FUTURE-PROOFING INVESTMENTS Resilience Due Diligence







Our increasingly VUCA environment provides increased risks and opportunities

The world is becoming more volatile, uncertain, complex and ambiguous (VUCA). There is an increased need to understand the factors that will affect our investments in both the short and long term, so that we can make informed decisions and safeguard our investments. Conversely, this volatile environment provides opportunities for those with the foresight and agility to capitalize on them.



A resilient organization is adaptive, agile, robust and competitive - harnessing experience and embracing opportunity to achieve longevity.



A resilient approach to due diligence provides a platform for responding and adapting to a dynamic business environment; allowing investors to take measured risks with confidence, responding quickly and appropriately to both opportunities and threats.

Whilst risk prevention and mitigation is an important part of resilience, it is not a defensive strategy. It is a positive, forward-looking strategic enabler. It reduces risk and therefore increases value. Resilient investors are agile and proactive: aware of, anticipating, creating, and taking advantage of new opportunities.

We have developed a framework and approach that can provide a comprehensive assessment of the resilience of your investment. Reviewing strategic risks and trends and comparing them with the robustness and agility of the investment to mitigate or adapt. This results in an overall quantification called the resilience rating for the investment, which provides the following benefits:



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- Provides increased confidence in resilience of investments
- Provides comparison of investments to facilitate clear decision making
- Provides business case for investing
- Leads to the realization of high return on investment
- Links technical risk to financial returns

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We offer a tiered approach to our resilience service, from a quick, high-level screening service, down to a more detailed assessment of an individual investment, as shown in the flow chart below.

Tiered Approach to Resilience Measurement



Our resilience screening service provides high-level advice for owners, investors or insurers into the potential risks to their investment due to the increasingly VUCA environment.

This service is a desktop study and considers the following:

- Assessment and prioritization of shock, stress and trend factors most pertinent to your transaction ٠
- Identification of key areas of vulnerability to identified shocks and stress and trend factors ۲
- Assessment of current capacity to mitigate or respond to identified factors •
- Overall resilience (risk) score identifying areas of concern and opportunity ٠
- Uncertainty guantification, depending level of information and depth of assessment
- Brief dashboard report covering the above ٠

We provide a measurement of the resilience of your organization or asset through our innovative resilience framework, shown below. This provides a baseline measure of the resilience of you investment. This quantitative measure will also assist you in building the business case for investing in resilience measures as the cost-benefit can be clearly measured and articulated over time.

Providing a comprehensive insight into your investment

Our innovative, multi-factor resilience framework considers all aspects of an investment and is centred around how it delivers value. This gives a comprehensive quick snapshot of how resilient your investment is and highlights risks and opportunities.



MMI'S ASSET RESILIENCE FRAMEWORK

(blue denotes resilience demand, green denotes resilience capacity). The biggest gap indicates the areas in most need of resilience building.



Multimillion dollar investments require a good understanding of the risks associated with both the revenue side and the cost side. Because of its simplicity, the net present value (NPV) technique is the most widely used method to evaluate long-term multimillion dollar investments. In the NPV method, all risks associated with a project are lumped into a single parameter (i.e., the risk premium) that is, the time value of money is adjusted to account for risk. However, because NPV results are very sensitive to the selection of the discount rate, this practice of selecting a discount rate based on heuristic arguments and rules of thumb introduces a time-bias effect that have led to significantly under- or over-valuing of future revenues and/or expenditures (or liabilities). Moreover, because risk and time are indeed independent variables, accounting for risk in this manner makes it difficult to take advantage of experts' experience as it is difficult to establish a direct correlation between risk and discount rate.

A complementary valuation method that decouples the time value of money from the risk associated with a project can be used to evaluate the effect of investing in resilience. The method, termed decoupled net present value (DNPV), is simple and intuitive yet flexible, consistent, and robust (for more details visit www.dnpv.org). This bottom-up approach allows all technical experts associated with the project to identify all risks associated with it and then integrate these risks in the project valuation (i.e., it is endogenous to the project). More importantly, it allows the financial benefits of investing in resilience measures (and averting future losses) to be quantified. Our ability to understand the project's financial and risk performance of a project allows us to provide clients with additional tools for their investment decisions. The classic NPV is used as a measure of the project financial performance whereas DNPV is used as a measure the project risk performance. A project is said to earn a return consistent with the risk of the project if DNPV>0 whereas it earns its cost of capital if NPV>0. Optimal investments are obtained when both the financial and risk performance measures are greater than zero.



Working closely with our clients, we help realize the benefits of investing in resilience.

Often, a more detailed assessment is required, if the screening identifies significant risks. We can provide a full spectrum of analysis from qualitative expertise through to advanced technical analysis, because unlike other advisors, MMI has deep engineering expertise to complement our strategic resilience service. This also allows us to provide advice and solutions on how to mitigate identified risks or realize opportunities.

We provide the following resilience related services:







ADVISORY SERVICES

- Resilience Investment Appraisal
- Resilience Strategy Development
- Risk & Resilience Governance & Management
- Resilience Audit
- Security & Counter Terrorism Strategy
- Change Management
- Client Value Surveys
- Risk & Resilience Data Management
- Community Resilience Initiatives

PHYSICAL VULNERABILITY REDUCTION

- Earthquake Engineering
- Water/Wastewater
- Flood Mitigation
- Systems Engineering
- Climate Change Mitigation & Adaptation
- Geotechnical Engineering
- Environmental Engineering
- Fire/Blast Engineering
- Structural Engineering
- Asset Integrity

BUSINESS CONTINUITY, INCIDENT RESPONSE & RECOVERY PLANNING

- Emergency Response Planning
- Business Continuity Planning
- Incident Management Plans
- Information Management Systems
- Training & Exercising

Our team of world class experts are here to assist you



CAROLINE FIELD is a Principal with more than 20 years of experience in engineering consultancy for the built environment. Caroline currently leads MMI's Resilience Practice Area; helping clients develop risk-based, comprehensive approaches to resilience. Her approach balances physical mitigations with adaptive capacity, consider shocks and stresses, social and economic factors, and incorporates future-trends analysis.

Using a resilience framework and approach that supports client decision-making and prioritization, Caroline assists clients in developing and implementing their resilience policy and strategy. The strategy can be used to help cities, masterplans, campuses, organizations, infrastructure systems and buildings manage disruption and change.

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Caroline recently completed a city resilience masterplan with the World Bank for the City of Beirut. Strategies included the establishment of a cross-sectoral platform for disaster risk management as a crucial aspect of risk governance to manage and implement the actions identified; an earthquake risk reduction plan; climate change adaptation plan; coastal resilience plan; information management plan, community resilience building plan, response plan and recovery plan framework.

Caroline is active in developing resilience standards and approaches with industry organizations such as the British Standard for City Resilience, which she Chairs and the ASCE Infrastructure Resiliency Division where she co-chairs the SPEED committee. Caroline is a Chartered Engineer with the Institute of Civil Engineers in the UK, a Member of the Register of Security Engineers and Specialists, a licensed professional engineer in California and a member of the American Society of Civil Engineers.



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RICHARD LOOK has worked at every level of government developing policy, managing requirements, systems mapping, implementing strategy and running critical operations. He has first-hand experience from every aspect of resilience from preparing communities, to developing hazard mitigation, to the coordination of numerous emergency responses and recovery operations. He is adept at eliciting requirements using a range of analytical and interactive methods and developing and delivering verification plans through test, exercise, audit, performance management and reporting. He applies a collaborative, innovative, systems approach breaking problems down to route causes and applying core principles to ensure robust, effective and efficient solutions. Richard is a Senior Resilience Consultant within the Resilience Team.

With a background in emergency planning, business continuity, programme and project management, procurement, systems, requirements and the military, he brings a practical, integrated, resilience approach to VUCA (volatile, uncertain, complex, ambiguous) problems. He has spent the last 17 years practicing in this area with significant experience both mitigating community risks and responding to emergencies. Most recently, Richard has focused on providing resilience consulting services for cities, organizations and buildings.

He has been a joint winner of the Royal Charter International Research Award, completed a resilience diagnostic and strategy for a \$10bn health care project, been core to the development of an online city resilience assessment tool and was the Project Lead delivering the Comprehensive Urban Resilience Masterplan for the City of Beirut. Richard has a pragmatic, systematic, performance-based approach to resilience that centres on creating and protecting value by balancing potential opportunities and threats with the clients' risk and cost appetite as well as the end users' safety needs.

Our team of world class experts are here to assist you



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DR. DAVID ESPINOZA is a Senior Principal at Geosyntec CAT Advisory with 25 years of experience. His particular expertise focuses on financial risk analysis and risk monetization for infrastructure and geoenvironmental projects. These projects have included municipal solid waste, transport infrastructure capital construction, and industrial facilities; mining facilities, reservoir systems, and renewable energy projects. His advisory experience in the risk area has included the evaluation of the economic feasibility of major capital projects including projects to reduce carbon emissions in South America and the U.S. He has developed quantitative methods for the evaluation of investment risk in environmental and infrastructure projects using state-of- the-art financial theory. His methodologies have been published in leading peer reviewed journals and presented at several conference venues. Dr. Espinoza has provided financial risk consulting services to PIMCO (the largest bond fund), Climate Change Capital (the largest carbon credit fund), the Inter-American Development Bank as well as several private equity investors.

Dr. Espinoza's financial modeling accomplishments include financial modeling of a 147-MW solar power plant in Atacama, Chile. He performed a financial analysis for PIMCO funds, for a \$300 million investment. Dr. Espinoza has also conducted financial modeling and strategy development for greenhouse gases for a US\$220 million project in Bogota, Colombia where he developed financial models and bid strategies. Dr. Espinoza has written several papers in the areas of engineering, solid waste and finance that have been published in peer-reviewed journals and trade magazines.



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TONY BYRNE is an experienced asset management professional with considerable capital asset experience specifically with operations and maintenance (O&M), overhaul, and development of projects in the petrochemical and power industries, having worked directly for and with some of the largest chemical and energy enterprises internationally. His O&M experience in petrochemicals and power includes development of operational procedures and standards, implementing maintenance management systems, plant and facility upgrades, control system upgrades, management of overhauls, contracts, and emergency procedures and systems. Tony's experience includes carrying out power and gas pipeline project development including site search, environmental permitting, planning, and negotiations with engineering, procurement, and construction (EPC) and maintenance contractors, government departments, and he has undertaken due diligence work for power plant acquisitions in the UK and Italy. His international project development work has involved direct experience in the UK, Spain, Norway, Croatia, Germany, the Netherlands, Middle East, Japan, and Australia.

Tony has supported clients with all O&M aspects of EPC contracts for power projects valued at \$1.6bn, and negotiated directly for gas turbine long term service agreements. He has provided clients with process safety management support for new gas production facilities, design basis development for offshore facilities, safety case development for a floating production, storage and offloading unit, review of a major international gas pipeline front-end engineering and design report, safety and environmental management systems, and ignition prevention reviews

We are engineers, scientists ^{and} innovators.

Technical, Engineering and Scientific Services to Help Manage Risk.



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