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The Construction of a Visual Model to Examine the Interactive Dynamics Between Creative Destruction and Corporate Longevity

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February 2022

Abstract

Richard Foster and Sarah Kaplan introduced Corporate Longevity as a graph that follows the rolling seven-year lifetime average of companies listed on the S&P 500 Index¹, which they propose to decline over time due to the capitalistic process named Creative Destruction². This research aimed to understand why or how the Foster Corporate Longevity Wave assumed the shape of a perfect sinusoidal wave with a consistent wavelength and reduction in amplitude, which is quite unique for a wave that should be random due to random events. With the hypothesis that Creative Destruction is responsible for the shape of the Foster Corporate Longevity Wave, a systems modelling methodology was used to construct a single visual model³ to examine the dynamic influence Creative Destruction may have on the shape of the Foster Corporate Longevity Wave. Creative Destruction is represented by innovation, economic and civilization waves. During the construction of the visual model, the following observations were made: (1) the Foster Corporate Longevity Wave has a consistent oscillating wavelength of 20 years and also a consistent longevity delta reduction of approximately 10.5% in wave amplitude after each wave cycle, (2) there is a significant interactive dynamic relationship between the innovation and the economic waves, which went through a wave phase shift during World War II, (3) the innovation and economic waves are in perfect harmonic phase with the Foster Corporate Longevity Wave until 2020. With the corrective extrapolation to keep the innovation and economic waves in phase with the Corporate

¹ Standard and Poor, Stock Market Index.

² Creative Destruction was introduced by Joseph Alios Schumpeter in his book titled “Capitalism, Socialism and Democracy” (Schumpeter, 1942).

³ The visual model will be referred to as the CLIEC (Corporate Longevity, Innovation, Economic, and Civilization) model.



Longevity Wave from 2020 until at least the year 2050, the following changes were made to the propagation of the innovation and economic waves from the year 2010 and onwards: (1) the innovation wave will have to fracture into several wavelets, and (2) the economic wave's wavelength must be halved to a wavelength of 20 years. They year 2020 was identified as a unique point in time with: (1) the disruption in the harmonious shaping of the Foster Corporate Longevity Wave, (2) the start of a new civilization wave cycle, and (3) also the start for the global economy to move into a recession until 2025 when it will go into a depression.

At the time this research and the construction of the integrated visual model were initiated in 2018, it was not possible to have known that the COVID pandemic would broke out in 2020 as the year for the global economic reset and the new civilization normal this paper predicted.

Keywords:

Richard Foster, Nikolai Kondratieff, Joseph Alois Schumpeter, Alvin Toffler, Innovation, Economics, Corporate, Longevity, Survivability, Civilization, Waves, Model, Creative Destruction.



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1 Introduction

“But the larger and slower changes are more important to understanding the role of innovation and its implications for corporate strategy.” (Forrester, 1979)

“... the same process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one.”
(Schumpeter, 1942)

Richard Foster and Sarah Kaplan introduced Corporate Longevity as a graph that follows the rolling seven-year lifetime average of companies listed on the S&P 500 Index⁴, which they found to decline over time due to Creative Destruction⁵. This research wanted to understand why or how the Foster Corporate Longevity Wave assumed the shape of a sinusoidal wave, which is quite unique for a wave that should be random due to random events.

From previous research, the decline of Corporate Longevity (or lifespan) as a trend since the 1960s has already been researched with conclusive quantitative results:

1. Richard Foster and Sarah Kaplan published a book titled “Creative Destruction: Why Companies That Are Built to Last Underperform the Market — and How to Successfully Transform Them” (Foster and Kaplan, 2001b). They have found that the average lifetime of companies listed on the S&P 500 Index measured with a rolling seven-year average shortened dramatically over time. The average lifetime of corporations on the S&P 500 was 61 years in 1959 and they predicted it to be less than 15 years after 2025 (Foster and Kaplan, 2001a) (Foster, 2012).
2. In 2016 Vijay Govindarajan performed a research study where he analyzed 29,688 firms that were listed on a public stock exchange from 1960 through to 2009 and which he divided into 10-year cohorts. He found that the newly listed corporations fail much sooner than corporations in older cohorts (Govindarajan and Srivastava, 2016). A public company that was listed in the 1960s had a 92% survival probability rate to stay listed the first five years, with a decline in the 2000s to 63% survival probability rate to stay listed during first five years.

⁴ Standard and Poor, Stock Market Index.

⁵ Creative Destruction was introduced by Joseph Alios Schumpeter in his book titled “Capitalism, Socialism and Democracy” (Schumpeter, 1942).



3. Martin Reeves analyzed 35,000 public listed corporations since 1950 (Reeves, 2015), they have found that the average age of a corporation in 1970 was 58 years with a five-year average mortality risk probability of 5% while in 2010 the average age was 33 years with a five-year average mortality risk probability of 32%. This quantitative data correlates extremely well with the data provided by Govindarajan.
4. In 2016 Bain & Company predicted that 66% of large companies worth US\$5 billion or more will either go bankrupt, be acquired or be divided up within the next 15 years (Zook and Allen, 2016).

With sustaining growth as a requirement for corporate longevity (Kutcher, 2014) (Zook and Allen, 2016), a small group of corporations do find it possible to do so:

1. Chris Zook and James Allen at Bain & Company have found that “11% of companies manage to grow profits and revenues by 5.5% or more over a 10-year period and earn back their cost of capital.” These companies were named Sustained Value Creator (SVCs) (Allen and Zook, 2012) (Zook and Allen, 2016) (Zook and Allen, 2016b).
2. PwC Strategy& invented the “Fit for Growth Index Score” analytical tool to measure the capability for a corporation to successfully grow sustainably and subsequently increase shareholder returns (Couto and Divakaran, 2013). They have found that 6% of corporations could perform well on all three specific dimensions which they defined as (1) Strategic Clarity and Coherence, (2) Resource Alignment and (3) Supportive Organization.

To sustain shareholder value, it has been shown that there is a direct correlation between corporate innovation and share price:

1. Corporate innovation generates shareholder confidence and can directly influence share price and market capitalization when a company release new inventions as new products to the market, as in the case with Tesla Motors Inc. (Bouwer, 2019).
2. Corporations who are identified as top innovators do outperform their competitors on the stock markets, with growth measured as market capitalization and TSR (Total Shareholder Return) (Jones, 2012) (Jones, 2014) (Engel, 2013) (Engel, 2015) (Barton, 2017).

Creative Destruction was introduced by Prof Schumpeter (Schumpeter, 1942) as a capitalistic process to explain the troughs (crisis) and peaks (boom) of an economic business cycle (Schumpeter, 1927) (Schumpeter, 1939) as a result driven by innovation and



entrepreneurship. It has also been proposed that Creative Destruction can influence corporate longevity (Schumpeter, 1942) (Forrester and Kaplan, 2001). According to this logic, it can be argued that it is also possible for strategic corporate innovation (Reeves, 2015) (Markides, 1997) (McGrath and Gourlay, 2013) (Govindarajan and Srivastava, 2016) to influence the survival of corporations as illustrated in Figure 1.

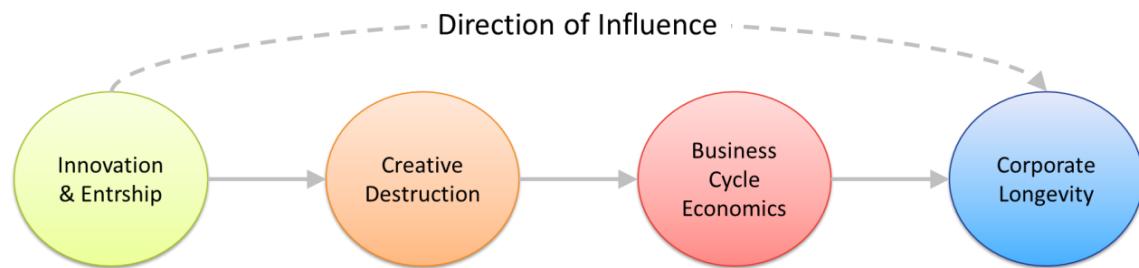


Figure 1: The Influence of Innovation on Economics, which Collectively Influences Creative Destruction, which influences Corporate Longevity and then hypothetically Innovation Should Influence Corporate Longevity Directly.

In summary, from the previous paragraphs:

- Corporate longevity declines.
 - Only a small percentage of corporations can sustain profitable growth.
 - A correlation exists between corporate innovation and share price.
 - Corporate innovation can influence corporate longevity.

We are aware that only a small percentage of corporations have a mature strategic corporate innovation program (Bouwer, 2020), which correlates with: (1) the small percentage of corporations that can sustain profitable growth, and (2) with the potential decline in share price and corporate longevity (the age of corporations that are being listed on the S&P 500 index).

Thus, it is possible to explain the decline in corporate longevity due to a lack of strategic corporate innovation, but there is absolutely no theory to explain the sinusoidal shape of the Foster Corporate Longevity Wave. Therefore, the aim of this paper is to determine what causes the Foster Corporate Longevity Wave to assume the shape of a sinusoidal wave.

2 Hypothesis

The hypothesis for this paper is that the sinusoidal shape of the Foster Corporate Longevity Wave is the result from a dynamic causal relationship with the elements being represented by Creative Destruction as corporate innovation, the state of an economic environment, and the behavior or values of a civilization or work force (as employees).

The innovation wave is based on the research done by Joseph Schumpeter and will be known as the Schumpeter Innovation Wave, the economic wave is based on the research done by Nikolai Kondratieff which will be known as the Kondratieff Economic Wave, and the civilization wave is based on the research done by Alvin Toffler and similarly will be known as the Toffler Civilization Wave.

3 Research Methodology

Since this research wants to understand how the Foster Corporate Longevity Wave assumed the shape of a sinusoidal wave, a systems modeling methodology (Forrester, 1958) (Forrester, 1994) (Senge, 1987) was used to construct a visual model to examine the interactive dynamics between Corporate Longevity and Creative Destruction on a single canvas, where Creative Destruction is represented by innovation, economic and civilization waves. During the rest of this paper, this visual systems model will be referred to as the CLIEC (Corporate Longevity, Innovation, Economics and Civilization) model.

To date, Foster's Corporate Longevity Wave, Kondratieff's Economic Prosperity Wave, Schumpeter's Innovation Adoption Wave and Alvin Toffler' Society Civilization Wave have all been studied at microscopic level, but only independently and in isolation. In contradiction to these previous approaches, this research modelled all four waves on a single canvas to examine various possible dynamic relationships, dependencies, and interactions.



The Foster Corporate Longevity Wave was first graphed on a standardized two-axis canvas representing time on the x-axis (to indicate the wavelength of each wave cycle) with corporate longevity (or lifespan) in years on the y-axis as a measurement for the wave's amplitude.

The Schumpeter Innovation Wave (Anonymous, 1999) was then modeled and analyzed on the same canvas, with the amplitude representing an abstract measurement for a new cluster of technologies' level of performance maturity and market adoption, similar to the amplitude of a technology lifecycle S-curve (Foster, 1986).

The Kondratieff Economic Wave (Korotayev and Tsirel, 2010) (Wilenius, 2012) (Nefiodow and Nefiodow, 2014) was also constructed on the same canvas to allow for further visual analysis. As a note, even though Kondratieff had already published his concept for Major Economic Cycles in 1925, it was Schumpeter who suggested naming it Kondratieff Waves with his publications in 1927 and 1939.

Since corporate longevity, innovation and economics happen within the context of social environments, the Toffler Civilization Wave (Toffler, 1980) was also added to the canvas to provide additional context and further analysis.

The canvas which resulted from the integration of the Foster Corporate Longevity Wave, Schumpeter Innovation Wave, Kondratieff Economic Wave and Toffler Civilization Wave became known as the CLIEC (Corporate Longevity, Innovation, Economics and Civilization) model.



4 The Difference Between Waves and Cycles

To stay true to how waves are being used in mathematics and theoretical physics, this paper defines a single wave as the continues progression of an oscillating particle that moves up and down over time (which can be indefinitely). Each full oscillating cycle (between two points in perfect phase with each other) represents the wavelength (measured in displacement) as being demonstrated in Figure 2. The full wave within the limits of a wavelength represents a cycle.

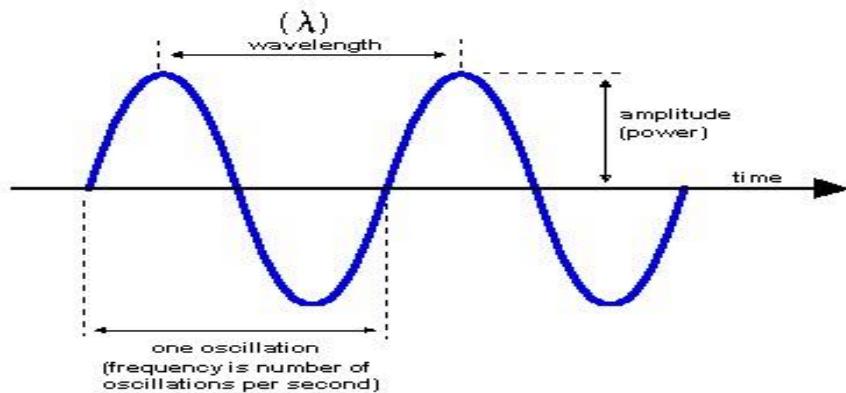


Figure 2: The Elements of a Wave (Source: Stack Exchange: Physics)

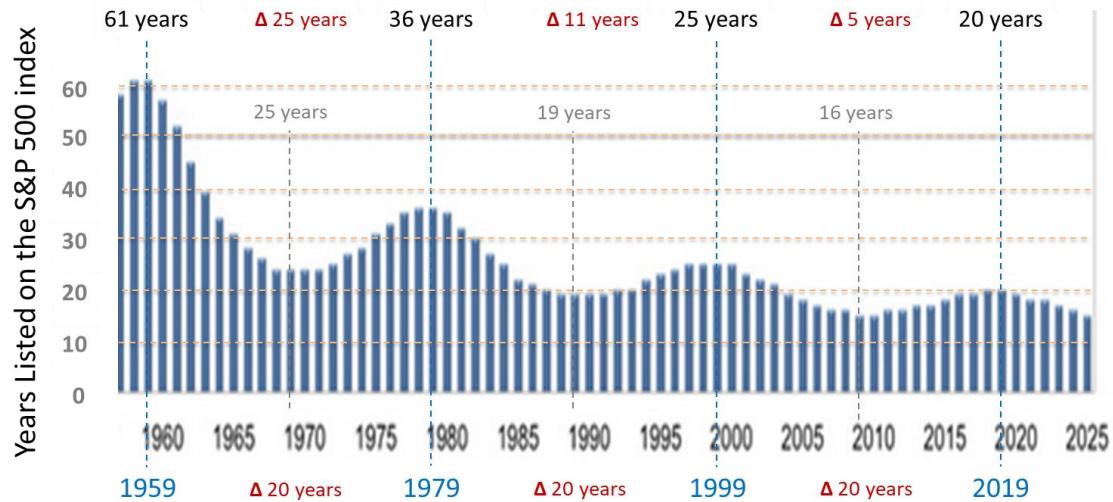
5 Article Layout

The remainder of this article is written in three parts: the (1) construction and initial observations and analysis of each individual wave, the (2) modeling of the four waves onto the same canvas with remarks on initial observations, and then (3) an in-depth discussion of the dynamic relationships, dependencies, and interactions of the waves.

6 Construction of Each Wave

6.1 Foster Corporate Longevity Wave

Richard Foster and Sarah Kaplan constructed the Corporate Longevity Wave (Foster and Kaplan, 2001a) (Foster and Kaplan, 2001a) (Foster, 2012) (Dolezalek and Freed, 2014) from their research (see Figure 3), which represents the rolling seven-year average lifespan of corporations listed on the S&P 500 index for each year. Still today, Richard Foster considers the shape of the Foster Corporate Longevity Wave as a result of arbitrary random events.



Adapted from: FOSTER, R. N. & KAPLAN, S. 2001. Creative Destruction:
Why Companies that are Built to Last Underperform the Market, and how to Successfully Transform Them.
FOSTER, R. N. 2012. Creative Destruction Whips Through Corporate America. Innosight.

Figure 3: The Foster Corporate Longevity Wave adapted from Richard Foster Based on S&P 500 Index data.
Sources: (Foster and Kaplan, 2001b) (Foster, 2012)

The graph in Figure 3 was published by Innosight in 2012 (Foster, 2012) as a summary of Foster's book in 2001, therefore it was considered the closest matching graph to be used according to Foster's research where each point represents a rolling seven-year average for the corporations' average lifespans that are listed on the S&P 500 Index.

I set forth the argument that it is impossible that random events can create a sinusoidal wave with the following characteristics as illustrated in Figure 3 and Table 1:

1. A perfect sinusoidal wave pattern over the past 60 years.
2. four waves with an exact constant wavelength of 20 years for each cycle.
3. A consistent longevity delta reduction of approximately 10.5% in wave amplitude after each wave cycle, see Table 1.

Table 1: Foster Corporate Longevity Wave Amplitude Analysis

Year	Longevity Wave Amplitude	Longevity Delta	Delta Reduction as a Percentage
1959	61 years		
1979	36 years	Δ 25 years	40.98%
1999	25 years	Δ 11 years	30.56%
2019	20 years	Δ 5 years	20%

6.2 Schumpeter Innovation Wave

This article selected to use the Schumpeter Innovation (and Entrepreneurship) Wave since it represents the adoption (Rogers, 1962) (Moore, 1991) and use of new revolutionary technologies. The best source that could be found to define the Schumpeter Innovation Adoption Wave was from an article posted in the Economist Industry Newspaper (Anonymous, 1999) with the Edelson Institute as the source. The suggested dates are well aligned with the proposed dates by Freeman and Louca (Freeman and Louca, 2001) (Smihula, 2009), but I disagree with their starting dates for the fourth and fifth innovation wave cycles which I considered to be too early for the new technologies to be adopted. Current researchers (Neufeld, 2021) also sides with the dates as proposed by the Edelson Institute, which became the de facto standard to model the Schumpeter Innovation Wave graphically as in Figure 5.

The Schumpeter Innovation Wave exhibits the following characteristics, see Table 2:

1. Each wave cycle is identified by a leading technology or industry where the most technological breakthrough inventions and transformations accrue.



2. The upward curve always takes twice as long as the downward curve.
3. The wavelength of each Schumpeter Innovation Wave cycle reduces significantly after each completed cycle.
 - Leading up to World War II the wavelength reduced at a rate of five years after each cycle, but after World War II the wavelength reduce consistently at 10 years after each cycle.
 - A much more concerning picture of how fast the wavelength really shortens is with the calculation of the delta reduction in wavelength as a percentage of the wavelength of the previous full wave, which increases linearly.
 - The assumption here is that the shortening of the wavelength is due to our ability to invent and innovate better and faster.

Table 2: Shortening of Schumpeter Innovation Wave Cycle Wavelengths

Wave Cycle Dates	Delta in Years	Reduction in Delta	% in Delta
1785 – 1845	60		
1845 – 1900	55	5	8%
1900 – 1950	50	5	9%
1950 – 1990 (Post World War II)	40	10	20%
1990 – 2020	30	10	25%
2020 – 2040 (Extrapolation)	20	10	33%

Several existing innovation theories can be used to give better context and understanding of the forces that shape the Schumpeter Innovation Wave, as: described below, summarized in Table 3, and illustrated in Figure 4 and Figure 5 (which were specifically color-coded to show correlations):

1. Each Schumpeter Innovation Wave cycle can be separated into four distinct quadrant phases similar to the **Foster Technology S-Curve** (Nieto, 1998) (Roussel et al., 1991) (Foster, 1986) (Foster, 2016) as in Figure 5: (1) embryonic, (2) growth, (3) mature and (4) aging phases.
2. The quadrants of the innovation wave can be associated with the five **Innovation Strategy Tactical Archetypes**, defined as a dimension from Bouwer's Strategic



Corporate Innovation Navigation (SCINav) systems model (Bouwer, 2020), which are the following (see Figure 4): (1) IP Inventors, (2) Technology Builders, (3) Business Disruptors, (4) Industry Followers, and (5) Market Advocates.

3. The innovation wave quadrants can also be associated with the five **Adoption of Innovation** consumer psychographic categories (Rogers, 1962) (Moore, 1991) as the adopters of new technologies: (1) Technical Innovators, (2) Visionary Early Adopters, (3) Pragmatic Majority, (4) Conservative Majority, and (5) Skeptic Laggards.
4. Each of the quadrant phases of the innovation wave can also be correlated with the four stages of the **Windermere Associates Buying Hierarchy** (Christensen, 1997) (Christensen, 1997b) as adapted by Bouwer (Bouwer, 2020): (1) Functional Performance, (2) Reliable Quality, (3) Accessible Convenience, and (4) Price. These stages were specifically color-coded to show the correlation from Table 3 to Figure 5.
5. A **Dominant Industry** (represented by marker “A” in Figure 5) forms during the Schumpeter Innovation Wave’s embryonic phase, which results in a cluster of related technologies that were further developed by the Technical Innovators (IP Inventors) to be adopted by Visionary Early Adopters (Rogers, 1962) and thus create a new industry.
6. A **Dominant Design** (represented by marker “B” in Figure 5) (Abernathy and Utterback, 1978) is the point where the industry gravitated to a preferred solution from various possible options from various startups or corporations before the Innovation Wave starts the growth phase.
7. New innovations will reach the **Technology Maturity and Market Adoption Limits** (represented by marker “C” in Figure 5) at the end of the Innovation Wave’s mature phase.



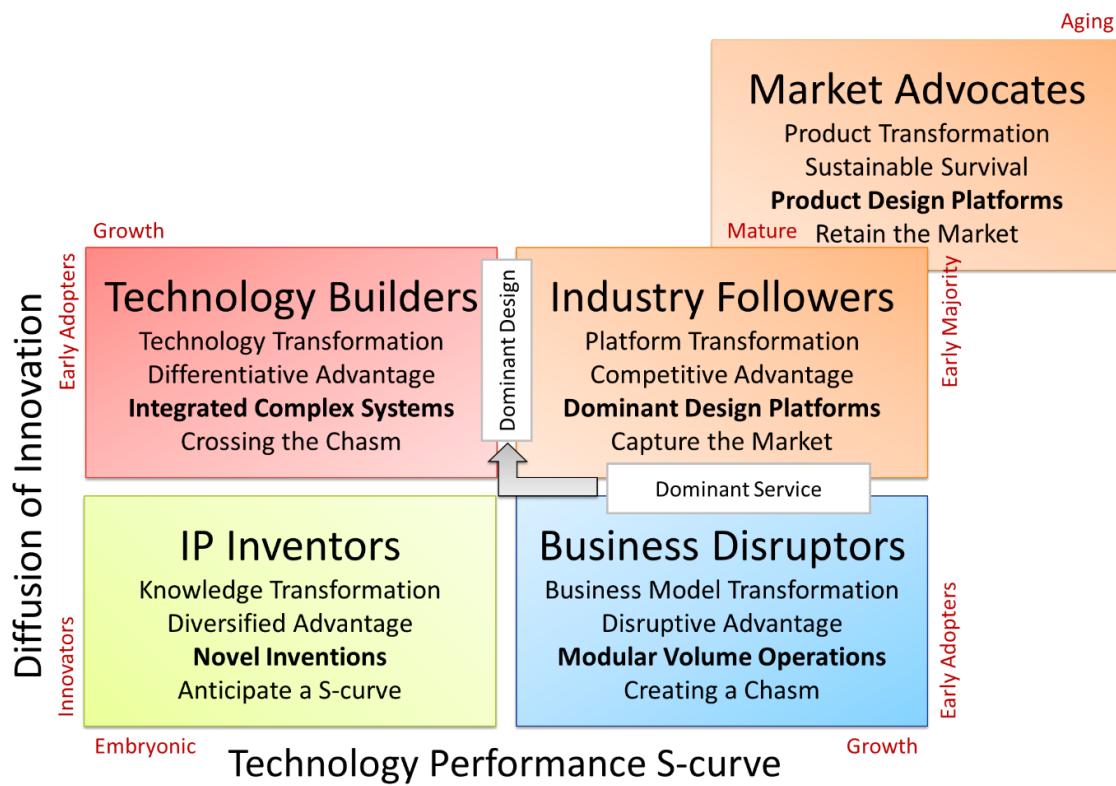


Figure 4: Innovation Strategy Tactical Archetypes Defined as a Dimension from the Strategic Corporate Innovation Navigation (SCINav) Systems Model. (Source: Bouwer, 2020)

Table 3: Correlating Innovation Wave Quadrant Phases with Existing Innovation Theory

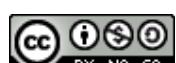
Innovation Wave Phase	Innovation Strategy Tactical Archetypes ⁶ and Diffusion of Innovation Adoption Psychographic Consumer Groups ⁷	Windermere Associates Buying Hierarchy of Value
Embryonic	IP Inventors Technical Innovators	Functional Performance
Embryonic	Tech Builders / Business Disrupters Visionary Early Adopters	Reliable Quality
Growth	Industry Followers Pragmatic Early Majority	Accessible Convenience
Mature	Industry Followers Conservative Late Majority	Accessible Convenience
Aging	Market Advocates Skeptic Laggard	Price

⁶ The Innovation Strategy Tactical Archetypes of innovators was proposed by Louis Bouwer as a dimension from his Strategic Corporate Innovation Navigation (SCINav) systems model (Bouwer: 2020).

⁷ The Diffusion of Innovation Adoption Psychographic Consumer Groups is a combination of the classification systems developed by Prof Everett Rogers (Adoption Profile) and Dr Geoffrey Moore (Psychographic).

Dynamic activities within the four suggested quadrants of the Schumpeter Innovation Wave as defined according to the four phases of the Foster S-Curve as outlined in Table 3, Figure 4 and Figure 5 are as follows:

1. **Embryonic Phase:** This is the downward slope of the innovation wave. The embryonic phase includes activities as defined by two SCINav Innovation Strategy Tactical Archetypes (as in Figure 4) and two Innovation Adoption Psychographic Consumer Groups (in Table 3): (1) the IP Inventors as Technical Innovators who develop new inventions and technologies which will shape a **Dominant Industry**, while the (2) Technology Builders and Business Disruptors as Visionary Early Adopters who then integrate several technologies to commercialize and deliver complete systems solutions to be adopted by Pragmatic Early Majority adopters which then become the **Dominant Design** (Abernathy and Utterback, 1978) solution and thus **Cross the Innovation Chams** (Moore, 1991).
 - The IP Inventors (as Technical Innovators) are mostly entrepreneurs with startups or intrapreneurs within corporations who usually files for Intellectual Property (IP) protection. Their focus is to establish a problem-solution fit.
 - The Technology Builders and Business Disruptors (as Visionary Early Adopters) are usually corporate engineering unites who then commercialize these revolutionary new technologies (as breakthrough or disruptive innovations) into the market. Their focus is to establish a product-market fit.
2. **Growth Phase:** This is the start of the **upward** curve of the innovation wave where technical systems solutions are being adopted at a significant pace by Industry Follower innovators as Pragmatic Early Majority consumers as the new technological systems solutions become more convenient to be acquired and adopted. The specific systems solution that is being adopted first and the fastest will eventually become the **Dominant Design** solution within the specific industry. Within this phase every company in the value chain responsible for the new systems solution as a complete product is now in a “tornado” (Moore, 2004) phase to **scale** their operations to meet demand with the focus on process efficiency, as explained by the **Dynamics of Innovation** (Utterback and Abernathy, 1975) theory.
 - In many cases the Industry Followers (as Pragmatic Early Majority adopters) are:
 - (1) existing or new corporate Business Units (BUs) or (2) startups who could



develop into Industry Followers with significant investments from Venture or Equity Fund firms.

- During this phase product managers continue to increase product-market fit to develop and penetrate new market segments.
3. **Mature Phase:** In this phase Industry Follower innovators start to include Conservative Late Majority adopters as well, who will continue to deliver on efficiency innovation to increase availability and affordability as demand continuous to increases. At this point the technological solution and the sub-components will be supplied by many competing enterprises with very little difference in functional performance, quality, durability, convenience, or availability. The new industry matures to become a commodity industry, as with in example the automotive or personal devices industries.
- With the evolving commodity market competition increases and market growth momentum starts to slow down significantly and thus capital investment as well.
 - At this point product managers will have to look at cross-industry innovation to expand their product-market fit to adjacent markets.
4. **Aging Phase:** Two scenarios apply at the Aging Phase: (1) Market Advocate innovators focus to repackage product-market fit of the existing commodity solution to up-sell or cross-sell Skeptic Laggard adopters who are extreme price conscious and resistant to change and (2) Business Disrupters apply disruptive business model innovation (Christensen, 1997) (Christensen, 2015) to deliver a good enough product at a significantly lower price to Skeptic Laggard adopters who are resistent to invest in new technology.



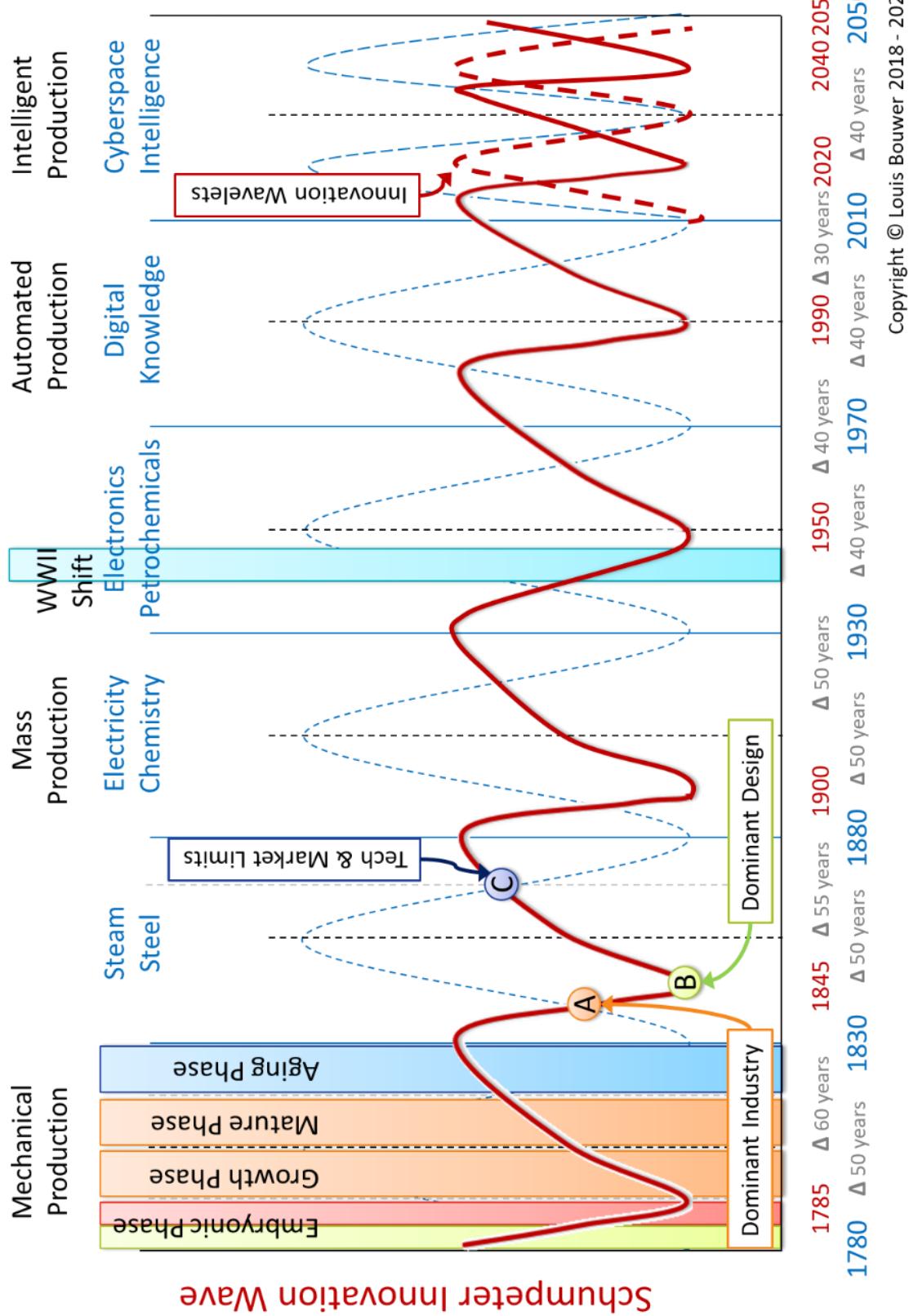


Figure 5: Schumpeter Innovation Wave
Source: (Anonymous, 1999)

1780 Δ 50 years 1830 Δ 50 years 1845 Δ 55 years 1900 Δ 50 years 1930 Δ 50 years 1950 Δ 40 years 1970 Δ 40 years 1990 Δ 30 years 2010 Δ 40 years 2020 Δ 40 years 2040 2050 Δ 40 years 2050
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6.3 Kondratieff Economic Wave

At the beginning of the twentieth century Schumpeter (Schumpeter, 1942) defined Creative Destruction as an essential fact about capitalism that starts with a clustered set of revolutionary new technologies where entrepreneurs innovate and transform specific industries that increase productivity, consumer confidence, aggregate demand and prices which cumulative result in economic booms (prosperity) and eventually also crises (depression), that can be modeled as a sinusoidal wave shape, which Schumpeter also defined as Kondratieff Economic long Wave Business Cycles (Schumpeter, 1939) (Wilenius and Kurki, 2012).

Nikolai Kondratieff was able to define long economic waves from a set of economic indicators from 1780 to 1920s, which were (Wilenius and Kurki, 2012) (Grinin et al., 2016):

1. Commodity Prices.
2. Work Wages.
3. Foreign Trade Turnovers.
4. Raw Material Production and Consumption Rates.
5. Private Bank Savings.

Jay Forrester identified Kondratieff Economic Waves while he was evaluating his systems dynamics model of the economy (Forrester, 1976) where he used the following factors (Wilenius: 2012):

1. Movement of people between sectors.
2. Timespan to change the production capacity of the capital sectors.
3. Way capital sectors provide their own input capital as a factor of production.
4. Need to develop excess capacity on deferred demand.
5. Psychological and speculative forces of expectations that can cause overexpansion in the capital sectors.

Andrey Korotayev applied spectral analysis techniques on world GDP (gross domestic product) (Korotayev and Tsirel, 2010) data and confirmed the existence of the various business cycles, which included the Kondratieff Economic Long Wave.



After modeling the Kondratieff Economic Wave according to the dates provided by Korotayev and Tsirel (Korotayev and Tsirel, 2010), the following observations were made from Figure 6 where the Kondratieff Economic Wave has been extrapolated to 2050:

1. Each single Kondratieff Wave cycle can be divided into separate quadrants (where each quadrant defines a specific economic state) according to the business cycle quadrants Schumpeter suggested for a business cycle (Schumpeter, 1939), which was adapted as in Figure 5:
 - **Improvement:** this is a recovery phase of the economy where the financial stock exchange recovers because of the fall in prices and incomes.
 - **Prosperity:** is an expansion phase with the increase of resource efficiency, productivity, production, and prices.
 - **Recession:** brings about a drop in prices and output.
 - **Depression:** represents a crisis phase where the stock exchanges crash and multiple bankruptcies of firms occur.
2. There will be a total of seven full Kondratieff Economic Wave cycles from 1780 to 2050. The first three cycles have a consistent wavelength of 50 years, with the next 2 wave cycles from 1930 to 2010 with a wavelength of 40 years and then the last two wave cycles from 2010 to 2050 was extrapolated with a predicted wavelength of 20 years each.
3. The Kondratieff Economic Wave cycle wavelength got reduced from 50 years to 40 years during World War II and got reduced again from 40 to 20 years during the economic crisis of 2008 to 2010.
4. A global recession will start in 2020 with a depression phase that will last from 2025 until 2030.
5. The Kondratieff Economic Wave cycles can also be grouped by a **Method of Production:**
 - **Mechanical Production** with the introduction of advanced mechanical systems.
 - **Mass Production** with the introduction of factories.
 - **Automated Production** with MRP and ERP systems.
 - **Intelligent Production** with which became known as 4th Industrial Revolution (4IR) technologies.



6. The Kondratieff Economic Wave cycles can also be separated and identified by the technology of the **national energy production systems** of choice being adopted at the time:

- Hydraulic Energy
- Steam Energy
- Electrical Energy
- Petrochemical Energy
- Nuclear Energy
- Renewable Energy

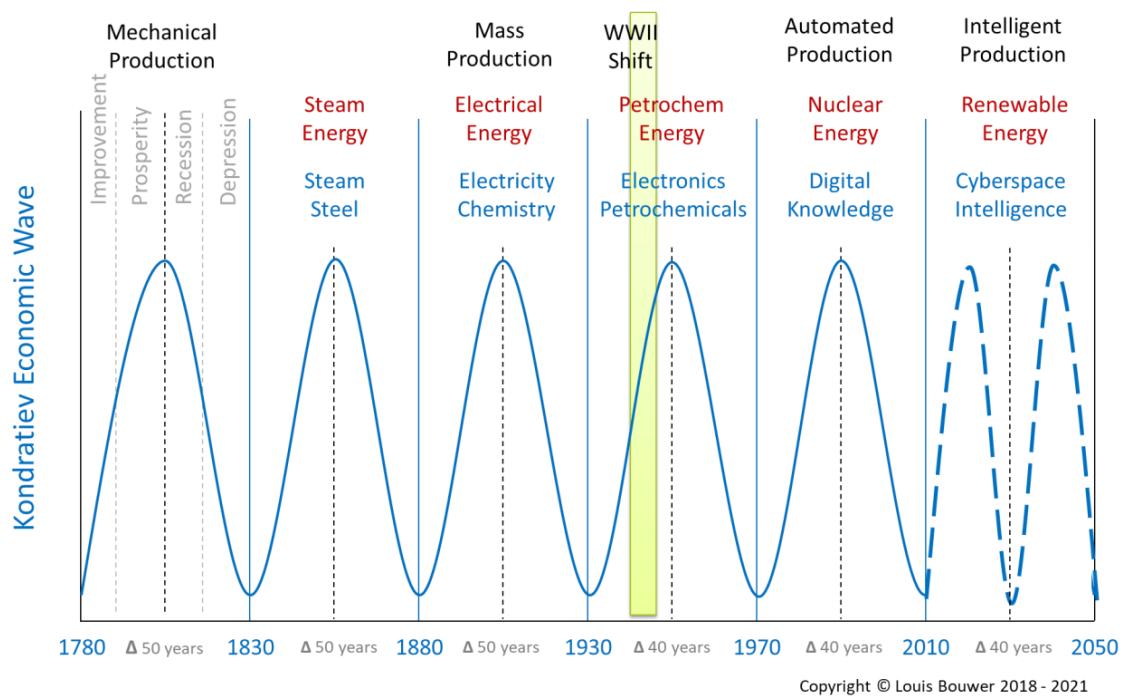


Figure 6: Kondratieff Economic Wave according to Data Presented by Korotayev and Tsirel
 Sources: (Korotayev and Tsirel, 2010) (Grinin et al., 2016) (Wilenius and Kurki, 2012) (Naumer et al., 2010) (Nefiodow and Nefiodow, 2014) (Nefiodow, 2006).

6.4 Toffler Civilization Wave

According to Alvin Toffler humanity has passed through three civilizations and is approaching the fourth wave cycle (Smihula, 2009) (Haller, 2011) (Maynard and Mehrtens, 1996) (Toffler, 1980), as in Table 4 and Figure 7:

1. Hunter-gatherer (pre-civilization)
2. Agrarian (first wave)
3. Industrialization (second wave)
4. Informational (third wave)
5. Consciousness (suggested to be the fourth wave)

In each case, the catalyst for change was a new form of technology: agriculture mechanization, industrial mechanical production, and information communication technologies. At this stage it appears that Artificial Intelligence (AI) is most likely the best candidate as the precursor technology for the transformation to a conscious civilization. Not as an enabler, most more as a point of debate where humans fit in the world since machines start to become intelligent as well.

Table 4: Toffler Technological Civilization Wave (Adapted).

Source: (Toffler, 1981)

Wave	Civilization	Economy	Suggested Dates	Delta Difference
1	Agriculture	Mechanization	8,000 B.C. - 1750	9750
2	Industrial	Technology	1750 – 1950	100
3	Information	Knowledge	1950 – 2020	70
4	Conscious	Intelligence	[2020 – 2060] proposed	[40] proposed



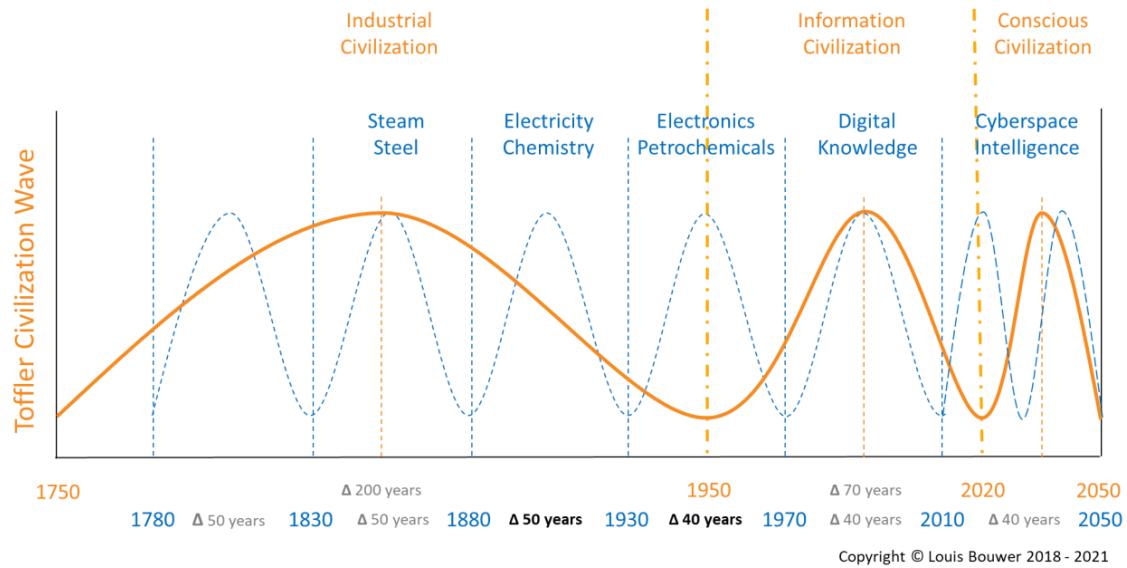


Figure 7: Toffler Civilization Wave

Sources: (Smihula, 2009) (Haller, 2011) (Maynard and Mehrdens, 1996) (Toffler, 1980)

From work done by Zook and Allen (Zook and Allen: 2016b) it is much rather internal corporate complexity than an external force that directly influence the longevity of the corporation, for this reason the Toffler Civilization Wave was also added as a Creative Destruction force that can influence Corporate Longevity. This paper proposed that the fourth Toffler Civilization Wave Cycle (as in Figure 7) should start in the year 2020, with the focus on consciousness already evident in the following areas:

1. **Shared economy** where people either share their cars (such as Uber, Lyft, etc.), bicycles, houses (Airbnb) golf clubs, etc.
2. **Millennial generation** (and younger) seek more flexibility in work hours, better work environment with a new set of priorities and values for a work vs life balance and who are increasingly more selective in the companies they work for (as evident from the great resign since 2021).
3. **Social responsibility** saw several academics and corporate executives who are standing up against Shareholder Capitalism to rather serve customers, take care of the well-being of employees and to be more responsible towards limited natural resources and the planet we live on.
4. **Flatter organization structures** start to appear where the traditional chain-of-command organization structures make way for new approaches where employees are empowered to form self-managed ecosystems within new agile oriented organization structures (Minnaar and de Morree, 2020).

7 Modeling of the CLIEC Waves

Up to now the Corporate Longevity, Innovation, Economics and Civilization (CLIEC) waves were each mapped and analyzed individually. In this section, the CLIEC waves will be mapped on the same canvas as in Figure 8. From a systems modeling approach the visual representation of the CLIEC waves all on the same canvas can help to visually identify newfound interrelationships, interdependencies or interactions.

With the Kondratieff Economic Wave's wavelength that shortens over time from 50 to 40 years, the actual distance on the canvas was kept at 3cm on the X-axis to simplify the mapping of the wave and to keep the wavelength of all the Foster Corporate Longevity Wave cycles at a workable size to provide adequate space to properly analyze it.

Four different colors were used for the four different waves on the CLIEC model: (1) the Kondratieff Economic Wave is a BLUE line graph, (2) Schumpeter Innovation Wave is a RED line graph, (3) Foster Corporate Longevity Wave is a GREY bar graph and (4) the Toffler Civilization Wave is an ORANGE line graph.

The following initial observations were made from a visual analysis of the CLIEC model:

1. The Kondratieff Economic Wave and Schumpeter Innovation Wave are very well synchronized (or in-phase) as one would expect, except for a wave phase shift during World War II, which will be discussed in more detail in section 8.
2. The sinusoidal shape of the Foster Corporate Longevity Wave is perfectly synchronized with both the Kondratieff Economic Wave and the Schumpeter Innovation Wave until 2020.
 - This provides evidence that both the Economic and Innovation Waves are two forces that directly influences the Foster Corporate Longevity Wave and is therefore not arbitrarily shaped by random forces.
3. The **year 2020** represents a significant shift or reset on the CLIEC model, some observations with supporting theory are:
 - The Foster Corporate Longevity Wave's wavelength is half of both the Kondratieff Economic Wave and that of the Schumpeter Innovation Wave's wavelengths until 2020 when it goes out of phase.
 - The reports Limits to Growth (Forrester, 1971) (Meadows et al., 1972) (Meadows et al., 2004a) (Meadows et al., 2004b) as an industrial dynamics world model research project (named World3) simulated: (1) population, (2) industrial capital



investment, (3) natural resources, (4) persistent pollution and (5) fraction of capital devoted to agriculture. The report predicted that under the business-as-usual scenario: (1) the world will experience a significant decline in industrial output, (2) economic growth will stop and reverse rather abruptly, and (3) standard of living will dramatically start to decline from 2020 and onwards.

- A group of Cliodynamics researchers (Turchin, 2012) identified a 200 to 300-year cycle and a shorter 50-year cycle for political instability in the United States. The short 50-year cycle of political instability was mapped out in a graph (Spinney, 2012), it indicates that the next peak for political instability to be the year 2020. According to them the conditions for the end of the long cycle are where: (1) elites are formed and fight for power, (2) the poor lose out on their living standard with the equality gap being significantly large due to unemployment and (3) the society falls into political instability. These conditions for the long cycle of political instability appears to match current political environment quite well which makes the year 2020 even more significant with the events started in 2020.
- To keep the Innovation and Economic Waves synchronized with the Foster Corporate Longevity Wave after 2020, the Kondratieff Economic Wave's wavelength had to be halved to 20 years and the Schumpeter Innovation Wave had to be fractured (or splintered) into several simultaneous waves as presented in Figure 8.
 - i. With the adjustment of the Kondratieff Economic Wave's wavelength, the global economy must start to go into a recession starting 2020 and the economic depression phase will be from 2025 until 2030.
 - ii. Even with the splintering of the Schumpeter Innovation Wave, the year 2020 still marks the beginning of the sixth Schumpeter Innovation Wave Cycle based on the propagation of the original wave that was measured from the start of the industrial revolution in 1780.
- 4. It does not matter how politicians manipulate financial metrics through Keynesian Economics (i.e., Quantitative Easing), the waves presented in the CLIEC model still progressed consistently through time as sinusoidal waves.



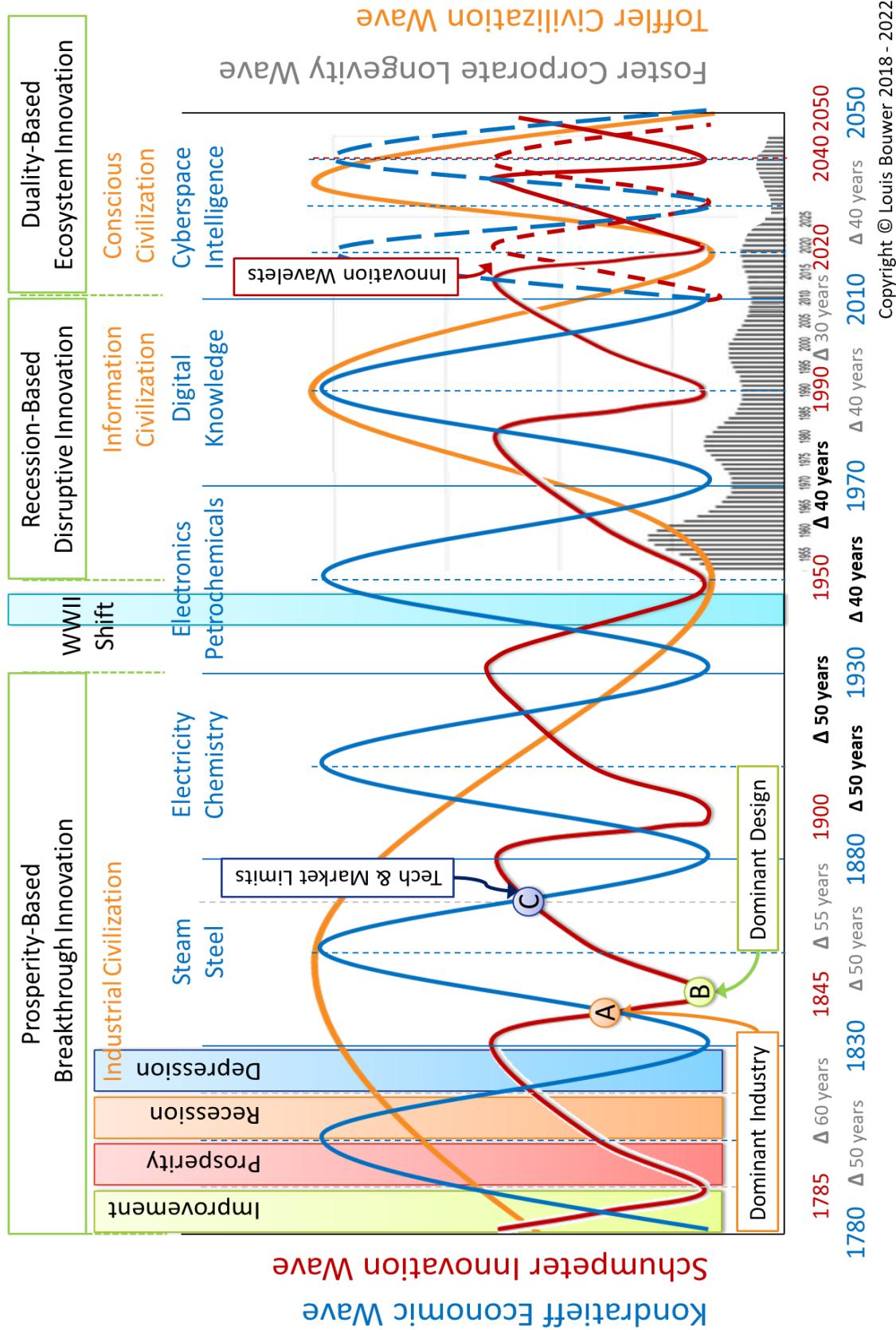


Figure 8: The CLIEC Wave Model – Mapping Corporate Longevity, Innovation, Economic and Civilization Waves

8 Dynamics of the Integrated CLIEC Model

8.1 Dynamics Between the Innovation vs Economic Waves

“Those booms [periods of prosperity] consist in the carrying out of innovations in the industrial and commercial organism “. (Schumpeter, 1927)

“But what dominates the picture of capitalistic life and is more than anything else responsible for our impression of a prevalence of decreasing cost, causing disequilibria, cutthroat competition and so on, is innovation, the intrusion into the system of new production functions which incessantly shift existing cost curves.” (Schumpeter, 1939)

“I do not see innovation as causing the long wave. Rather, I believe that the long wave strongly influences the climate for innovation by compressing technological change into certain time intervals and altering the opportunities for innovation.” (Forrester, 1979)

Reviewing the dynamic interaction and phase shifts between the innovation and economic waves in Figure 8 and Figure 9Figure 8, three distinct dynamic interactions were identified: (1) Prosperity-Based Breakthrough Technology Innovation Interaction before the WWII phase shift where breakthrough technology innovation is leading and driving economic prosperity, (2) Recession-Based Disruptive Business Model Innovation Interaction after the WWII phase shift where disruptive business model innovation is following and nurturing an economic recession, and finally the (3) Duality-Based Ecosystem Platform Innovation Interaction where both breakthrough technology and disruptive business model innovation is interacting with the economic wave.

Therefore, it may appear that the direct quotes from Schumpeter and Forrester (from the direct quotes above) may contradict each other, but from the CLIEC model (Figure 8) they are both correct for the time when they conducted their research. Based on the evidence presented in Figure 8 and Figure 9:

- Schumpeter is correct that **breakthrough technology innovation** was driving economics when he conducted his research before the World War II (WWII) phase shift between the innovation and economic waves.
- Forrester is also correct that economic conditions drive innovation when considering that **disruptive efficiency innovation** after the WWII was the result of strained economic conditions after the WWII phase shift between the innovation and economic waves.



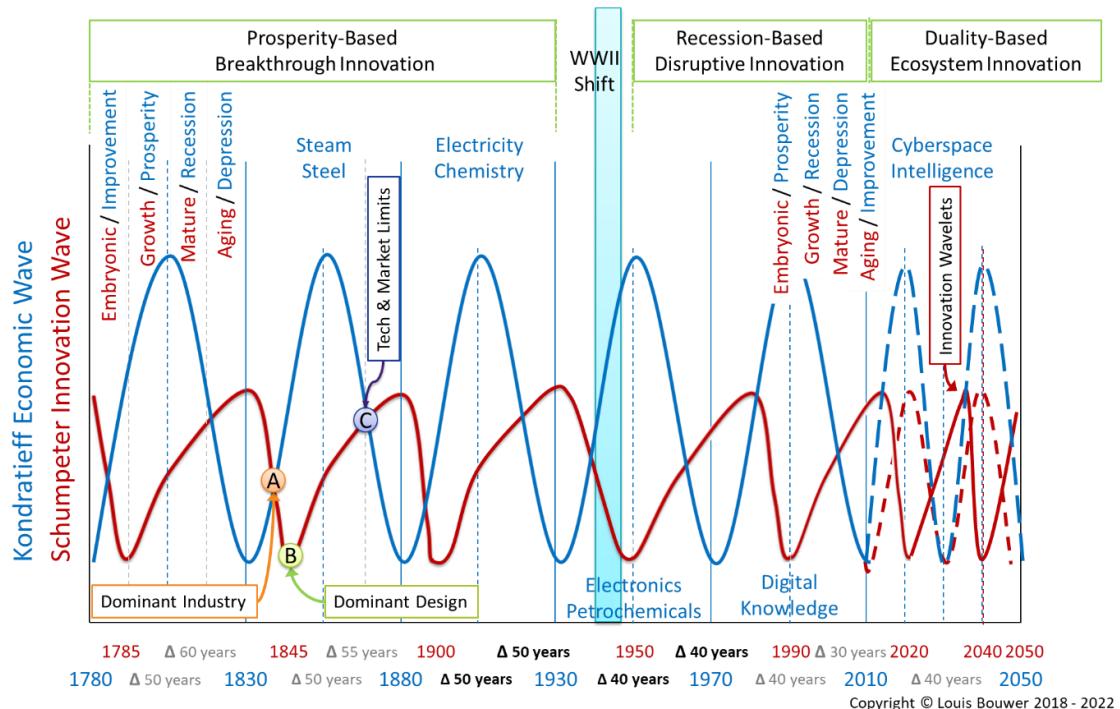


Figure 9: Three Distinct Different Dynamic Interactions Between the Schumpeter Innovation and Kondratieff Economic Waves

In more detail, the three different dynamic interactions between the Schumpeter Innovation and Kondratieff Economic Waves are as follows (see Figure 9):

1. Prosperity-Based Breakthrough Technology Innovation Interaction (pre-WWII phase shift) is where a new Schumpeter Innovation Wave starts with a growth phase of breakthrough technology (entering the industry as a Dominant Design) being adopted while the Kondratieff Economic Wave starts with the prosperity phase. Alternatively, when the Schumpeter Innovation Wave starts the aging phase, marked as the Technology Development and Market Growth Limit (as point “C” in Figure 9), it coincides with the start of the depression phase of the Kondratieff Economic Wave. This symbiotic relationship correlates extreme well:

- During the economic prosperity phase, the industry has the financial resources to acquire and adopt new available breakthrough technologies that can give companies a competitive advantage in their respective industries to increase their market share, revenues, profits, and Total Shareholder Returns (TSR).
- During the economic depression phase industries find themselves in a position where they will only purchase a new technology when the price is lower than existing solutions or it is not possible to purchase any existing solutions anymore.

This correlates extremely well with the innovation wave’s aging phase where the

relatively new technologies are general commodities within the market with many suppliers and options that drives the price down.

2. Recession-Based Disruptive Business Model Innovation Interaction (post-WWII phase shift) is where a new Schumpeter Innovation Wave starts with a growth phase (entering the industry with a Dominant Design) while the Kondratieff Economic Wave starts with a recession phase. Alternatively, when the Schumpeter Innovation Wave starts with the embryonic phase, the Kondratieff Economic Wave starts moving into the economic prosperity phase.

- During an economic recession cost optimization starts to become most important and therefore corporations need disruptive business model innovation (Osterwalder and Pigneur, 2010) where this innovation then focuses more to improve the efficiency of the business significantly. This saw the invention and adoption of digital information management systems. This trend then continued with the Kondratieff Economic Wave into the depression phase where the technology becomes mature, the new disruptive business models become very common, simple, and convenient to implement within a company to help it survive the following economic depression phase as well.
- When the Kondratieff Economic Wave goes into the prosperity phase with significant amounts of capital available, the Schumpeter Innovation Wave goes into the Embryonic phase. This can explain the rise of Angel Investors and Venture Capital firms as a new industry that seek to invest in new startup companies that can generate significant returns with new disruptive business models based on information systems and digital platforms.

3. Duality-Based Ecosystem Platform Innovation Interaction occurs after 2010 with the fracturing of the Schumpeter Innovation Wave into multiple Wavelets and the significant shortening of the Kondratieff Economic Wave to a 20-year wavelength. The ecosystem in which corporations compete became much more Volatile, Uncertain, Complex and Ambiguous (known as VUCA).

- Dual-based means strategic corporate innovation must focus simultaneously on: (1) breakthrough technological innovation seeking significant product functionality improvements and (2) disruptive business model innovation to increase the efficiency of the business to deliver personalized products or services faster and cheaper.



- An example of breakthrough technological innovation is the success of Elon Musk who brought the manufacturing of breakthrough mechanical products back to the forefront with Tesla and SpaceX.
- An example of disruptive business model innovation to increase efficiency is the introduction of cloud computing services such as Microsoft Azure, LinkedIn or Alibaba.

8.2 Shaping of the Corporate Longevity Wave

[“No business survives over the long term without reinventing itself.” \(Bertolini, 2015\)](#)

[“As the needs of society vary and the challenges confronting corporations shift, the nature of innovation must also change to fit the circumstances.” \(Forrester, 1979\)](#)

Following the dynamic propagation of the Foster Corporate Longevity Wave and how it relates in phase to the propagation of the Kondratieff Economic and Schumpeter Innovation Waves as in Figure 8, the following observations were made:

1. Available data for the Foster Corporate Longevity Wave is after the WWII phase shift between the Innovation and Economic Waves (starting at around 1950), which was named the Recession-Based Disruptive Innovation Interaction as in Figure 9.
2. The **peaks** of the Corporate Longevity Wave are when Kondratieff Economic and Schumpeterian Innovation Waves intersects (crossing) each other, with each entering a new quadrant phase until 2020.
3. During the **upswing** segment of the Foster Corporate Longevity Wave very few of the corporations are being delisted from the S&P 500 Index, which results in an increase in the average lifespan of corporations. This occurs with two different scenarios:
 - The **first scenario** is when the Schumpeter Innovation Wave is in a high growth phase which starts with the Dominant Design as point “B” in Figure 8 (Abernathy and Utterback, 1978) for the industry, while the Kondratieff Economic Wave is in a recession phase. This implies that the new business models enabled by digital information management software systems help companies to survive during the economic recession phase.
 - The **second scenario** is with the Schumpeter Innovation Wave that is in an aging phase with the Kondratieff Economic Wave in the improvement phase, also within the Recession-Based Disruptive Business Model Innovation Interaction (as in Figure 8 and Figure 9). This implies that with the companies that survived the previous economic depression phase, the existing digital information management software



systems that became commodities within the industry with significant low pricing (from many competing vendors) and common knowledge of best practices how to make the best use of the business models and digital systems increases the survivability of existing corporations.

4. With the **downswing** segment of the Corporate Longevity Wave, many of the corporations that were listed quite long cannot maintain their market capitalization, liquidity or financial viability to stay listed on the S&P 500 Index, and thus become delisted (Forrester, 1979). This represents the Creative Destruction (Schumpeter, 1942) (Foster and Kaplan, 2001b) where newly listed corporations replace incumbent corporations. There are two scenarios for when this occurs:

- The **first scenario** is when the Schumpeter Innovation Wave goes through a mature phase where the development and adoption of the new technologies slow down until it reaches the Technology and Market Limits as point "C" in Figure 8, while the Kondratieff Economic Wave goes through a depression phase. The fact that the economy is going through a depression explains the downswing of the Foster Corporate Longevity Wave in itself.
 - The **second scenario** is when the Schumpeter Innovation Wave progresses during the embryonic phase while the Kondratieff Economic Wave progresses through the prosperity phase. With new technology and business models still in the embryonic phase, most companies still invest in R&D and there is no adoption yet that can translate into sales, revenue, and profits. This most likely create a problem for many corporations with little financial reserves to their disposal.
5. The **trough** of the Corporate Longevity Wave is observed when either the Kondratieff Economic or Schumpeterian Innovation Waves also go through a trough.

9 Conclusion

The peculiar sinusoidal shape of the Foster Corporate Longevity Wave as presented by Foster and Kaplan was investigated and modelled against Creative Destruction as innovation, economic and civilization waves from 1780 to 2050, which became known as the Corporate Longevity, Innovation, Economic and Civilization (CLIEC) model.

With the graphical evidence and theoretical discussions from the construction of the CLIEC model, it was demonstrated how the dynamic interaction between the innovation and economic waves shape the Foster Corporate Longevity Wave.



This paper also discovered and presented many additional findings which emanated during the construction of the CLIEC model with the most important predictions to be the following from the year 2010 and onwards: (1) the Schumpeter Innovation Wave fractured into several wavelets, (2) the economic wave's wavelength halved to a wavelength of 20 years, (3) the global economy is moving into a recession, (4) the world is undergoing a change to a new civilization, and (5) corporate longevity is declining significantly fast.

With the knowledge we have now about the shaping of the Foster Corporate Longevity Wave, corporate executives will have to change their current corporate growth strategy from shareholder capitalism (Martin, 2010) (Bower, 2017) with M&As as the primary tool to drive artificial perceptual growth for shareholders to consumer capitalism (Van der Merwe, 1999) where they must consider innovation to drive organic growth to enable sustainable corporate longevity.

Finally, this paper hopes to give Richard Foster and Sarah Kaplan recognition for their contribution to point out the decline of corporate longevity and to get corporate executives to think about the critical importance of Creative Destruction.

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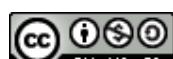


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