Pension Case Study

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An Overview of GRAFT was published by GRI in October 2017. Available on our website, this article should be read before the Pension Case Study to provide the overview of the concept of the Global Risk and Trends Framework (GRAFT).

This **Pension Case Study** provides the process, implementation, and outputs of the GRAFT process. The complete GRAFT framework, including automated tools and a full suite of case studies, will be released later in 2018.

GLOBAL RISKS AND TRENDS FRAMEWORK CASE STUDY:

MAPLE PENSION FUND

In this case study, Maple Pension Fund reviews its fund objectives in the context of increasing risks that could result in reduced long-term performance within its existing portfolio. Using the Global Risks and Trends Framework process helped this pension fund refine its investment strategy and develop more targeted portfolio monitoring and proactive investment management practices. This increased the likelihood that the pension fund would achieve its growth objectives, remain within its risk appetite for investment decisions, and meet their liability and funding requirements.

ADDRESSING GLOBAL RISKS AND TRENDS AT "MAPLE PENSION FUND (MPF)"

Maple Pension Fund (MPF)[1] is a major player in the Canadian pension fund industry. The MPF was created by specific federal legislation that sets their mandates and assigns oversight of the activities of the pension fund to a board of directors. The organization is responsible for both assets and liabilities, the fund reports to the pension regulator that focuses on the soundness of the plans, as measured by their funding and solvency ratios, and on the protection of the rights of their members.

The board is concerned about Global Risks and Trends and how they may impact Canada and specifically MPF and its portfolio of investments and liability obligations. The board of MPF has asked their CEO, Michael Abu, to identify the implications of world events in the context of potential adverse effects on MPF's portfolio. Michael used the GRAFT process Application Wheel[2], shown on the following page in Figure 1 to outline the nine steps that their organization went through with their management team to address the board's concerns. This was an iterative process based upon the key learnings of the team.

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1   Maple Pension Fund is a fictitious example of a Canadian Financial Institution created for the purpose of illustrating the GRAFT process.

2   Lois Tullo, "*A Global Risk & Trends Framework: Overview*", October 16, 2017

STEP 1. ARTICULATE KEY STRATEGIES

The process begins with a review of the organization's mandate, strategy, and risk appetite, leveraging existing corporate documentation.

MPF's overarching goal is to achieve the firm's investment returns with minimal risks, over the long term. While pursuit of this goal is solely for the benefit of pension recipients it will also contribute to the stability of the financial system.

Mission
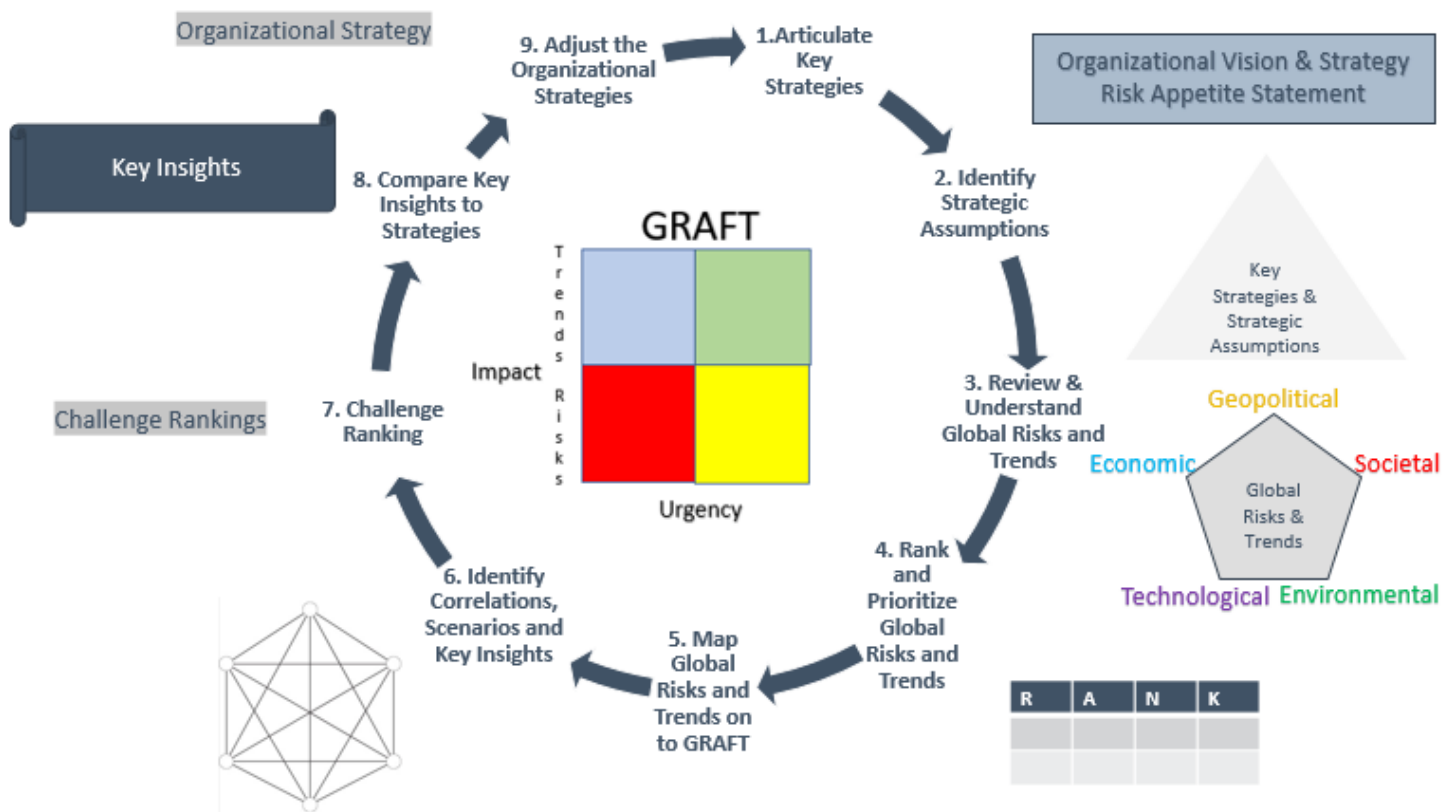To provide excellent service through prudent investment and innovation methods.

Vision
To be a leader in providing pension security.

Values
- *Excellence*
- *Diversity*
- *Honesty*
- *Repect*
- *Transparency*

1. *Our primary investment strategy is to be diversified by asset class, region, and timeframe. While acknowledging fluctuations of market prices in the short term, we shall achieve investment returns in a more stable and efficient manner by taking full advantage of our long-term investment horizon. At the same time, we shall secure sufficient liquidity to pay pension benefits.*

2. *We formulate the policy asset mix and manage and control risks at the levels of the overall asset portfolio, each asset class, and each investment manager. We employ both passive and active investments to attain benchmark returns (i.e., average market returns) set for each asset class, while seeking untapped profitable investment opportunities.*

3. *By fulfilling our stewardship responsibilities, we shall continue to maximize medium- to long-term investment returns for the benefit of pension recipients.*

Figure 1: GRAFT Application Wheel

STRATEGIC PRIORITIES 2018 - 2020

> *Build and maintain one of Canada's leading pension funds, serving an established member base*

> *Generate a real return target of close to 4 per cent per year over the long term*

> *Match asset/liability ratio growth through 2020*

> *Grow total assets under administration to $200 billion*

> *Keep total operating expenses under 0.3 per cent*

> *Manage about 80 per cent of the fund's assets internally*

> *Maintain an estimated solvency ratio (ESR) > 100%*

> *Continue to enhance the risk framework*

Broadly, MPF wants to grow its portfolio while remaining within its existing risk appetite. To do so, MPF has been expanding its investments in alternative asset classes such as infrastructure, private equity, and real estate, in Canada and abroad.

Step 1 of GRAFT involves ensuring the key strategies of MPF are articulated with objectives that:

- *Define the ends that the strategy is designed to achieve within a specific period;*
- *Outline the scope of the business landscape in the company operates; and*
- *Highlight the organization's competitive advantage (what the organization will do differently or better than the competition) to achieve the strategic objectives.*

Michael completed the table below to summarize MPF's strategy objectives.

Table 1: MPF Strategy

Strategic Objectives	Timing	Business Landscape	Competitive Advantage
Build and maintain one of Canada's leading pension funds with AUM of $200B, >4% return on AUM through asset diversification, pursuit of new opportunities and active portfolio management, serving an established member base.	Match asset/liability ratio growth through 2020. Grow assets under management by 15% by 2020, Maintain and manage a strong return of >4% over the long-term. Maintain management costs under 0.3% in 2018.	• Expected Canadian inflation growth close to 2%. • Interest rates near historical lows but projected to increase by 50 bps for 2018. • Equity markets at record highs, after 10% correction and 5% recovery in February 2018, greater than before credit crisis of 2007/08, with recent shift away from record low volatility. • Increasing world political unrest and instability. • Canadian dollar recent range of $0.75 - $0.80 to the US dollar expected to increase as oil prices recover.	MPF is one of Canada's Top 10 pension funds and ranks in the top 10 globally for performance of assets invested in alternative asset classes and commercial real estate. MPF is also one of the top 20 pension funds globally for overall return.

STEP 2. IDENTIFY STRATEGIC ASSUMPTIONS

In strategy setting it is important to identify the assumptions that the strategies are based upon and the critical dependencies for their strategies to be successful. Analysing the underlying strategic assumptions in concert with the changes in global risks and trends allows organizations and their leaders to identify, discuss, and model the implications of changes to the underlying assumptions. In these discussions, it is important to articulate how different scenarios of an event or trend could positively or negatively affect the underlying assumptions, and thus the level of success of the organization's strategy.

As part of the GRAFT process, MPF's leaders identified the strategic assumptions that MPF made for their strategy to be successful in their geographical location and industry. MPF's suggested (but not exhaustive) list is provided in Table 2. Primary considerations included factors affecting the value of their asset portfolio, the influences on the materiality and liquidity requirements of their pension liabilities, and potential for changes in the regulatory environment, in a Canadian context, but also with a global focus. Other factors considered relevant for MPF's assets outside of Canada were also considered to ensure a thorough analysis.

Explicitly identifying the underlying strategic assumptions was a new exercise for MPF's senior management (they were previously implicitly embedded in their planning process).

Table 2 – Example of Strategic Assumptions for MPF

	Strategic Assumptions	Risk Trend		
Primary:				
1	Directionality of interest rates	Declining	⦿	Rising
2	Stability of housing prices	Declining ⦿		Rising
3	Directionality of unemployment rates	Declining ⦿		Rising
4	Directionality of commodity prices	Declining	⦿	Rising
5	Stability and liquidity in bond markets	Unstable	⦿	Stable
6	Volatility and liquidity in equity markets	Volatile	⦿	Stable
7	Degree of volatility and liquidity in FX markets	Volatile ⦿		Stable
8	Stability of credit ratings of investments	Unstable ⦿		Stable
9	Degree of stability of the regulatory environment	Unstable	⦿	Stable
10	Current demographic trends	Changing ⦿		Stable
OTHER				
11	Security of computer systems	Declining ⦿		Improving
12	Degree of stability of the Government *(longevity, privatization, corruption, debt)*	Unstable ⦿		Stable
13	Degree of freedom of movement of and security of information	Limited ⦿		Free
14	Degree of freedom of movement of individuals	Limited ⦿		Free
15	Degree of social stability globally	Unstable ⦿		Stable
16	Degree of peace	War	⦿	Peace
17	Degree of the effect of Rule of Law	No rule	⦿	Rule
18	Degree of reliability of the infrastructure (power, telecommunications, water, etc.)	Unreliable	⦿	Reliable
19	Access to skilled workforce	Limited ⦿		Free
20	Law abiding workforce	Unstable	⦿	Stable
21	History and prediction of infectious diseases	Unstable ⦿		Stable

STEP 3. REVIEW AND UNDERSTAND GLOBAL RISKS AND TRENDS

Michael and his team then turned their attention to the specific Global Risks and Trends on the horizon using the **World Economic Forum's Global Risk Report for 2018**. [3]

From the World Economic Forum's Global Risk Report:

A *"**Global Risk**" is an uncertain event or condition that, if it occurs, can cause significant negative impact for several countries or industries within the next 10 years.*

A *"**Global Trend**" is defined in the World Economic Forum's Report as a long-term pattern that is currently taking place and that could contribute to amplifying global risks and/or altering the relationship between them.*

Unlike risks, trends are occurring with certainty and can have both positive and negative consequences. Trends can alter how risks evolve and interrelate, and they inform efforts at risk mitigation.

The Top Global Risks from the World Economic Forum's 2018 Global Risks Report are listed in Table 3 and the Global Trends are listed in Table 4. They are colour coded to reflect The World Economic Forum's classification into five risk clusters: **Geopolitical**, **Societal**, **Economic**, **Environmental**, and **Technological**. [4]

To gain context for understanding the Global Risks and Trends, Michael and team also reviewed the more detailed information regarding these risks and trends.

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3   The World Economic Forum, "The Global Risks Report 2018, 13th Edition,

4   A review of the Global Risks and Trends will be included in Appendix 1 of the proposed eBook "A Riskier World: It's Here", to be used to gain a common definition, factual backup for risks and trends, and insights. Use the information provided in Appendix 1 as input to the ranking and determination of the correlations between risks and trends. When reviewing the global risks and trends please keep in mind the strategic assumptions that will be impacted by the changing global risks and trends.

Table 3 - Top Global Risks

🟩	1.	Extreme Weather Events
🟩	2.	Natural Disasters
🟪	3.	Cyberattacks
🟩	4.	Failure of Climate-Change Mitigation & Adaption
🟨	5.	Weapons of Mass Destruction
🟥	6.	Water Crises
🟥	7.	Large-Scale Involuntary Migration
🟩	8.	Man-Made Environmental Disaster
🟩	9.	Biodiversity Loss and Ecosystem Collapse
🟥	10.	Food Crises
🟪	11.	Data Fraud or Theft
🟨	12.	Interstate Conflict
🟨	13.	Terrorist Attacks
🟨	14.	Failure of National Governance
🟦	15.	Asset Bubble
🟦	16.	Unemployment and Underemployment
🟥	17.	Profound Social Instability
🟦	18.	Fiscal Crisis/Sovereign Debt
🟨	19.	State Collapse or Crisis
🟨	20.	Failure of Regional or Global Governance
🟪	21.	Failure of Critical Information Infrastructure
🟥	22.	Spread of Infectious Diseases
🟦	23.	Failure of Critical Infrastructure
🟦	24.	Illicit Trade
🟥	25.	Failure of Urban Planning
🟪	26.	Adverse Consequences of Technological Advances
🟦	27.	Failure of Financial Mechanism or Institution
🟦	28.	Energy/Commodity Price Shock
🟦	29.	Deflation and/or Inflation

Table 4 – Global Trends

🟦	1.	Rising Income and Wealth Disparity
🟩	2.	Changing Climate
🟥	3.	Increasing Polarization of Societies
🟪	4.	Rising Cyber Dependency
🟥	5.	Ageing Population
🟨	6.	Increasing National Sentiment
🟦	7.	Growing Middle Class in Emerging Economies
🟨	8.	Changing Landscape of International Governance
🟥	9.	Rising Urbanization
🟩	10.	Degrading Environment
🟨	11.	Shifting Power
🟥	12.	Rising Geographic Mobility
🟥	13.	Rising Chronic Diseases

STEP 4.   RANK AND PRIORITIZE GLOBAL RISKS AND TRENDS

PRIORITIZE AND RANK GLOBAL RISKS

After reviewing and assessing each of the Global Risks, Michael's team started the prioritization process by rating each Global Risk as High, Medium, or Low impact based on their assessment of relevance (likelihood of occurrence, size of impact) for the organization. The team then considered likely timelines and assigned a timing or urgency factor of (<1 yr., 1 – 5 yrs., 5 – 30 yrs.) for each.

After this initial assessment, the team then proceeded with a more granular ranking, ranking each of the Global

Risks from 1 to 30 based upon impact to MPF, from highest to lowest. Table 5 shows the output of MPF's ranking, highlighting the risk of a shock to MFP's portfolio from the impact of extreme weather events and climate change on stock valuations, and inflation and debt levels impact on interest rates and fixed income portfolios.

(Risk 30 is left intentionally blank for the organization to add any risk that the World Economic Forum may not have highlighted that is specifically pertinent to the organization.)

Table 5 – MPF's Global Risks Ranking

	Global Risks	Magnitude/ Impact Low, LM, Medium, MH, High	Timing Immediate, Mid 3-5 yrs., Future > 5yrs	Prioritization 1 - 25
	1. Extreme Weather Events	H	I	5
	2. Natural Disasters	M	IM	9
	3. Cyberattacks	H	I	4
	4. Failure of Climate-Change Mitigation & Adaption	M	MF	25
	5. Weapons of Mass Destruction	H	IM	11
	6. Water Crises	MH	MF	21
	7. Large-Scale Involuntary Migration	M	M	19
	8. Man-Made Environmental Disaster	ML	M	16
	9. Biodiversity Loss and Ecosystem Collapse	L	F	28
	10. Food Crises	ML	IM	15
	11. Data Fraud or Theft	H	I	6
	12. Interstate Conflict	H	I	8
	13. Terrorist Attacks	H	M	10
	14. Failure of National Governance	H	M	14
	15. Asset Bubble	H	IM	1
	16. Unemployment and Underemployment	M	M	18
	17. Profound Social Instability	M	IM	13
	18. Fiscal Crisis/Sovereign Debt	H	I	3
	19. State Collapse or Crisis	M	M	17
	20. Failure of Regional or Global Governance	M	MF	24
	21. Failure of Critical Information Infrastructure	MH	M	23
	22. Spread of Infectious Diseases	ML	MF	26

	23.	Failure of Critical Infrastructure	ML	MF	27
	24.	Illicit Trade	H	I	7
	25.	Failure of Urban Planning	LM	M	29
	26.	Adverse Consequences of Technological Advances	H	FM	22
	27.	Failure of Financial Mechanism or Institution	H	F	20
	28.	Energy/Commodity Price Shock	H	I	12
	29.	Deflation and/or Inflation	MH	I	2
	30.	Global Risk Specific to Organization			

PRIORITIZE AND RANK GLOBAL TRENDS

Next, Michael's team reviewed each of the Global Trends to ensure that they understood and gave consideration to each, then rated each Global Trend based on their assessment of degree of impact, High, Medium, or Low, on the organization. They also assigned a timing of immediate (I), medium term (M) or future (F) and then refined the ranking to order the Global Trends from 1 to 14 based upon impact to MPF. The results are documented in Table 6.

(Trend 14 is left intentionally blank for the organization to add any trend that the World Economic Forum may not have highlighted that is specifically pertinent to the organization.)

Table 6 – MPF's Global Trends Ranking

	Global Trends	Magnitude/ Impact Low, LM, Medium, MH, High	Timing Immediate, Mid 3-5 yrs., Future > 5yrs	Prioritization 1 - 25
	1. Rising Income and Wealth Disparity	H	I	2
	2. Changing Climate	MH	M	10
	3. Increasing Polarization of Societies	MH	IM	5
	4. Rising Cyber Dependency	MH	I	4
	5. Ageing Population	H	I	1
	6. Increasing National Sentiment	M	I	3
	7. Growing Middle Class in Emerging Economies	M	M	7
	8. Changing Landscape of International Governance	M	M	8
	9. Rising Urbanization	M	M	9
	10. Degrading Environment	M	F	13
	11. Shifting Power	MH	F	11
	12. Rising Geographic Mobility	M	MF	12
	13. Rising Chronic Diseases	H	M	6
	14. Global Trend Specific to Organization			

STEP 5. MAPPING GLOBAL RISKS AND TRENDS

Michael's team then used the GRAFT mapping tool to populate the GRAFT map, the output of which is shown in Figure 2. The GRAFT map illustrates risks and trends that have been prioritized based upon urgency and impact. This facilitated a discussion of the events on the horizon that may have the most significant impact on MPF's portfolio.

The lower left corner of the **RED** zone shows the MPF's most urgent and immediate global risks:

1. *Asset Bubble*
2. *Inflation / Deflation*
3. *Fiscal Crisis / Sovereign Debt*
4. *Cyber Attacks*
5. *Extreme Weather Events*
6. *Data Fraud or Theft*
7. *Illicit Trade*

The lower left corner of the **BLUE** zone shows MPF's most urgent and immediate trends:

1. *Ageing Population*
2. *Rising Income and Wealth Disparity*
3. *Increasing National Sentiments*
4. *Rising Cyber Dependency*
5. *Increasing Polarization of Society*
6. *Rising Chronic Disease*

The risk and trend numbering on the GRAFT map identifies MPF's ranking before the risk or trend and the World Economic Forum [ranking] after the risk or trend.

The GRAFT map in Figure 2 is "terribly busy", however, it is included in its complete level of detail to demonstrate the complexity that organizations face. Without a systematic process to address that complexity it is too easy to give in to the temptation of the simplistic solution.

Figure 2 – GRAFT Map

STEP 6. IDENTIFY GLOBAL RISK AND TREND CORRELATIONS, MAGNITUDE, IMPLICATIONS, AND ORGANIZATIONAL KEY INSIGHTS

With the ranking and prioritization of the Global Risks and Trends completed, MPF compared and discussed the top trends and their interaction with the top risks and strategic dependencies at their organization. Next, they identified the correlations between each of the Global Risks and Trends, assisted by the GRAFT Correlation matrix tool (Figure 3). They also considered the interplay between the risks and trends to identify where one risk may give rise to other risks, thereby amplifying their impact. They used this step to inform and enhance their risk scenarios for quantitative stress testing, considering how events would play out and the impacts for the organization, to drive more directed quantitative stress testing analysis.

Michael and team ranked Asset Bubbles as the highest risk given how market shocks could affect their asset values, and they ranked Aging Population as the most relevant trend. Step 6 of GRAFT stimulated a discussion about how the aging population would change demand for equities,

bonds and for real estate and the resulting effects on asset values, returns, and liquidity, in tandem with other influences such as an increase in equity market volatility and an increasing interest rate environment.

They also considered the interplay of asset values and extreme weather events as highly correlated. EWEs such as flooding, hurricanes, and drought have over the past several years had a significant impact on individual stocks and certain indexes. These moves have often been correlated with other global risks and trends such as natural disasters, man-made disasters and climate change.

As shown in Figure 3, the GRAFT Correlation Matrix ranks the correlations between risks and trends as High, Medium or Low, based upon their combined interaction. For example, the risk of an Asset Bubble is highly correlated/ combined with the risk of increasing Inflation and Fiscal Crisis/Sovereign Debt.

Figure 3 – GRAFT Correlation Matrix Tool
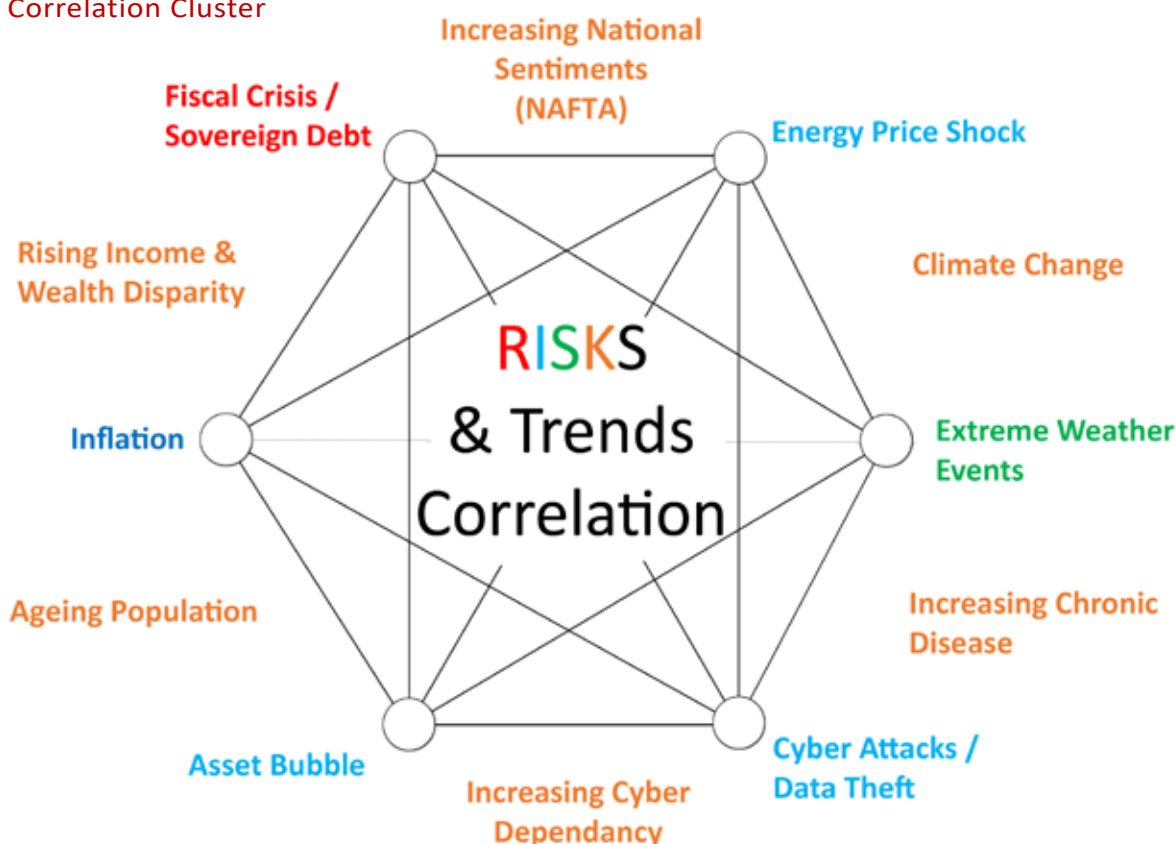
STEP 7. RE-ASSESSMENT AND CHALLENGE

Throughout the process, MPF was assessing and challenging the rankings and correlations through discussion sessions with senior leaders. They concluded that as they reviewed the Global Risks and Trends, unforeseen forces outside their home market had an impact on their portfolio. This led to the inclusion of a larger set of risks and trends for analysis. For example, they considered the influence interstate conflicts could have on asset prices globally and the potential cascading effects for Canada.

MPF's re-assessment and challenge focused mainly on the top trends and how the long-term implication of these trends would affect the second list of high impact and current risks:

For example, the team considered and discussed how rising income and wealth disparities could lead to an increase in interstate conflicts, with a coincident rise in cyber terrorism and illicit trade to raise funds and arms for such conflicts.

Looking forward, MPF is considering the impact that developments around the globe such as the evolving political horizon in the United States, the Brexit EU discussions, OPEC oil production, North Korea missile testing, power shifts in several countries including Brazil, Venezuela, and Turkey could have, and the correlation with the Global Risks and Trends affecting MPF and their rankings and prioritizations.

Figure 4 – GRAFT Correlation Cluster

Michael and his team then used the identified correlations to inform their quantitative scenario analysis, giving consideration to potential short run and longer-term implications. The main factors considered in their analysis are documented in the window box that follows.

MICHAEL'S TEAM DISCUSSION CENTRED ON THE FOLLOWING RISKS, TRENDS AND THEIR CORRELATIONS.

Asset Bubble:
The Dow Jones industrial average since November 2016 increased 40% to January, 2018, followed by the decline of 10% in 4 days, and 5% recovery in the first week of February, 2018. Toronto Multiple Listing Service (MLS) home price index year over year change increased between 15 – 30% in 2017. Canadian home prices are 55% greater at the end of 2017 than Q4 2009.[5] Toronto area home prices declined 12% in February of 2018.

Fiscal Crisis / Sovereign Debt:
Major economies including the US, EU, and Canada running significant deficit budgets, US debt ceiling, tightening of Monetary Policy and tapering of quantitative easing by the European Central Bank (ECB) and the Bank of Japan (BOJ).

- US deficit levels rose to $980 billion for 2018, $1.2 trillion for 2019, with a now estimated 10-year horizon to balance the budget. US National debt levels reached $21 trillion in March 2018, while total US debt was at $69 trillion.[6]

- Treasury Borrowing Advisory Committee expects the federal government will need to borrow $955 billion in fiscal year 2018, which ends on September 30. "If interest rates are just one percentage point higher than projected, federal interest payments would be around $1.5 trillion higher through the next 10 years.[7]

- Canadian deficit levels have risen to new highs of $19.9 billion for the 2017/18 budget year, with a target of 2045 for a balanced budget. Federal government debt levels at the start of 2018 were at $650 billion increasing at $57 million a day.[8]

Inflation:
Increasing and expected increases in inflation rates globally, and specifically for December 2017 Canada 1.87%, US 2.11%, UK 3.0% and Europe 1.4%. Forecast inflation for 2018 is Canada 2.0%, US 2.1%, UK 2.2% and Europe 2.3%. US annual rate of headline inflation figures for January increased to 2.1%.

Cyber Attacks:
There were 700M global cyberattacks in 2017, an increase of 44% over 2016. In 2017 there were 1.7B bot attacks. In 2017, more than 1 in 10 new account creations were fraudulent, and there was a steady growth of attacks on mobile devices, of which 52% of all transactions are made on mobile devices.

Extreme Weather Events:
EWEs caused damages incurring world losses of US$ 3.16 trillion, these losses were incurred as a direct result of almost 11,000 extreme weather events, between 1997 and 2016. During this time more than 528,000 people died globally.[9]

Climate Change:
2017 was the third warmest year in National Oceanic and Atmospheric Administration's (NOAA) 138-year record. Increasing CO_2 levels are a key risk factor in climate change models that have predicted the least temperature rise would be on average 1.65°C (2.97°F), but upper estimates vary a lot, averaging 5.2°C (9.36°F). Current best estimates are for a rise of around 3°C (5.4°F), with a likely maximum of 4.5°C (8.1°F).[10]

Rising Income and Wealth Disparity:
For 2017, eight individuals had the same wealth level as 3.6 billion or 50% of the global population. Recent US tax revisions focus on providing tax benefits to large corporations and the top 1% of individuals.

Ageing Population:
The support ratio of contributors to pensioners dropped from 4.1 in 2010, to 3.5 in 2017 and is projected to reach just 2.1 by 2050 due to increases in life expectancy and employee mix.

Increasing National Sentiments:
Protectionism sentiments in trade negotiations and immigration in the US (NAFTA, TPP) and some European countries are influencing future investment decisions.

Increasing Polarization of Society:
Global interest in populism is four times greater today than it has been in at least the past decade,[11] according to Google Trends. Christopher Garman, a lead analyst and managing director with the political risk consultancy Eurasia Group, calls it a "tipping point phenomenon." Politics are driving the economy now, he says, and the growing income gap coupled with the migration crisis has created an "aligning of the stars" for populists to take power.[12]

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5   The Economist, "*Daily Chart: The Economist house-price indices*"

6   "US Debt Clock" http://www.usdebtclock.org/

7   Jeanne Sahadi, "*Trillion-dollar deficits will hit sooner than expected*", February 7, 2018,

8   "*Canada's Federal Debt*"

9   German Watch, "*Global Climate Risk Index 2018*"

10 Skeptical Science, "*How do we know more CO2 is causing warming?*"

11 Google Trends, "*Populism*"

12 Deidre McPhillips, "*What is Populism?*" March 31, 2017

STEP 8. IDENTIFY KEY INSIGHTS AND COMPARE INSIGHTS TO STRATEGY

MPF then identified Key Insights stemming from the correlation of the prioritized Global Risks and Trends.

MPF compared the correlation relationships to the organization's strategy and strategic assumptions. The exercise facilitated a discussion confirming and contradicting some of the participants' previous views about MPF's strategy and strategic assumptions. MPF next compared the prioritized risks and trends to their underlying strategic assumptions to identify the key relationships and potential event drivers that would impact the organization's ability to achieve their goals.

Michael then discussed with his team the impact and correlations that Global Risks and Trends relationships had on MPF's high-level business strategies. The outcomes of those discussions are summarized in Table 7 – Correlation Implications and Key Insights.

Table 7 – Correlation Implication and Key Insights Table

Primary Risk or Trend	Identify Correlated Risk or Trend	Magnitude of Correlation and Implication	KEY INSIGHTS Events or Potential Events Stemming from Correlation of Trends and Risks
Increasing National Sentiments / Increasing Cyber Dependency	*Asset Bubble*	Social media influenced the BREXIT vote which triggered a correction of the asset bubble in London and has added pressure to the asset bubble in other major EU cities. Revisions in US tax reforms focus on repatriation of currently untaxed profits of US companies being stored abroad — profits that would normally be taxed at a 35 percent rate upon being brought back to the US — and tax them at new ultra-low rates: 8 percent for profits invested in real estate and other hard assets abroad, and 15.5 percent for profits in cash and stock and other liquid assets.	*Shift in asset allocation toward continental Europe away from England continues as uncertainty around a hard or soft BREXIT continues.* *The US tax reforms have continued to vitalize the equity markets, driving P/E ratios to new highs. Sentiment has turned from a win for the economy to a potential driver of an increase in inflation in an overheated economy.* *Pressure on the asset bubble in the late stage of the economic cycle maybe lead to outsized correction due to the dual economies that have developed caused by the separation of wealth distribution, return of increased volatility levels to the market, rising employment levels and the resulting reduction in productive GDP forces.* *As asset prices continue to grow, scenario analysis and stress testing should increasingly focus on including higher levels of correction, and implications of softer trends and risk factors.* *The results of the increased stress testing indicated a shift away from emerging market investments that have high US dollar debt exposures.*
Disparity of Income & Wealth	*Asset Bubble*	The disparity of income and wealth is increasing due to asset bubbles: inflated prices make attainment of housing and equity ownership more challenging, with a lack of savings by the bottom 60% of wage earners. The last tax holiday in the US resulted in the top companies repatriating earnings, but the companies actually shed jobs over the next few years, and the funds were mostly funneled to shareholders in the form of higher dividends and more stock buybacks. That helps wealthy stock owners, but not the overall economy.	
Unemployment	*Asset Bubble*	Low unemployment levels in Germany, France, the US, and Japan are raising questions whether the economies have reached full employment. If so this would drive higher inflation, interest rates, real estate values and equity prices.	

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Table 7 – Correlation Implication and Key Insights Table - con't

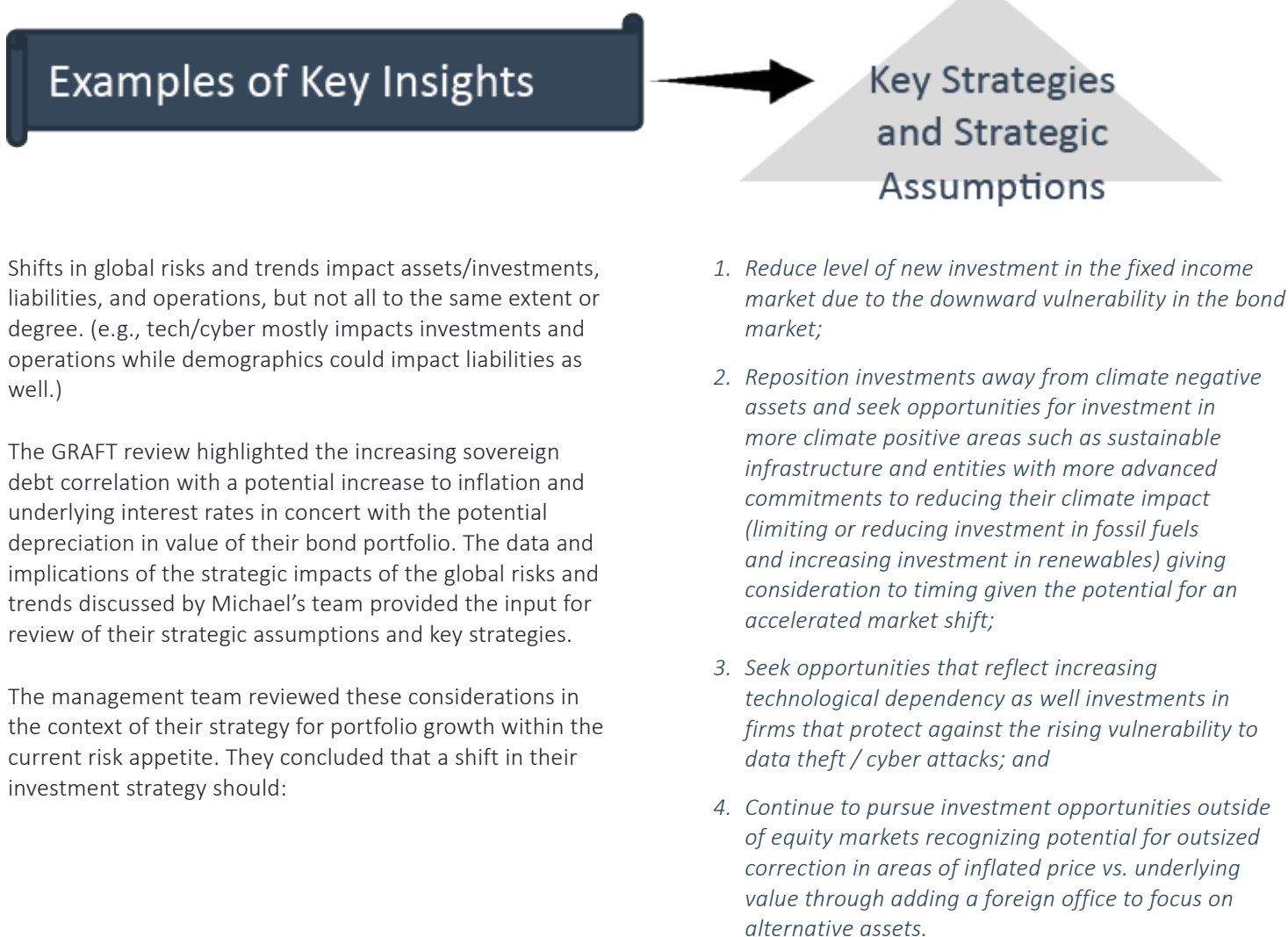| Primary Risk or Trend	Identify Correlated Risk or Trend	Magnitude of Correlation and Implication	KEY INSIGHTS Events or Potential Events Stemming from Correlation of Trends and Risks
Fiscal Crisis/ Sovereign Debt	*Inflation / Deflation*	Procyclical effects of increasing government deficits and debt levels will be exacerbated by the reduction of the workforce due to the aging population.	*US debt ceiling, as well as reduction in quantitative easing in Europe, Japan and the US, are causing 10-year bond yields to rise significantly, and thus bond prices to decrease to new lows. Further increases in the 10yr bond rate are expected along with new lows in bond market pricing.*
Climate Change	*Extreme Weather Events / Increasing Cyber Dependency*	Climate change presents market risks and opportunities through four channels: 1) physical: more frequent and severe weather events over the long term; 2) technological: advances in energy storage, electric vehicles (EVs) or energy efficiency undermining existing business models; 3) regulatory: tightening emissions, energy efficiency standards, changing subsidies and taxes; 4) social: changing consumer preferences and pressure groups advocating divestment of fossil fuel assets. (*Blackrock on Climate Change*)	*Climate-aware investing includes gradual implementation of climate considerations into portfolio management and addressing the complexities of a one-time portfolio makeover (exit strategy for stranded assets, etc.). Opportunities for expanded investment in sustainable infrastructure will become available to offset the downside risks that climate change brings.* *Opportunity to use artificial intelligence tracking of social media mood shifts in the area of climate change, effect of government regulation and sentiment towards investing in borderline industries. Attention should be given to companies with good climate governance to avoid having invested in companies with compliance failures that can trigger large fines, legal bills, reputational loss, and a sudden implosion in asset prices.*
Ageing Population	*Increasing Chronic Disease*	Increasingly ageing population and increased frequency of chronic disease has led to longer payout periods on pensions, and increasingly heavy demands on health benefit coverage.	*Portfolio stress testing in relation to aging population and increasing chronic disease costs should be used to identify potential increasing demands on the portfolio.*
Large Involuntary Migration	*Increasing National Sentiment*	The strain on resources along with the unknown outcome of involuntary migration into Europe has increased national sentiments, e.g., Brexit vote prompting Britain to leave the EU. Further European votes may lead to further breakup of EU. Immigration and populism in the US tied to increasing national sentiments have influenced the adoption of stricter border controls, immigration regulations, and deportation enforcement.	*Increasing national sentiment within and outside Europe may lead to fluctuations in currencies and further inflationary pressures, exacerbating concerns regarding asset bubble / negative equity and loan default risks. This may lead to increased volatility in the equity markets, and further upward rate pressure in fixed income markets.* *Scenario analysis and investment discussions should highlight recent changes in immigration and populism trends that may affect national elections, and confidence in newly elected governments.*

MPF leaders acknowledged the growing array of factors, both domestic and international, that could potentially result in reduced portfolio growth and increase liabilities. They concluded that certain areas of the portfolio would be more at risk than others and that more granular portfolio monitoring, isolating the higher risk segments, would be beneficial. Segmenting the portfolio by vulnerability would facilitate a better understanding of

the level of risk in the portfolio and would allow for stress testing these segments to quantify potential downside impacts. It would also allow for implementation of Early Warning Indicators designed to flag when risk factors reach a designated level of concern so that pro-active steps (e.g., more active and early intervention efforts) can be taken to reduce the potential for portfolio losses.

STEP 9. ADJUST THE ORGANIZATIONAL STRATEGIES AND PREPARE FOR CHANGES IN THE GLOBAL RISKS AND TRENDS

Figure 5 - Map out an action plan to prepare for changes in the Global Risks and Trends

Shifts in global risks and trends impact assets/investments, liabilities, and operations, but not all to the same extent or degree. (e.g., tech/cyber mostly impacts investments and operations while demographics could impact liabilities as well.)

The GRAFT review highlighted the increasing sovereign debt correlation with a potential increase to inflation and underlying interest rates in concert with the potential depreciation in value of their bond portfolio. The data and implications of the strategic impacts of the global risks and trends discussed by Michael's team provided the input for review of their strategic assumptions and key strategies.

The management team reviewed these considerations in the context of their strategy for portfolio growth within the current risk appetite. They concluded that a shift in their investment strategy should:

1. *Reduce level of new investment in the fixed income market due to the downward vulnerability in the bond market;*

2. *Reposition investments away from climate negative assets and seek opportunities for investment in more climate positive areas such as sustainable infrastructure and entities with more advanced commitments to reducing their climate impact (limiting or reducing investment in fossil fuels and increasing investment in renewables) giving consideration to timing given the potential for an accelerated market shift;*

3. *Seek opportunities that reflect increasing technological dependency as well investments in firms that protect against the rising vulnerability to data theft / cyber attacks; and*

4. *Continue to pursue investment opportunities outside of equity markets recognizing potential for outsized correction in areas of inflated price vs. underlying value through adding a foreign office to focus on alternative assets.*
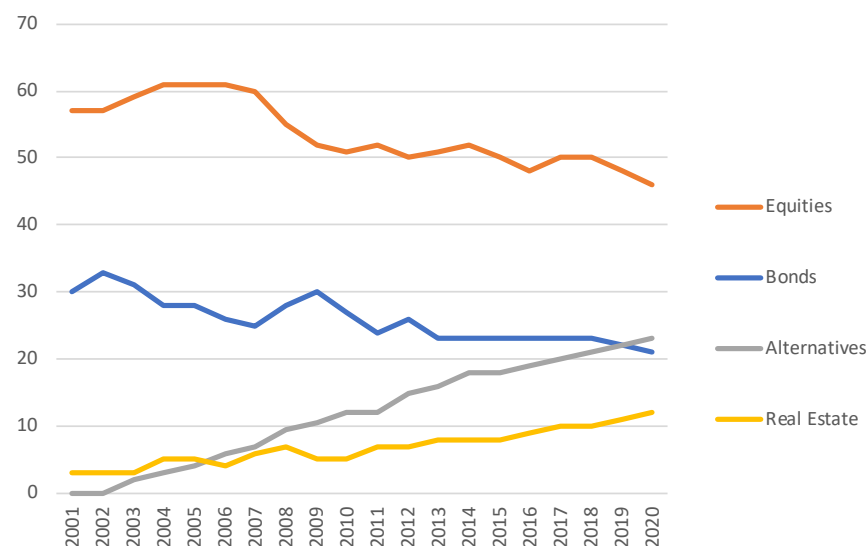
As a result, MPF modified its growth strategy to specifically target artificial intelligence, blockchain, and cyber protections technology investments on a test basis; they also decided to avoid potential downturns in more vulnerable sectors affected by climate change, and to slowly reduce their bond portfolio through a non-reinvestment as bonds mature strategy. MPF set new targets for portfolio mix which reflected the increase in Alternatives and a reduction in Bonds, and a rebalancing of their equity portfolio

In addition, they identified opportunities for enhanced portfolio monitoring and proactive counterparty risk strategy to identify credit quality risks before they deteriorate significantly. The revisions to strategy are shown in Table 8.

Figure 6 – Shift in Portfolio Mix

Percentage of the Pension invested in each category

Source: Heather Gillers, "Pension Funds' Dilemma: What to Buy When Nothing Is Cheap?" January 1, 2018,

Table 8 – MPF Strategy

Strategic Objectives	Timing	Business Landscape	Competitive Advantage
Build and maintain one of Canada's leading pension funds with AUM of $200B, >4% return on AUM through asset diversification, pursuit of new opportunities and active portfolio management, leveraging AI capability, serving an established member base.	Match asset/liability ratio growth through 2020. Grow assets under management by 15% by 2020. Maintain and manage a strong return of >4% over the long-term. Maintain management costs under 0.3% in 2018.	• Expected Canadian inflation growth of 2%. • Interest rate increases projected at 50 bps for 2018. • Equity markets at record highs, after 10% correction and 5% recovery in early 2018, greater that before credit crisis of 2007/08, with recent shift away from record low volatility. • Increasing world political unrest and instability. • Canadian dollar recent range of $0.75 - $0.80 to the US dollar expected to increase as Oil prices recover.	MPF is one of Canada's Top 10 pension funds and ranks in the top 10 globally for performance of assets invested in alternative asset classes and commercial real estate. MPF is also one of the top 20 pension funds globally for overall return. Growing expertise in emerging technology, using AI to support investment analysis.

CONCLUSION

The pension fund industry is faced with global risks and trends that are increasingly complex. Solutions to the challenges that the industry is facing today, and tomorrow must take into consideration these complexities. Doing this will enable participants to develop strategies that prepare for potential Black Swan and Grey Rhino [13] events.

Prior to implementing GRAFT, MPF had an "decentralized process" to identify and evaluate the impact of risks that were external to the organization. MPF's enterprise risk management framework focused mainly on Market, Credit and Operational Risk, without an explicit linkage to strategic risks and opportunities, material dependencies / strategic assumptions, and trends.

By following the GRAFT process, MPF leaders completed a systematic and thorough review of risks and opportunities. They confirmed their intuitive concerns surrounding the shifting global landscape of geopolitical, environmental, and economic trends. More importantly, use of GRAFT stimulated awareness and discussion of a broader range of risks, direction of their quantitative scenario analysis considering the cascading effects of risks, and expanded stress testing to incorporate knock-on impacts, looking at how events could play out. This analysis led to the development of a more targeted growth strategy as well as a plan to develop enhanced, segmented portfolio monitoring, analysis to quantify the magnitude of opportunities and risks under a variety of scenarios and the implementation of early warning indicators to prompt early action in the face of actual market deterioration. By implementing GRAFT, MPF's senior leaders and the Board were able to enhance both their approach to portfolio growth and to risk management.

APPENDIX

Using GRAFT to Meet Regulatory Compliance Requirements

MPF was able to use the GRAFT process to support regulatory requirements for risk identification.

OSFI's Risk Assessment System for Pensions (RASP) requires private pension plans registered with OSFI to generate key risk indicators, thereby enabling early identification of issues. The analysis completed using GRAFT was useful to meet this requirement.

OSFI's Risk Assessment Framework for Federally Regulated Private Pension Plans Framework (RAFFRP) requires a separate evaluation of the inherent risks and quality of risk mitigants for four significant activities that cover the operations of all pension plans: administration, communication to members, actuarial and asset management. Again, the GRAFT process was useful for this purpose.

OSFI's RAFFRP also involves an assessment of risks associated with solvency. OSFI reviews pension plan solvency ratios (the ratio of assets over liabilities on a plan termination basis) for the defined benefit plans it regulates. As at December 31, 2016, the estimated solvency ratio (ESR) for MPF's plan was 0.99, versus 0.97 for the year earlier. ESRs calculated by OSFI for the defined benefits plans that are subject to OSFI regulation averaged 0.80 as at December 31, 2016 (0.79 for the year earlier) meaning that their estimated liabilities exceeded assets on a plan termination basis.

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13   *The highly obvious, probable threats that may or may not be getting the attention and responses they need to be averted.*