THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF SUPPLY CHAIN AND INFORMATION SYSTEMS

Strategic Framework for Supply Chain Manufacturing Relocations

GARRETT Z. CALLENBERGER
SPRING 2024

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Supply Chain and Information Systems
with honors in Supply Chain and Information Systems

Reviewed and approved* by the following:

Dr. Robert Novack
Associate Professor Emeritus of Supply Chain Management
Thesis Supervisor

Dr. Saurabh Bansal
Professor of Supply Chain Management
Honors Adviser

* Electronic approvals are on file.

ABSTRACT

This thesis deals with the development and formulation of a standard framework to be used when analyzing a manufacturing relocation, regardless of company-owned or contracted manufacturer. In what can be a dynamic and complex concept with many stakeholders, the framework aims to create a clearer vision for a manufacturing relocation by separating its pieces and aligning them in a story that makes logical sense.

Humans, alone, are irrational, conflicted by emotions, fallacies, and biases that oftentimes prevent the observation of reality. A structural framework provides the foundation for reality. The first part of the framework (Initiator) obeys to human nature and allows the eye-catching, news-headline, or conversation-starter to initiate the discussion of a manufacturing relocation. This initiator usually always catches everyone's attention, and it's supposed to. The initiator's role is to promote the company's growth and evolution. The second part of the framework (Checks & Balances) checks to see if the initiator is logical. It removes itself from the spotlight and steps back to take the most rational approach, analyzing reality for what it is and aligning company priorities with a decision.

Within the writing, the most common examples of initiators are described and grouped into three categories: Government Policy, Operations, and Business Strategy. The most common example of checks and balances are also described and grouped into three categories: Financials/Shareholder Value, Business Continuity, and Risks.

The data gathered that served as inputs in the framework came from industry leaders who have extensive experience in manufacturing relocation strategy. Their diverse backgrounds and experiences provided the basis for which the framework exists.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

Dr. Bob Novack represents everything good about higher education. His unwavering support and investments he's made to build and shape future leaders continue to withstand the test of time. His relentless efforts have resulted in him being a model for what a student-oriented educator should be like. The guidance he gave me for this thesis amounts to a small percentage of the cumulative guidance he gave me over the last four years. For all of it, I am eternally grateful. Thank you, Dr. Novack, for making such a positive impact on myself and on countless others.

My additional gratitude also goes out to Andy Mowery, Dr. Kevin Linderman, and Dr. Felisa Higgins; all of whom have contributed to the creation of this thesis and have had meaningful impacts on me during my time at Penn State.

Thank you to my family for allowing me the opportunity to explore my curiosities and for being a constant light in my life. And thank you to The Pennsylvania State University and The Smeal College of Business for your help in shaping my future.

Chapter 1

Introduction

Terms and Definitions

Manufacturing relocation is when companies move their manufacturing plants, partnerships, and/or departments to another location. This concept can be related to common terms such as offshore, nearshore, or onshore. Offshoring is when companies move their manufacturing processes *away from* their consumer market, *closer to* their consumer market for nearshore, and *in* their consumer market for onshore. Manufacturing relocation is the umbrella term that the three other concepts fit under. Regardless of whether a company wants to move its manufacturing closer to or further away from its consumer market, it must consider factors that will impact its decision.

Contextual Overview

Companies of the likes of Intel, GE, Nike, Apple, and Dell have been famous for holding a large percent of their manufacturing in China, even though it's further away from their primary consumer markets. They first made this decision to move into China for several reasons: low labor costs, extra government support, well-developed infrastructure, and advanced technology. A large and young workforce in China, coupled with low labor wages, made China an appealing location for cost savings. Support from the Chinese government in the forms of incentives, subsidies, and tax breaks encouraged manufacturing to boost their economy. China also made it easy to transport goods into and out of their nation with well-developed roads, ports, and

airports. Lastly, China has invested significant amounts of money into developing manufacturing technologies so they can be a pioneer in the technology space.

Analyzing manufacturing relocation to China serves simply as an example of who has chosen to make the move and why they have chosen to. Some of the same companies mentioned above are in deliberations and considering moving some of their manufacturing out of China and into other nations such as Vietnam, India, Mexico, Indonesia, and Bangladesh, all for various reasons. While companies and countries serve as the moving pieces and various reasons as the justification for the moves, the manufacturing relocation concept remains unchanged, simply altered to fit the company initiatives, goals, and performance metrics.

The following sections of this paper provide the foundation and history behind offshoring and relocating manufacturing operations, in-depth analyses of conversations with industry professionals who have experienced manufacturing relocation deliberations, a current framework to analyze a relocation, a new way to think about a relocation, and a short case study highlighting the main factors behind an Intel investment. The background section in this thesis will describe, in recent times, how offshoring gained its popularity and why. The methodology section will explain the approach that was taken for the research that went into this thesis followed up with the interviews held with three industry professionals and their main takeaways. The analysis section includes a brief explanation of a popular current framework for manufacturing relocations along with a newly proposed solution to turn a complex concept into a simpler process. The analysis will also include a short case study discussing the main factors behind a recent investment from Intel into Israel.

The methodology for conducting the research that will act as the input to the framework will consist of primary and secondary research, conducted jointly. The primary research includes

interviews with three representatives: a former Chief Procurement Officer at a Fortune 50 CPG company and Chief Supply Chain Officer at a Fortune 500 CPG company, an executive at a large technology company, and a current strategist at a Fortune 40 company. These three representatives serve as very experienced professionals with first-hand experience in the procurement, strategy, and network design and optimization spaces. Their own strategies, as well as the strategies developed at each of the companies they currently and formerly worked at will serve as inputs to the framework and solution. Secondary research will also provide data and evidence that has already been made available to the public through various papers, news articles, official statements, and documents. It will serve to benefit the framework and solution by analyzing who, where, when, and why companies decided to move their manufacturing processes.

Chapter 2

Background

The idea of moving manufacturing processes, facilities, and capital is not a new phenomenon. To fully understand its environment, one must understand how and why it started. While it may not be necessary to go back to the earliest waves of globalization (Industrial Revolution) and global trade, it is critical to go back to a more recent wave.

20th Century Free Flow

The barriers of a free flow of goods were finally overcome when Japan formally surrendered to the United States, marking the end of the second World War in 1945. While the battles were in their last stages, groups and organizations worked hard to create infrastructure to govern a new marketplace once the war ended. What resulted was the creation of the International Monetary Fund (IMF) and World Bank, both in 1944, and the General Agreement on Tariffs and Trade (GATT) in 1948. The IMF worked with their member countries to promote monetary cooperation, global financial stability, international trade, and in general, enhance global economic growth and poverty reduction (U.S. Department of the Treasury, 2024) while the World Bank served as a source of funding and knowledge for developing countries (World Bank, n.d.). The GATT was created for the participating members to contribute to mutually beneficial trade agreements aiming to reduce tariffs and any other barriers to trade including discriminatory treatment (WTO, n.d.). While many more organizations and agreements were made during this time, these three provided the foundation for global commerce growth for years to come.

Once trade barriers were eliminated, offshoring became a popular manufacturing strategy, especially for firms in developed countries moving their manufacturing to developing ones (Masi, 2021). Understanding the high yields and great opportunity, large investments came into the United States from Great Britain, Japan, Germany, and Holland, knowing that U.S. firms were going to see great success with the offshoring strategy (Masi, 2021). The investment inflows made up the Foreign Direct Investments (FDI). Much of these inflows targeted developing economies in Southeast Asia. When China joined the World Trade Organization (WTO) in 1995, they were seen as a clear frontrunner for FDI inflows as the nation represented the world's largest market with the largest population (1.3 billion people at the time) and the presence of related and supporting industries for manufacturing (Masi, 2021).

Reasons for Relocation

Some of the first and most prevalent companies that offshored their manufacturing to China and Southeast Asia included General Electric (GE), Dell, and IBM. While their primary markets remained in the United States and North America, these firms understood that the large labor cost reduction was enough the offset the increased transportation and duty costs (Full Scale, 2021). Each of these firms sought to shift their most labor-intensive and low-skilled operations to Asian countries. Mexico also emerged as a large player in the labor-intensive and low-skilled assembly operations during this time after they created the Maquiladora System, better understood as a manufacturing plant in Mexico while the parent company's administration facility is in the United States (City of San Diego Official Website, n.d.). This system provided the opportunity for U.S.-based companies to capitalize on less expensive labor in Mexico while also having cheaper transportation costs (compared to China and Southeast Asia) and duty-free

trade to the United States thanks to the North America Free Trade Agreement (NAFTA), allowing free trade amongst Canada, United States, and Mexico.

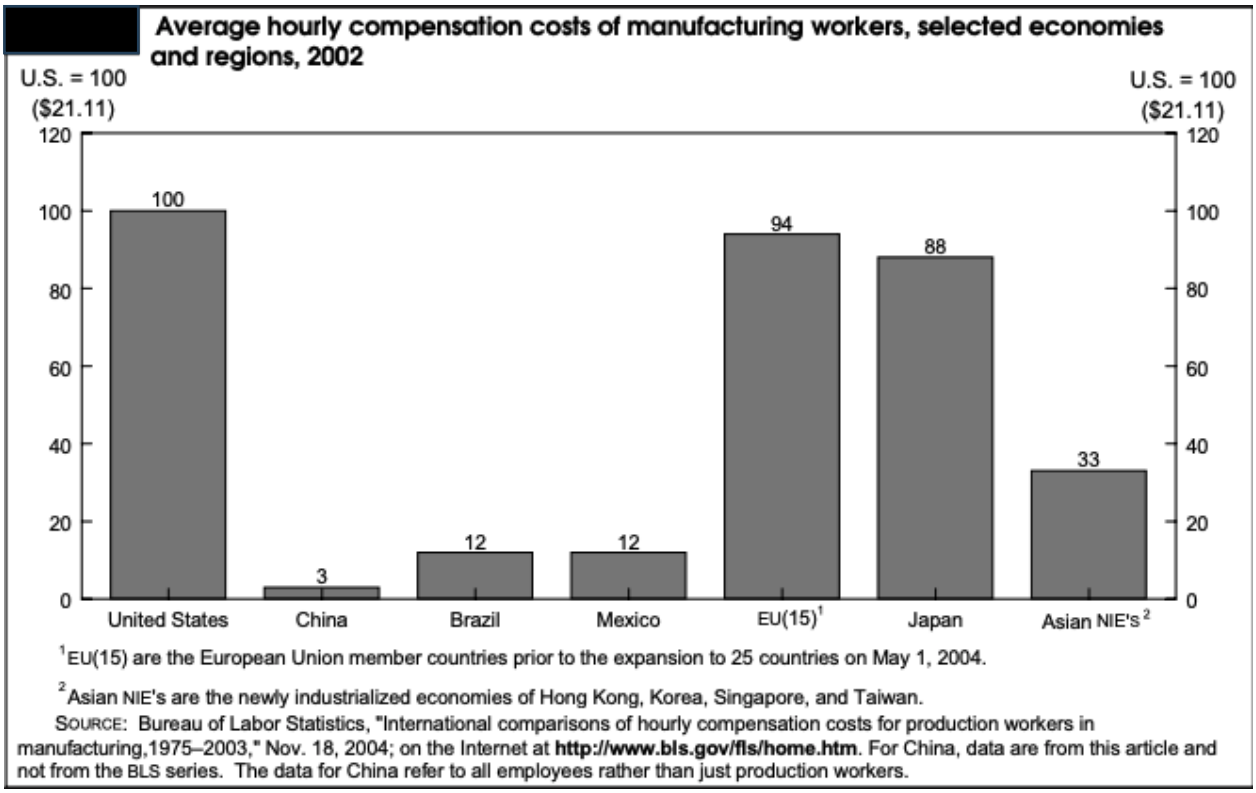

Figure 1: Manufacturing Employee Hourly Wages by Country/Region

As seen in Figure 1, the average manufacturing hourly wages in 2002 in the United States stood at $21.11 while the average was $2.53 in Mexico. Since the data for China in Figure 1 refers to all employees, Figure 2 can be analyzed for China manufacturing employees specifically.

Compensation of urban manufacturing employees and TVE[1] industry employees, Yangtze Delta provinces and Guangdong, China, 2002

Province	Annual earnings (yuan)	Adjusted annual labor compensation		Adjusted monthly labor compensation		Adjusted hourly labor compensation	
		Yuan	U.S. dollars	Yuan	U.S. dollars	Yuan	U.S. dollars
Urban manufacturing employees:							
National average	11,152	17,152	$2,071	1,429	$173	7.87	$0.95
Shanghai municipality	21,957	33,770	4,078	2,814	340	15.50	1.87
Zhejiang province	13,435	20,663	2,496	1,722	208	9.48	1.15
Jiangsu province	11,731	18,042	2,179	1,504	182	8.28	1.00
Guangdong province	14,958	23,005	2,778	1,917	232	10.56	1.28
TVE[1] industry employees:							
National average	6,891	7,442	$899	574	$69	3.13	$0.38
Shanghai municipality	11,939	12,894	1,557	1,075	130	5.86	.71
Zhejiang province	10,188	11,003	1,329	917	111	5.00	.60
Jiangsu province	8,143	8,794	1,062	733	89	4.00	.48
Guangdong province	8,345	9,013	1,088	751	91	4.10	.49

[1]TVE's are town and village enterprises.

NOTES: U.S. dollars are calculated at the 2002 prevailing commercial exchange rate: 8.28 yuan = U.S.$1. Hourly wage estimates for urban workers are calculated under the assumption that urban manufacturing employees perform 2,179 actual hours of work per year and that TVE workers perform 2,200 hours per year. (See text for details.)

SOURCES: Table 3; China National Bureau of Statistics and China Ministry of Labor, compilers, *China Labor Statistical Yearbook 2003* (Beijing, China Statistics Press, 2003), pp. 179, 473; China Ministry of Agriculture, TVE Yearbook Editorial Committee, ed., *China Village and Town Enterprise Yearbook 2003* [in Chinese] (Beijing, China Agriculture Publishing House, 2003), pp. 156, 174.

Figure 2: Manufacturing Employee Wages in China

Amongst urban manufacturing employees in China, the national average wage was 17,152 Yuan which equates to $2,071. Further, that comes to $0.95 an hour. Whereas for manufacturing employees in town and village enterprises within China would earn $0.38 an hour (Banister, 2005). A side-by-side comparison for hourly wages in the United States, Mexico, and both regions in China are shown in Table 1.

Table 1: Manufacturing Employee Hourly Wage by Country/Region Summary

Country/Region	Hourly Wage ($)
United States	$21.11
Mexico	$2.53
Urban China	$0.95
Town/Village China	$0.38

While there were various driving factors to offshoring certain manufacturing processes to Southeast Asia, China, and other developing nations, the primary reasons were centered around a significant decrease in costs. The realized decreased costs included energy, land, and capital but the frontrunner was labor according to a study surveying 1,664 German companies (Kinkel & Maloca, 2009) from 1999 to 2006, stating that the cost of wages was the most important driver for offshoring in emerging markets. The other two key reasons from the study include access to new markets and vicinity to foreign markets. Many firms saw China as an especially positive opportunity as they had it all: low wages and largest emerging market given they had the largest population (Kinkel & Maloca, 2009).

21st Century Developments and Trends

Experts and researchers still do not know if globalization and manufacturing offshoring has hit its peak, but there are trends and initiatives that have become clearer due to recent events. World exports and imports as a share of world GDP have continued to climb over time. In 1946, fifteen percent of the world GDP accounted for world exports and imports and by 2008, sixty-one percent of the world GDP was exports and imports (The World Bank, n.d.). Fast-forward to 2022, seventy-five percent of the world GDP is exports and imports. Focusing on China alone, the nation attracted $68B in net FDI inflow in 2004 and continued to fluctuate while steadily increasing until they hit a peak in 2021 of $344B and dropped significantly in 2022 to $180B, a similar level as they were in 2008 (The World Bank, n.d.). While the exports and imports as a percent of world GDP continues to increase year over year, investments in China look to now possibly be going in the opposite direction (The World Bank, n.d.).

Due to the large investments in China over the last twenty-five years, various impacts have come to fruition. First has been developments of large Chinese companies, including Foxconn, which serves as the largest contract manufacturer for electronics (Foxconn, n.d.). They have close ties with Apple, the electronic and technology giant, as they are the primary manufacturer of the iPhone. As Apple has grown to a giant, so has Foxconn, a company that had 878,000 employees in 2020 (Slotta, 2023). Another impact is the increased reliance on China and Southeast Asia for their manufactured goods as the United States not only sent their dollars in the form of investments, but also sent their leading technologies so China could continue to innovate their manufacturing processes. While China initially exported low-cost goods that were manufactured using labor intensive practices and cheap labor, the country imported valuable technology and management skills. The result was China replacing the United States as the world's largest manufacturer (Yoe, 2022).

Then came January of 2020, the breakout of the Covid-19 pandemic; one that would plague the world and create disruptions felt in all aspects of life. Global supply chains were certainly not invincible. Rather, the pandemic exposed global supply chains risks and impacts that were never seen before on a scale like this. The combination of a drastic increase in demand for essential products like food, cleaning products, and personal hygiene products mixed with labor shortages, government-mandated shutdowns of production facilities, and additional stimulus packages that aided in purchasing and consumption caused extreme supply chain disruptions worldwide (Yoe, 2022). Due to the already long lead times of global supply chains, companies could not flex to the rapid changes in demand. As some products saw drastic demand increases, others saw drastic demand decreases. The long lead times became even longer as production facilities in China temporarily shut down due to Covid-19 outbreaks. For the

production facilities that were able to stay open, the number of orders coming in exceeded capacities and ports in the United States could not handle the amount of product being received all at once, particularly some of the largest and busiest ports in the U.S., including the Port of Los Angeles and Port of Long Beach. It seemed as if all the issues came at once.

United States Government Intervention

The United States government fought fires as quickly as they could, passing short-term legislation that minimized as much damage as possible, but experts knew that it would take more than just short-term solutions to mitigate the damages caused by a failed supply chain. In the years to come, the United States government passed legislation that set out to rebuild supply chains. First came the Infrastructure Investment and Jobs Act. Signed by President Biden towards the end of 2021, the bill allocated $1.2 trillion for “transportation and infrastructure spending with $550 billion of that figure going toward ‘new’ investments and programs” (U.S. Department of Transportation, 2023). Then came the Inflation Reduction Act of 2022. This bill set out to reduce the deficit to “fight inflation, invest in domestic energy production and manufacturing, and reduce carbon emissions to roughly 40% by 2030” (Senate Democrats, 2022). The Inflation Reduction Act set the stage for the final large piece of legislation, creating the foundation to bring manufacturing and production back to the United States. The final bill passed was the CHIPS and Science Act of 2022. The CHIPS and Science Act’s main objective is to bring semiconductor manufacturing back to the United States. The government is investing $52.7 billion for American semiconductor research, development, manufacturing, and workforce development where $39 billion of that will go towards manufacturing incentives in the United States (The United States Government, 2023). Additionally, the act includes $1.5 billion to promote U.S. innovation in wireless supply chains (The United States Government, 2023). In all,

the three pieces of passed legislation provide investments in transportation and infrastructure, domestic energy production and manufacturing, reduced carbon emissions, semiconductor development and production and digital supply chains. It acts as a recipe for a near self-sustaining supply chain, one that is not reliant on foreign nations for its most critical needs.

Government intervention stirred public interest and what resulted was spikes in Google search trends for the terms “nearshoring”, “deglobalization”, and “reshoring,” as seen in Figure 3.

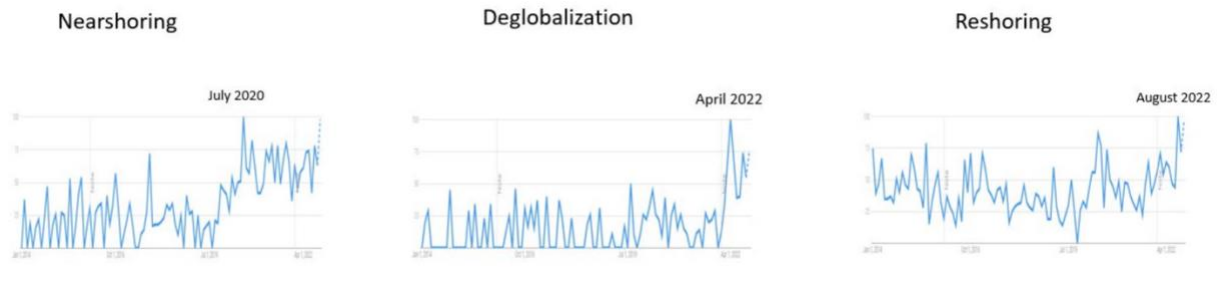

Figure 3: Google Search Trends

Despite the investments, news, and talking, U.S. imports in 2022 were roughly forty percent above pre-pandemic levels, but China’s share in U.S. imports dropped from 21.6 percent to 16.3 percent between 2017 and 2022. This new data suggests that companies may not be ready to fully reshore, rather, they may just be interested in getting out of China (Freund et al, 2023).

The history behind manufacturing relocations has set the stage for its current environment. In its most modern form, relocation decisions arrive at the intersection of many competing and ever-changing factors. From government policy to environmental and societal pressures, to security and risk, it is not an easy job to be the decision-maker. In the next section,

this thesis will take a deeper dive into conversations with three decision-makers with experiences in this space to get a better understanding of the most important driving and deliberating factors.

Chapter 3

Methodology and Analysis

Methodology and Interviewee Information

The primary research process provides an in-depth and warranted opportunity to learn about this space within supply chain strategy. A great way to do this is to create dialogue with professionals who have experienced it first-hand. The professionals who gave their time to assist in this process had not only experienced a manufacturing relocation decision multiple times, but also have been trusted by their organizations to lead them through the strategic process. Three professionals gave their insights, knowledge, and expertise to benefit this paper. Information about each one is below:

1) Former Chief Supply Chain Officer at Fortune 500 CPG company & former Chief Procurement Officer at Fortune 50 CPG company.
2) Current Head of Sourcing at European Fortune 200 technology company, former VP of Global Procurement at CPG company, former VP of Global Strategic Sourcing at Fortune 200 CPG company.
3) Current Director of Supply Chain Strategy at Fortune 50 technology company.

Each professional was asked an identical set of questions to create unanimity and consistency from one interview to the next. The questions asked during each interview are in Appendix A.

The purpose of conducting primary research in the form of interviews was to obtain first-hand insight from sources who have the credibility to contribute to a framework creation on the subject. It also allowed for a more personable environment to analyze not just the words they are speaking, but also their tones and emotions.

Interview 1

There were many instances in which this professional was a part of strategic decision-making processes related to large-scale manufacturing relocation, but one primary example was discussed. The example was a decision to shut down an internal manufacturing plant in the eastern U.S. that produced a large percentage of the company's core products. The company decided to move the low-density products to an external plant still within proximity to the old plant and the higher-density products to a foreign internal plant. The main reason why the company made the decision was *shareholder value*. While shareholder value was the overarching concept, there were smaller areas including profitability growth, increased earnings per share (EPS), greater capital utilization and return on invested capital, and business continuity that contributed to the increased shareholder value.

> *"Companies exist to create a product and to grow shareholder value. If you don't grow shareholder value, you don't survive."*

The shareholder value theme remains the same for private companies as it does for public companies. Although there is not as great a pressure on private companies due to the absence of disclosing financials, they still have a mindset revolved around making "penny profits," simply just looking to turn a profit while public companies are focused on increasing profit margins to benefit the shareholders over time.

They used a consistent process for this type of decision-making with one of the companies the professional worked for. The first step of the process was Value Chain Segmentation (VCS). To get away from a "one-size-fits-all" supply chain design, they customized each segment's supply chain design based on the business and product type. This process also allowed consistent engagement with stakeholders of each business to build a supply chain that suited their needs. The second step in the process was the "Make vs Buy" discussion. It was one that was based on capital, costs, and other strategic factors. They would follow it up with least-landed cost models for each of the different scenarios within discussion.

While the primary factors included many centered around growing shareholder value, the companies also considered other factors that came secondary. Some of these factors included regulation and government policy, workforce/labor pools, one-way or two-way exits, and risk mitigation. While there may be various "initiators," increasing shareholder value and long-term growth were the final deciders in all the different instances this professional was a part of.

Interview 2

From explanations of three different instances in which this professional has been a part of and led discussions around a large-scale manufacturing relocation, there was a wide variety of contributors and factors considered, including government policies, rezoning, residential requirements, strategic footprint, tax environment, labor pools, customer requirements, supply chain simplification, optimization, and cost savings. The factors explained were able to be articulated in a way that represented a hierarchy, with the lowest common denominator being *shareholder value*. The one main factor, again, was the impact to shareholder value.

"Without shareholder value, nothing else makes sense. What can move the needle the most from the shareholder point of view and generate the most long-term value?"

The commonalities between the processes used at different companies was the thorough analysis of costs and impacts. Before the analysis, they asked themselves "Do we have the right group of people to evaluate the costs and impacts of this move?" The different groups of people included representatives and leaders in each function of the business, decision-makers, and influencers. If they did not have the necessary personnel, they oftentimes found themselves bringing in third-party consultants to assist. By creating buckets of costs and impacts, the company was better suited to make a decision based on the evidence and data they obtained.

The differences and variety from one instance to the next for this professional began with differences in industry and company goals. The strategic direction in which the company intended to go played a vital part in the decision-making process of a manufacturing relocation. For one company, they understood the large-scale part they played in the industry and human civilization at large; if they failed, the world would fail. The company was the only source in the world for a specific piece of human-dependent technology, so the main goal revolved around simply staying profitable. Another company focused on providing dividends to shareholders through growth of profit margins as they understand their position in the competitive market. Whatever the industry, company, and product it was, the result was a strategic decision based on what would shift the shareholder needle the most.

Interview 3

The final interview included a call for urgency. Before discussing the strategies, the professional expressed their concern for a widespread strategic framework on this subject. As the number of disruptive events has increased across the globe (pandemics, wars, various shutdowns, etc.), stretching their supply chain to their maximum capacity to minimize costs from an efficiency standpoint is a thing of the past. Their company is taking more of a regionalization approach to manufacture locally to meet local demand.

> *"The days of optimizing our supply chain are over. There are now different risks that are taking precedent."*

Due to the fluctuating environments in laws, calamities, and government affairs, a unified risk framework can better help their organization to make decisions to minimize the risks they are facing. The decision-making framework they use helps determine the priority of a certain risk event using the product of its probability and impact; most of the time, financial impact.

Two of the four critical factors they consider the most in their discussions are directly related to impacting shareholder value: end-to-end cost of the product and quality costs. The other two factors were related to business continuity and risk management: productivity time/enablement timelines and the questions "What are the key risks you are trying to solve? And are you eliminating them by making this move?" While shareholder value was not the end-all-be-all in the conversation, it certainly served as a critical priority.

Beyond the critical considering factors, their company used a process to further analyze a manufacturing relocation. They would go about answering and discussing the following set of questions:

1. Where is the inbound material coming from?
2. Where are the customers? / Where is the outbound material going to?
3. What is the trade environment like between all the countries in contention around the world?

Based on these questions, they are first focusing on the matter from a geographic standpoint to understand the network in which they operate, further understanding the cost and risk mitigation perspectives. Geopolitical matters are volatile, so the last question at hand can uncover other various cost contributors as well as risk mitigation from a security perspective.

Interview Conclusion

Between all three interviews conducted, impact to shareholder value was the deciding factor (or one of) behind all the decisions that were discussed. The shareholder value impact was not the only factor being considered. Other factors such as regulatory issues and policies, labor pool availability, risk mitigation, customer requirements, and geopolitical matters all played contributing parts in the deep analysis of a large-scale manufacturing relocation, but no other factor was as decisive as shareholder value impact.

The research served the purpose to better understand what is currently going on in this environment between a variety of organizations and credible professionals. The information from the interviews and secondary research will lead into a strategic framework discussed in the next section. This framework can be used by organizations and teams looking to explore the opportunity of a manufacturing relocation by focusing on the most critical factors that will impact their decision.

Comprehensive Tsai and Urmetzer Framework

Companies face financial, operational, political, and strategic pressures as a result of the Covid-19 pandemic and various geopolitical tensions worldwide (Tsai and Urmetzer, 2023). Academia and research initiatives have reacted in their own way by producing more literature related to manufacturing reshoring. From Tsai and Urmetzer's (2023) conducted study, the most scholarly manufacturing reshoring publications were used to extract their data and synthesize the factors that were most prevalent in causing reshoring. Unlike offshoring, a concept that has been researched in abundance largely due to globalization, reshoring is a newer concept. One hundred fifty-eight peer-reviewed articles, editorials, and research notes from peer-reviewed journals were synthesized in their study. A distribution of the dates in which they were published is visualized in Figure 4:

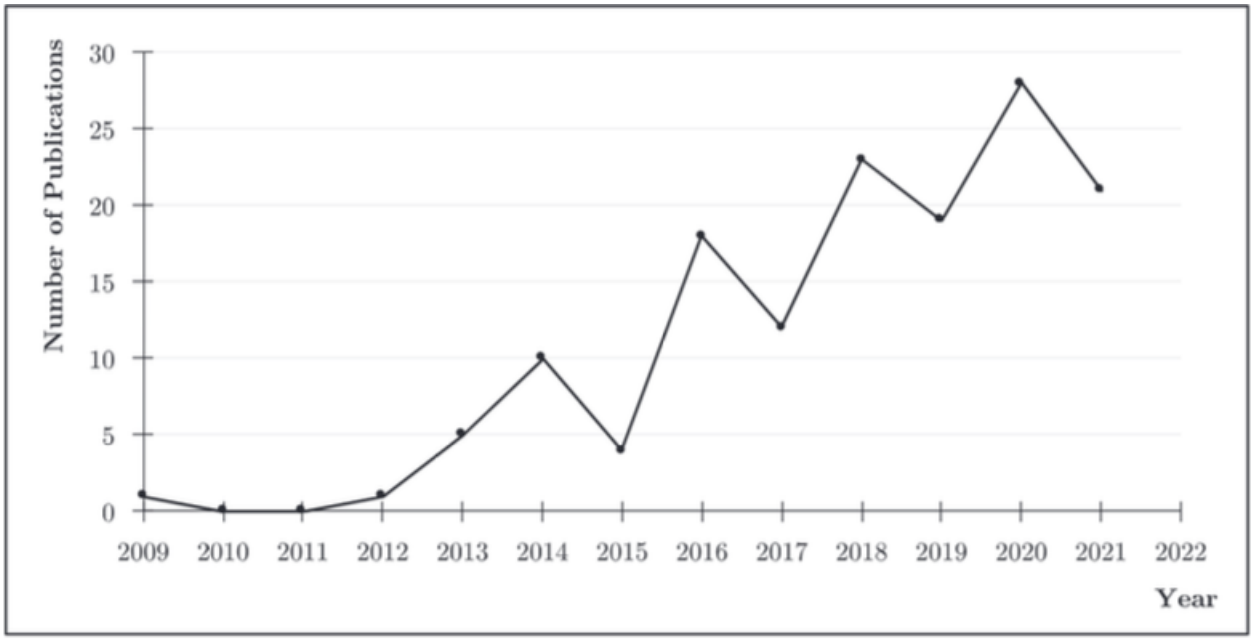

Figure 4: Publication Date Distribution (Input for Tsai and Urmetzer's Framework)

Tsai and Urmetzer (2023) synthesized all the one hundred fifty-eight publications into seven decisional aspects grouped into three categories. What resulted is their "C-D-E decisional framework" which further stands for consideration, decision, and evaluation decisional framework, referencing the three categories the aspects are grouped into.

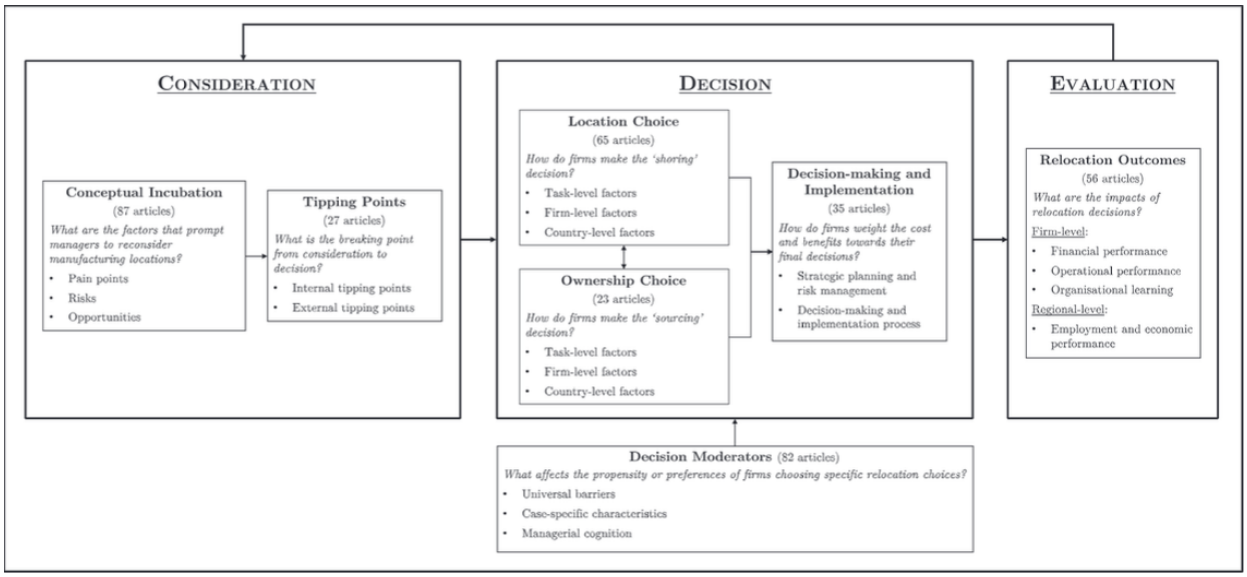

Figure 5: Tsai and Urmetzer's Visualized Framework

While there may be frameworks already in place to guide companies through a comprehensive strategic plan when executing a manufacturing relocation, like the one shown in Figure 5, this thesis is focused less on the comprehensive and more on the critical. The critical driving forces from one relocation example to the next oftentimes overlap and the reasoning for executing the relocation also oftentimes overlap, creating trends and many similarities throughout time.

Initiator/Checks and Balances Framework

To better understand the strategy and context behind manufacturing relocations, one may look at the situation using a different framework seen below:

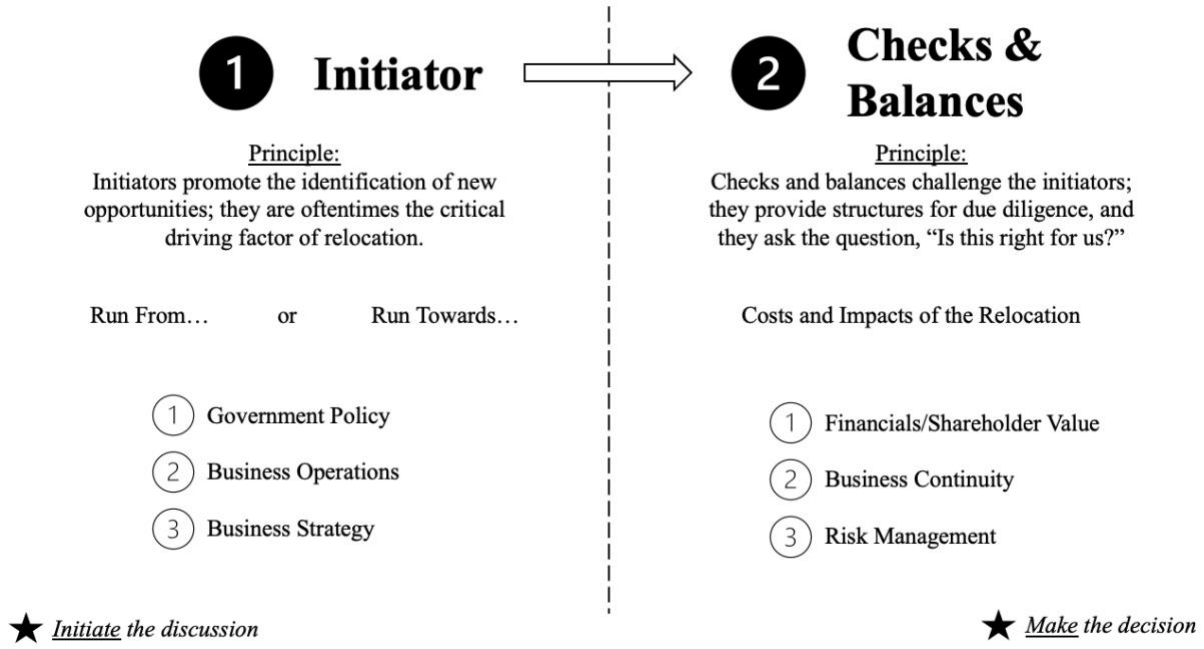

Figure 6: Initiator/Checks and Balances Framework

Initiator Analysis

As seen in Figure 6, there is an initiator (sometimes multiple) and then there are checks and balances. The role of the initiator is to force companies to constantly observe and look out for every new opportunity. They are oftentimes the largest "needle-movers" from a financial standpoint, and they oftentimes serve as the critical driving factor for a manufacturing relocation. Since they are the critical driving factors, they are oftentimes considered to be what keep the company with or ahead of the market. They are also oftentimes used in news headlines to state why companies are relocating their manufacturing. Initiating factors are further broken down

into two categories: running from or running towards. Specific examples for initiators related to government policy and regulation, running from something includes the United States government announcing tariffs on imports coming from China for the next ten years, so a given company decides to relocate their manufacturing from China to India where there are no tariffs. Running towards something includes the United States government announcing large investments and subsidies to companies who manufacture semiconductors domestically in the United States for the next twenty years, so a given company moves their manufacturing from Japan to the United States to benefit from the subsidies.

To better understand whether a company's initiator is causing them to run from something or to run towards something helps one better understand the full context, or the full story behind the motive. To run from something may be better characterized as a company prioritizing mitigating a certain risk or being in a protective position. To run towards something may be better characterized as a company prioritizing to capitalize on an opportunity that may not be available later down the line. Some of the most common initiators found in the interviews and public domains include the following in Table 2:

Table 2: Common Initiators

Area of Business	Run From…	Run Towards…
Government Policy	Increased taxes Imposed tariffs Trade restrictions Government tensions/instability	Subsidies SDI/Investments Improved infrastructure
Operations	Quality concerns Expensive labor	Cheap labor Skilled labor Manufacturing technology Cheap energy/land/capital costs Specific manufacturing partner location
Business Strategy	Security risks Rezoning purposes Declining country economy Declining market/demand Climate risks	Value Chain Segmentation Flexibility/Adaptability Planned risk mitigation Supply Chain Simplification New markets/vicinity to current markets Vicinity to raw materials/supply

Checks and Balances Analysis

On the other side of the framework, the checks and balances obtain an immensely important responsibility. If executed correctly, the checks and balances challenge the initiators; they ask the questions “Are you sure?”, “Does this make sense?”, and “Is this right for us?” In other words, the checks and balances provide a way for companies to validate and comprehensively justify a manufacturing relocation.

To begin, a company analyzing a possible manufacturing relocation due to a recent initiator must first ask themselves, “Do we have the right people to comprehensively analyze this situation and to understand all of the costs and impacts?” A “yes” to the previous question would mean bringing in the necessary business leaders and expertise from engineering, supply chain, marketing, sales, finance, accounting, and representatives from other necessary functional business units to better understand the costs and impacts relating to all other stakeholders. If the

answer is “no” to the previous question, it would require the company to likely bring in a third party with expertise to execute the analysis.

The way that the United States legislative, executive, and judicial branches all provide checks and balances for each other so that not one branch can overpower the others in times of decision-making, the checks and balances in the framework provide the same value. When an initiator comes about, there is likely an emotional reaction in addition to a logistical and operational reaction. These emotional reactions can cause companies to make decisions that make sense in the short-term but may not make sense in the long-term. For example, if a company that has all their manufacturing operations in three sites under the same company in China that all operate the same way and is beginning to experience costly quality concerns and an increase in complaints from a large customer, they may be faced with making a decision. An emotional reaction may tell them that they need to get out of this relationship immediately altogether, relocate back to the United States, and resume business with another partner. What would this do to margins, profitability, labor costs, and land and energy costs? Or does is make more sense to invest more time and money into the manufacturing partner’s processes and work together to create a product of higher quality?

These checks and balances can be broken down further into categories of impact: Financials/Shareholder Value, Business Continuity, and Risks. Certain metrics, measures, and concepts are assessed under each of these categories. Under the Financials/Shareholder Value category, a company may go through the checks and balances process for the initiator by analyzing impacts related to future revenue, costs, margins, profitability, EPS, capital utilization, end-to-end costs, quality costs, shutdown/move-in costs, etc. Under the Business Continuity category, a company may go through the checks and balances process for the initiator by

analyzing impacts related to supply chain flexibility, adaptability, productivity, enablement times, lead times, environmental impacts, etc. Under the Risks category, a company may go through the checks and balances process for the initiator by analyzing impacts related to the risks they are decreasing or eliminating and the risks they are assuming given the relocation. Further analysis of these risks may include establishing which risks will assume priority given the product of the likelihood of the certain risk occurring and the impact that risk with create (Likelihood * Impact). The higher the product, the higher the priority.

Given the company goals and objectives as well as the nature of the industry they are in and various other factors, there will be different measures of checks and balances across the board. For example, if a technology company is selling a product with highly volatile demand that is dependent on other technological successes (software, hardware, etc.), supply chain flexibility and adaptability will be a very important measure of checks and balances as those concepts are very important to them. Compared to large soup company that sells a very functional product and a staple on many American's pantry shelves; they have a very stable, predictable demand that should not change much over time (Fisher, 1997). Supply chain flexibility and adaptability may not be very important to them as they will not have to change much due to a stable demand. For other common checks and balances within each category, see Table 3:

Table 3: Common Checks and Balances

Financials/Shareholder Value	Business Continuity	Risks
Revenue	Supply Chain Flexibility	What risks are being decreased or eliminated?
Costs	Supply Chain Adaptability	What risks are being increased or assumed?
Profit Margins	Productivity	
Profitability	Enablement Times	
Earnings Per Share	Lead Times	
Capital Utilization	Environmental Impacts	
End-to-End Costs		
Quality Costs		
Shutdown/Move-In Costs		

Intel Case Study using Initiator/Checks and Balances Framework

Intel, the technology company known for its manufacturing of central processing units (CPUs) and semiconductors, has had operations in Israel for nearly five decades. One of their latest moves in the country included a $25 billion investment for a new factory in Kiryat Gat, intended to help meet their future manufacturing needs and capacities (Reuters, 2023). The investment was announced in June 2023. Four months later, Hamas, a Palestinian militant group, attacked the Gaza Strip with the objective to take control of the area. The new factory set to be in Kiryat Gat is just twenty-five miles away from the attacks. Israel and Hamas have fought against each other in five wars since 2006.

Initial reactions to reverse the investment are prompted by the fact that the country they are investing in is under attack and currently at war, which could include many risks including disrupted network and transportation channels, labor difficulties, financial hardship, etc. In this case, the attacks and conflict between Hamas and Israel represent a “run from” initiator driving a possible manufacturing relocation. Intel, providing reasoning for why they continue their

investment despite extreme risks, stated the investment will “foster a more resilient global supply chain” (Lu, 2023). This reasoning is very similar to some of the signs that the largest semiconductor manufacturers are aiming to diversify their global production. The resulting checks and balances most prevalent in this case are supply chain flexibility and adaptability along with lead times and likely revenues given the company is looking to expand manufacturing capacities. Pertaining to risks, the likelihood the company does not have the capacity to fulfill demand given constrained capacities will decrease as they directly diversified and added capacity, but possible risks directly related to the war will also be assumed by Intel given their investment in the country.

In summary, the current environment in Israel has led to many uncertainties in the supply chain world, as do all wars, conflicts, and government instability. The war and conflict in Israel were the initiators behind Intel having the opportunity to leave the country altogether to eliminate associated risks with the war. The checks and balances including supply chain flexibility and adaptability to ensure Intel is meeting global demand proved most worthy to keep part of the company’s manufacturing in Israel.

Chapter 4

Conclusion

The purpose of this paper initially revolved simply around the exploration of a vitally important concept that is discussed in great depths in global supply chain. To better understand the reasons and justifications for a manufacturing relocation is to better understand a complex global supply chain and its broad relationships. A key objective in writing this paper quickly became to be able to break down a complex concept (manufacturing relocation) and create a simple and straightforward structure to analyze any given past, present, or future manufacturing relocation. The paper is also intended to begin discussions around manufacturing relocations and the company's purposes and objectives with a relocation, setting the stage for further discussions on the topic.

The purpose of this paper is not the following: a comprehensive analysis of how to execute a manufacturing relocation, a recommendation for where to relocate manufacturing processes, or an examination of successes and failures of past manufacturing relocations. With all the complexities, relationships, and impacts, a comprehensive paper on the topic of manufacturing relocations would simply take far beyond the amount of time to write than what was allotted to write this paper. Additionally, there is too important of information that is still unavailable to the public and to companies when discussing and making these decisions. Important information like the available technology, data and security, and government affairs, two, five, and ten years down the line. The uncertainty creates skepticism, resulting in researchers and industry professionals being forced to make the best decision they can with the information they have available to them. Two forces pushing them in different directions; one

being the uncertainty that they may not have enough information to make a decision and the other being the devastation of a missed opportunity in relation to competitors.

This paper accomplished providing a clear explanation of some of the most common reasons for past manufacturing relocations, beginning with the earliest examples. Some of these reasons included extremely low labor costs which provided obvious financial incentives to firms. The vicinity to new markets also provided market share and growth opportunities to firms. It also accomplished analyzing and summarizing the findings from three industry professionals who have been a part of discussions and decision-making processes for manufacturing relocations for their firms. Seemingly, most everything else came second to the primary focus on shareholder value and other financial incentives in their processes. Lastly, this paper analyzes a new framework for strategic manufacturing relocations. While this framework is not intended to be superior nor comprehensive, it provides a simple and straightforward view of a complex and multi-dimensional concept, focusing on the most important factors to consider.

Appendix A

Industry Professional Interview Question Template

1) What were the instances in which you were a part of large-scale manufacturing relocation decision-making?
2) Is it possible to identify one main reason why you moved? Explain what and why…
3) What were the primary factors you considered when strategizing a manufacturing relocation?
4) What were the secondary factors you considered when strategizing a manufacturing relocation?
5) Who were the stakeholders in the process?
6) Was there a framework that you used when discussing a manufacturing relocation?
7) What was the general process you used when involved in a manufacturing relocation decision?
8) Did this process work well? What would you change about it?

BIBLIOGRAPHY

Banister, J. (2005). (rep.). *Monthly Labor Review - Manufacturing Compensation in China* (pp. 22–40).

Bipartisan Infrastructure Law (BIL) / infrastructure investment and jobs act (IIJA). U.S. Department of Transportation. (2023). https://www.phmsa.dot.gov/legislative-mandates/bipartisan-infrastructure-law-bil-infrastructure-investment-and-jobs-act-iija#:~:text=The%20Infrastructure%20Investment%20and%20Jobs,%22new%22%20investments%20and%20programs.

Fisher, M.L. (1997) What Is the Right Supply Chain for Your Product? A Simple Framework Can Help You Figure out the Answer. Harvard Business Review, 75, 105-116.

Freund, C., Mattoo, A., Mulabdic, A., & Ruta, M. (2023). (rep.). *Is US Trade Policy Reshaping Global Supply Chains?* Retrieved from https://documents1.worldbank.org/curated/en/099812010312311610/pdf/IDU0938e50fe0608704ef70b7d005cda58b5af0d.pdf.

The history of offshoring: How it all began. Full Scale. (2022, September 21). https://fullscale.io/blog/history-of-offshoring/#:~:text=History%20of%20Offshoring%3A%20How%20It%20All%20Started,of%20outsourcing%20at%20the%20time.

International Monetary Fund. U.S. Department of the Treasury. (2024, January 9). https://home.treasury.gov/policy-issues/international/international-monetary-fund#:~:text=The%20IMF%20is%20an%20organization,reduce%20poverty%20around%20the%20world

Kinkel, S., & Maloca, S. (2009). Drivers and antecedents of manufacturing offshoring and backshoring - A German perspective. *Journal of Purchasing and Supply Management, 15*(3), 154–165.

Lu, Y. (2023, December 27). *Intel moves forward with $25 billion chip plant expansion in Israel*. The New York Times. https://www.nytimes.com/2023/12/27/world/middleeast/intel-israel-factory-expansion.html

Maquiladoras/Twin Plants. City of San Diego Official Website. (n.d.). https://www.sandiego.gov/economic-development/sandiego/trade/mexico/maquiladoras

Masi, D. (2021). (publication). *1 past, present, and future of supply chains* (pp. 1–15).

Overview of Hon Hai Technology Group (Foxconn®). Foxconn. (n.d.). https://www.honhai.com/en-us/about/group-profile

Reuters. (2023). *Intel to invest $25 billion in Israel factory in record deal, ...* https://www.reuters.com/technology/intel-build-25-bln-factory-largest-foreign-investment-israel-netanyahu-2023-06-18/

Review of *Summary: the inflation reduction act of 2022*. (n.d.). *Senate Democrats*. Retrieved from https://www.democrats.senate.gov/imo/media/doc/inflation_reduction_act_one_page_summary.pdf.

Slotta, D. (2023, June 12). *Foxconn: Employee number 2022*. Statista. https://www.statista.com/statistics/1389729/foxconn-employee-number/#:~:text=In%202022%2C%20the%20Taiwanese%20electronics,devices%20for%20the%20overseas%20market

Tsai, T.-Y., & Urmetzer, F. (2023). A decisional framework for manufacturing relocation: Consolidating and expanding the reshoring debate. *International Journal of Management Reviews*. https://onlinelibrary.wiley.com/doi/10.1111/ijmr.12352

The United States Government. (2023, February 3). *Fact sheet: Chips and science act will lower costs, create jobs, strengthen supply chains, and Counter China*. The White House. https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/

Who we are. World Bank. (n.d.). https://www.worldbank.org/en/who-we-are#:~:text=The%20World%20Bank%20Group%20is%20one%20of%20the%20world's%20largest,prosperity%2C%20and%20promoting%20sustainable%20development.

The World Bank. (n.d.). Foreign direct investment, net inflows (boP, current US$) - China.

World Trade Organization. WTO. (n.d.). https://www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm

Yoe, J. (2022). (publication). *Monthly Labor Review*. Retrieved from https://www.bls.gov/opub/mlr/2022/beyond-bls/covid-19-has-unfairly-hurt-the-reputation-of-global-supply-chains.htm#:~:text=Increased%20demand%20for%20personal%20protective,caused%20serious%20goods%20shortages%20worldwide.