, Geographic Presence, R&D, and Foreign revenue contribute the most to the resilience to financial crisis for companies from the selected industry.

Business development and diversification are strategic groups with the highest impact on resilience. Maintaining investments in business development helps restore revenue and quickly return to normal conditions. Business diversification compensates potential areas of the highest negative impact by having operations in the other, more stable ones.

No company indicators were identified that have a significant adverse effect on resilience.

| Company indicator | Strategic group | Resilience |
|---|---|---|
| Sales & Marketing expenditures | Business development | -0,495 |
| Geographic presence | Diversification | -0,380 |
| R&D expenditures | Business development | -0,358 |
| Foreign revenue ratio | Diversification | -0,356 |
| Gross profit margin | Income statement | -0,249 |
| Interest coverage ratio | Income statement | -0,232 |
| Free cash flow to revenue | Cash flow | -0,204 |
| Number of industries | Diversification | -0,200 |
| Revenue | Income statement | -0,198 |
| Free cash flow | Cash flow | -0,168 |
| Cash flow margin | Cash flow | -0,163 |
| Return on equity | Income statement | -0,131 |
| Debt-to-equity ratio | Balance sheet | -0,109 |
| Net profit margin | Income statement | -0,082 |
| Current ratio | Balance sheet | -0,080 |
| Service Revenue | Diversification | 0,015 |
| Operating margin | Income statement | 0,016 |

Table 2. Findings on resilience

### 3.1.2. Case Studies

Sales & marketing impact of recovery from the crisis is highlighted as criteria with the highest impact on the company's recovery from the crisis. NetScout Systems, Inc. and Exlservice Holdings Inc. case studies are selected to analyze this criterion from different perspectives.

**NetScout Systems, Inc.** provides products to manage the performance of applications and networks. In 2006, the company had revenue of $97,9mln, with 34,8% from services. In addition, the company dedicated 41,4% of its revenue to sales and marketing activities in 2006, a significant percentage for the industry, see Image 4.

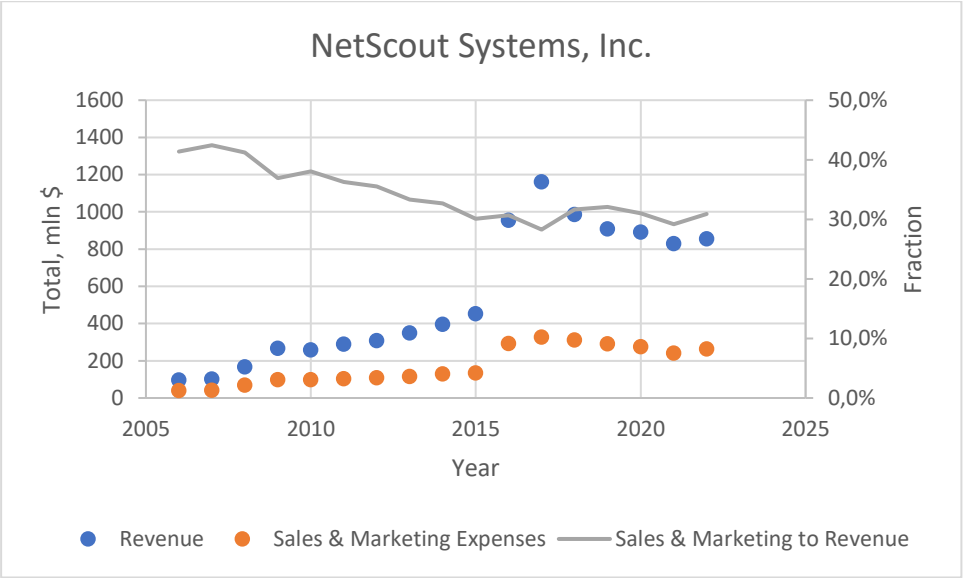


Image 4. Revenue and Sales & Marketing Expenses of NetScout Systems, Inc.

The company's stock price fell by 56% during the Global Financial Crisis at its lowest point. However, the company recovered within 40 weeks, among the fastest in the industry. Significant spending on sales and marketing contributed to the quick recovery, among other factors.

Some critical elements of the sales and marketing strategy of NetScout Systems, Inc. are:

- Commercial businesses, non-profit entities, governmental agencies, and other service providers are all considered as target audiences
- A "High-touch" sales model is applied that starts with meetings with customers to understand their business needs, which are then translated into requirements for the solutions. Typical sales cycles last from three to twelve months
- Indirect sales channel consists of original equipment manufacturers, distributors, resellers, service providers, and system integrators, which represented 61% of total revenue in 2006
- The sales force is organized into three central geographic regions: North America and Europe, the Middle East, Africa, and Asia Pacific
- The sales organization consisted of 79 employees, and the marketing organization consisted of 14 employees in March 2006

- The company associates its future growth with the ability to maintain and expand its sales force

**Exlservice Holdings Inc.** provides digital solutions and global analytics in banking, healthcare, media, retail, etc. In 2006, the company had a revenue of $121,8mln. The company dedicated 3,9% of its revenue to sales and marketing activities in 2006, which is close to the lower bound for the industry, see Image 5.

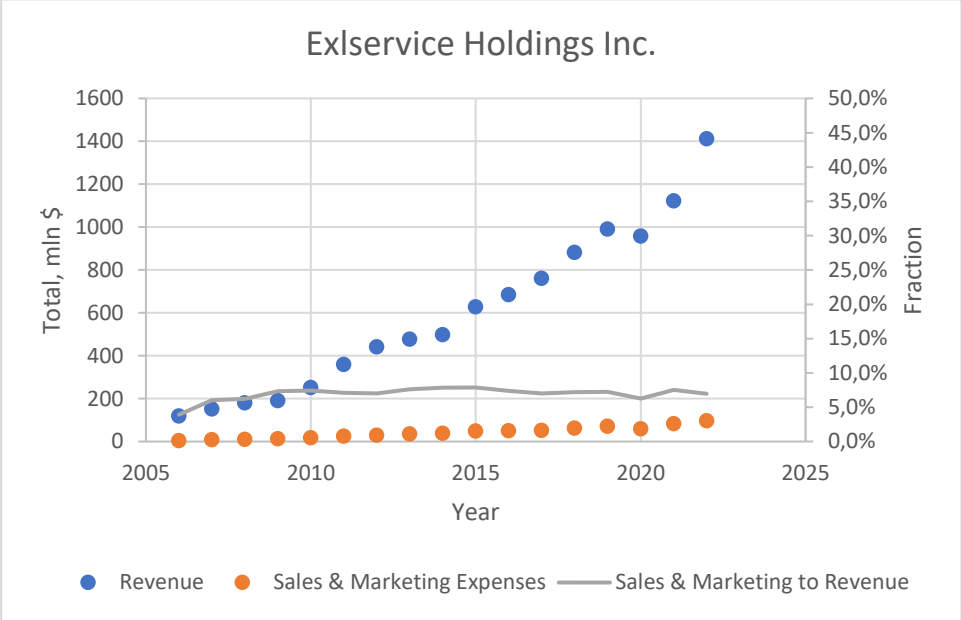


Image 5. Revenue and Sales & Marketing Expenses of Exlservice Holdings Inc.

The company's stock price fell by 79% during the Global Financial Crisis at its lowest point. It took 175 weeks for the company to recover from the crisis. Limited sales and marketing efforts didn't significantly contribute to the accelerated recovery from the crisis.

The sales and marketing strategy of Exlservice Holdings Inc. is brief and little specified. The main point is its commitment to increasing the investment in front-end sales and client relationship management to serve clients better. Overall, the investments in sales and marketing represent a smaller fraction of revenue compared to the industry standard.

#### 3.1.3. Managerial Conclusions

Investments in sales and marketing correlate firmly with a company's resilience to crisis. In addition, diversified geographic presence, foreign revenue streams, and R&D investments contribute positively to the company's quick recovery from a crisis. Establishing sales and marketing departments with a global presence and clear strategy contributes significantly to the company's resilience to the crisis. Still, it may not be decisive for long-term growth, as shown in Images 4 and 5 before.

NetScout Systems, Inc., with an order of magnitude more significant fraction of investments in sales and marketing compared to Exlservice Holdings Inc., was able to recover from the Global Financial Crises more than four times faster.

### 3.2.Growth

#### 3.2.1. Summary of Key Findings

Positive values of resilience can be interpreted as follows: strong values of company indicators contribute to long-term solid growth, see Table 3.

R&D and Debt-to-equity ratio contribute the most to long-term growth for companies from the selected industry. R&D investment is vital to building solutions that solve customer problems and become leaders in the market. Debt-to-equity may indicate the company's risk during business downturns, as well as the capacity of a company to grow.

Business development and Balance sheet are strategic groups with the highest impact on long-term growth.

Strong Geographic presence indicates weaker long-term growth despite its substantial contribution to resilience. This may be due to inefficiencies and alignment difficulties for different geographies. Also, being present in a segment of the highest growth may help the company to grow accordingly. However, such companies will be highly exposed to this segment's risks.

| Company indicator | Strategic group | Growth |
|---|---|---|
| R&D expenditures | Business development | 0,266 |
| Debt-to-equity ratio | Balance sheet | 0,261 |
| Free cash flow to revenue | Cash flow | 0,186 |
| Cash flow margin | Cash flow | 0,114 |
| Sales & Marketing expenditures | Business development | 0,105 |
| Net profit margin | Income statement | 0,105 |
| Operating margin | Income statement | 0,086 |
| Current ratio | Balance sheet | 0,076 |
| Gross profit margin | Income statement | 0,050 |
| Free cash flow | Cash flow | 0,009 |
| Service Revenue | Diversification | -0,024 |
| Fraction of foreign revenues | Diversification | -0,043 |
| Return on equity | Income statement | -0,047 |
| Number of industries | Diversification | -0,065 |
| Interest coverage ratio | Income statement | -0,105 |
| Revenue | Income statement | -0,129 |
| Geographic presence | Diversification | -0,276 |

Table 3. Findings on growth

### 3.2.2. Case Studies

R&D investments correlate the most with the company's capacity for long-term growth. Pegasystems Inc. and Unisys Corporation case studies are selected to analyze the impact of R&D investments on long-term growth from the opposite perspectives.

**Pegasystems Inc.** provides software for the management of business processes and customer relationships. In 2006 the company's revenue was $126mln, with 71,9% coming from services. The company invested 18% of its revenue in R&D in 2006, a significant percentage for the industry, see Image 6. After a slight decrease in R&D investments, the company continued to invest at least 15% of its yearly revenue as of 2010.

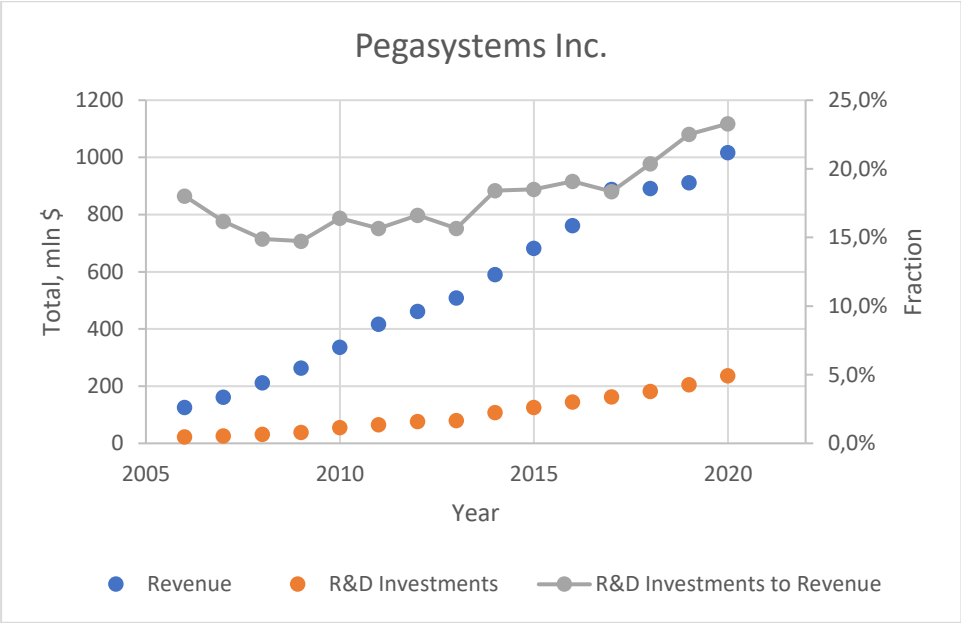


Image 6. Revenue and R&D Investments of Pegasystems Inc.

Since 2006, the company's stock price has grown more than 2200%. Significant R&D investments contributed to the solid long-term growth of the company.

Some critical elements of the R&D strategy of Pegasystems Inc. are:

- The R&D team is responsible for product architecture, core technology development, testing, and quality assurance. In December 2006, the team consisted of 108 people and was significantly augmented by contracted resources
- The goal of the R&D department is to build new products and enhance the capabilities of the existing ones
- Hardware platforms, operating systems, databases, and connectivity are among the technology interests to facilitate software deployment on various information technology infrastructures
- The R&D team is expected to maintain a leadership position in the company's products on the market

**Unisys Corporation** provides cloud applications, infrastructure, enterprise computing, digital workplace, and business process services. In 2006 the company's revenue was $5757,2mln, with 85,4% coming from services. In addition, the company invested 4% of its revenue in R&D in 2006, see Image 6. Both revenue and R&D investments continued to drop over time.

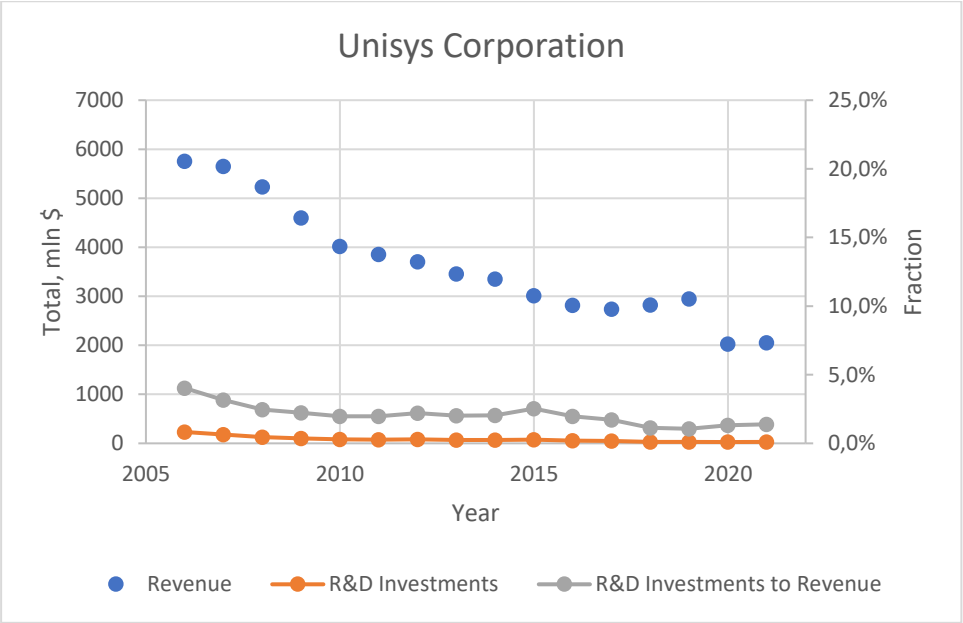


Image 7. Revenue and R&D Investments of Unisys Corporation

Since 2006, the company's stock price has dropped around 45%, opposite to the technology company's growth trend.

R&D investments were tightly coupled with the company's revenue and continued to decrease. Unisys Corporation attempted to refocus R&D investments in 2007 by shifting towards value-added software and services-based offerings. The company planned to involve a broader pull of investments for the hardware components while focusing primarily on the software systems themselves. However, limited innovation didn't allow the company to adapt to the new business conditions, and its revenue kept decreasing.

### 3.2.3. Managerial Conclusions

R&D investment plays a crucial role in a company's long-term growth. High-impart R&D organizations contribute to the development of new products as well as improving the existing ones. Their scope of work is not limited to developing core innovations but covers the entire cycle of product development and even maintenance.

Being agile in following customer needs and building innovative products is an essential feature of effective R&D organizations.

Effective R&D teams are responsible for the company's awareness of the forefront of technology innovations and for maintaining leading positions in the market.
An interesting observation is that R&D investments in product development contribute the most to the long-term growth of a company. In contrast, a fraction of a company's product revenue has little impact on it. This can be explained by the fact that only complex, innovative products that are difficult to replace contribute to long-term growth.

## 4. Ukrainian Technology Companies During War and Potential Recession

SoftServe, Inc. is a privately held Ukrainian company specializing in consultancy services and software development. It was founded in 1993 and has witnessed several crises in its history. More recently, it was impacted by the russian war and a potential economic recession.
The company's strong presence in Ukraine has been a source of tremendous growth over the past decades but has also led to significant uncertainty since the beginning of the war. As a result, SoftServe is actively developing its hubs worldwide, including countries from Latin America, Poland, and others.
Another priority for the company is the diversification of its business presence. SoftServe is opening new offices in regions where our customers are present to build trusted long-term relations and find new customers. This process is time-consuming and may be accelerated by the acquisitors of external companies. The advantage is that this brings new customers, resources, and expertise in a short period of time. Both initiatives align well with the thesis's conclusion about the importance of diversification for the company's resilience to crisis.
SoftServe is optimizing the costs and saving on inefficiencies, consequently reinvesting in sales and marketing. This aligns well with the findings of the thesis on the importance of sales and marketing expenses for quick recovery from a crisis.
SoftServe considers both future scenarios with the realization of the crisis of different severity or without it. During these uncertain times, customers are more conservative

about significant investments in IT infrastructure upgrades. This is more applicable to enterprise customers compared to independent software vendors.

IT Service companies with a presence in Ukraine face similar challenges during the war and before the potential financial crisis. EPAM is an example of a public company that has increased its revenue to $4824,7mln in 2022 from $3758,1mln in 2021. The company has a diversified global presence and revenue streams. Its R&D investments are not specified in the public statement for 2022. Despite the revenue growth in 2022, the company's share price has significantly decreased during 2022, see image 8.


Image 8. Epam share price [13]

According to the National Bank of Ukraine, exports of computer services technology companies in Ukraine grew by 5,8% in 2022 compared to 2021, see Image 9. However, at the same time, the valuation of the public companies decreased despite the revenue growth.

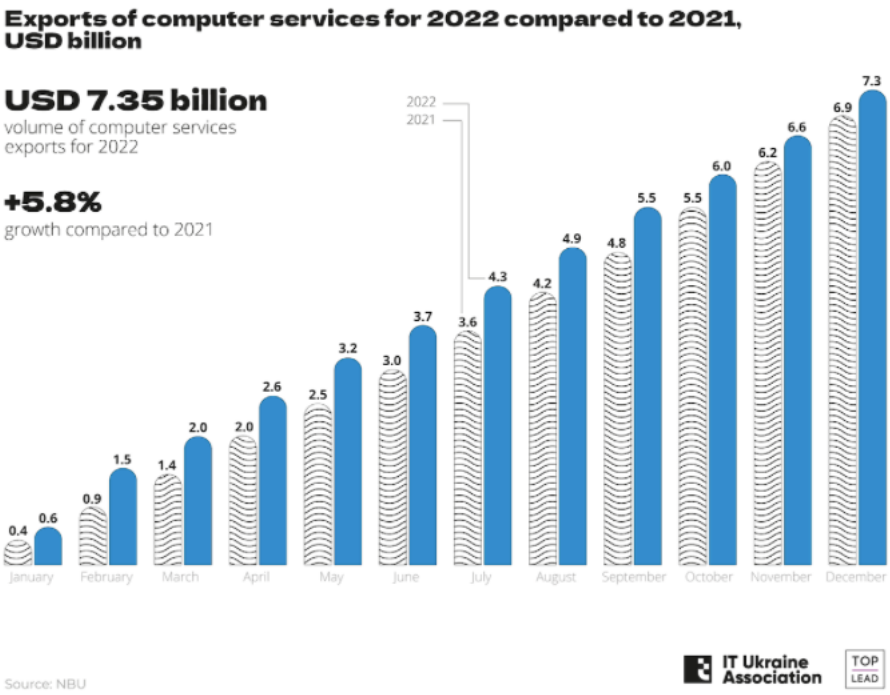


Image 9. Exports of computer services for 2022 compared to 2021 [14]

# 5. Executive summary

## 5.1. Thesis Contributions

Global Financial Crisis had a significant impact on financial and industrial companies but also the technology sector overall. To improve resilience during the economic downturn, it is recommended to focus on investments in the Sales & Marketing department, Research & Development department and broadening the geographic footprint and foreign revenue. Business development efforts naturally contribute to regaining the loss during the crisis, while diversification reduces exposure to the critical negative impact in any single segment.

Investing in Research & Development departments and closely monitoring the debt-to-equity ratio is critical for the company's sustainable growth. Research & development contributes to building unique market-leading products and services that generate recurring revenues and retain customers. The debt-to-equity ratio indicates a company's risks during financial downturns and represents the potential to generate additional revenues.

Interestingly, while broad geographic presence contributes to resilience to crisis, it negatively influences sustainable long-term growth.

The thesis introduces a quantitative methodology for assessing a company's reaction to a crisis. This methodology extracts patterns from historical data and is general enough to be applied to future crises.

## 5.2. Limitations and Suggestions for Future Work

The proposed methodology relies heavily on data quality, and consequently, improving data quality improves the quality of the outcomes of this approach. For instance, financial statements have different intervals of reporting. Therefore, even though there are common standards for financial statements, they still may need to include various information about product/service split, R&D, or Sales & Marketing investments.

Finally, companies may represent information in different currencies, and additional conversions may be needed to perform the analysis.

Future studies may focus on analyzing more companies to get higher confidence in the outcomes. Another direction is to compare the strategic indicators obtained from the analysis of historical data from the Global Financial Crisis and the Covid-19 pandemic may provide additional evidence on the generalizability of this approach. Finally, extending this approach to other industries will enable comparing the outcomes to some of the existing qualitative studies.

## 5.3. Conclusions

This study proposes a quantitative approach to identifying strategic indicators of company resilience and sustainable growth as a reaction to an economic crisis. The study was conducted for the companies from Information Technology Services and Business Software & Services industries and their response to the Global Financial Crisis in 2007-2008.

The findings of the study include the following:

- Companies with solid Sales & Marketing and R&D departments, diverse geographic presence and fraction of foreign revenue, showcased resistance to the negative impact of the financial crisis by restoring their share value within the shortest timeframe.
- Companies with solid R&D departments and good debt-to-equity ratios showcased sustainable growth within 16 year-long duration until the present.
- Despite the positive impact on resilience, diverse geographic presence may slow down sustainable growth in the long term.

The proposed quantitative approach is general enough to apply to companies from different industries. Furthermore, the statistical reliability of the method improves with the number of reviewed companies.

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