XDI CROSS DEPENDENCY INITIATIVE

TCFD PHYSICAL RISK REPORT

EXCERPT

(Sample Company) Profile Overview

A closer look at the (Sample Company) assets

(Sample Company) Hazard Snapshot

XDI PLATFORM

XDI Globe globe.xdi.systems / Easy XDI easyxdi.com / XDI Company Portal

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1.2 SUMMARY TABLE: XDI DELIVERY OF TCFD REPORTING RECOMMENDED PRACTICE

ELEMENTS OF PHYSICAL RISK ASSESSMENT	GUIDANCE AND RECOMMENDATIONS	WHAT XDI DELIVERS
Hazards	Storms, extreme rainfall, extreme heat, heatwave, flood, drought and wildfire, variability in precipitation and temperature, water stress, sea-level rise, land degradation (IIGCC 2020a). Heat stress, extreme rainfall, drought, cyclones, rising sea levels, wildfire and other industry-relevant and/or locally specific climate hazards across the corporate value chain (EBRD 2018).	XDI modelling incorporates eight climate hazards: coastal inundation (sea level rise), riverine flooding and pluvial flooding (extreme rainfall), extreme heat, wind (storms), soil contraction (effect of drought), freeze/thaw (effect of temperature) and forest fire.
Timeframes	Short and medium term: 2020-2040 (IIGCC 2020a, EBRD 2018). For this time frame, the EBRD recommends probabilistic risk analysis. Longer term: 2040-2100 (IIGCC 2020a, EBRD 2018). For this time frame, the EBRD recommends scenario-based analysis. The BOE's biennial exploratory scenario will model 2020-2050 but for the "no policy action" scenario, physical impacts in 2050 will represent expected physical impacts in 2080 (BOE 2019b).	The analysis is probabilistic from 2020 to 2100 for multiple climate scenarios ranging from "no policy action" (RCP8.5) through to "extreme policy action" (RCP2.6). Results can be presented in different decadal time steps (e.g. 2030, 2050 and 2100) depending on client requirements.
Scale	Location (country or city) of key supplier facilities and critical business facilities with evaluation of their importance (EBRD 2018). Asset-level data and assessment with attention to downscaling limitations of models (IIGCC 2020a, CISL 2019).	XDI works at address and site level, data is aggregated from suburbs to national as required. Regional Climate Models (RCMs) include local topology and land surface information to provide spatial resolutions to between 5 and 50km square resolution. Further hazard layer context includes local weather data, elevation data, vegetation maps and wind zones with resolutions between 5 and 250 metres

ELEMENTS OF PHYSICAL RISK ASSESSMENT	GUIDANCE AND RECOMMENDATIONS	WHAT XDI DELIVERS
Scenarios	**Most guidance for physical risk assessment recommend use of 2°C and 4°C pathways** (CISL 2019, IIGCC 2020a). Consistent with IIGCC recommendation, the TCFD 2019 Status report indicates that RCPs 2.6 and RCP8.5 are commonly being used as best and worst case 2°C scenario and 4°C scenarios respectively.	XDI can model comparative effects of RCP2.6 and RCP8.5 and can also include RCP4.5 as a moderate mitigation pathway (which still results in average warming over 2°C).
Direct and indirect physical climate impacts	**Direct and first-order:** damage and loss of real assets, disruption to value chains, supply chain costs, lost hours of staff (IIGCC 2020a, EBRD 2018). **Indirect and second-order:** Insurance costs, energy costs, regulatory change, legal liabilities, market changes, borrowing costs, social licence (IIGCC 2020a, EBRD 2018).	**Direct and first-order:** damage and loss of real assets, lost hours of staff, customer impact. **Indirect and second-order:** insurance premiums.
Metrics and outputs	**Data:** Most guidance recommended climate data overlaid with business data, within a socio-economic and regulatory context. **Recent and historic impacts:** EBRD recommends firms estimate current costs of extreme weather events, including days of business interruptions and associated costs, costs of repairs or upgrades, fixed-asset impairment, supply chain disruptions and lost revenues. **Average Annual Loss** (CISL 2019, BOE 2019b, EBRD 2018) **Number of sites and business lines** exposed to relevant climate impacts (EBRD 2019) **Value-At-Risk** (EDRB 2018) Identification of **critical thresholds** (IIGCC 2020a)	Climate data overlaid with business asset data. Outputs include: **Average Annual Loss** **Total Technical Insurance Premium** (TTIP), (total annual cost of damage assuming all hazards are insured) **Percentage of Value-at-Risk** (VAR%), (TTIP as a percentage of the replacement cost of the property) **Number of High Risk Properties** (HRP#), (property assets where the VAR is greater than 1%) **Percentage of High-Risk Properties** (HRP%), (HRP# expressed as a percentage of all properties in the LGA) **Failure Probability** **Productivity Loss**

ELEMENTS OF PHYSICAL RISK ASSESSMENT	GUIDANCE AND RECOMMENDATIONS	WHAT XDI DELIVERS
Adaptation measures	Inclusion of asset-level and broader adaptation options in model (CISL 2019, BOE 2019b, IIGCC 2020a) including planned improvements, retrofits, relocations, or other changes to facilities.	Analysis of available adaptation measures at the address and locality scale and how they change risk profile. Evaluation of net risk exposure after adaptation applied.
Strategy, policy and advocacy	Supply-chain risk management strategy incl. engagement with suppliers on strategy (EBRD 2018). Engagement with local or national governments and local stakeholders on local climate resilience (EBRD 2018).	Cross dependency analysis identifies shared risk with upstream infrastructure including road access, water and power supply.

References

Taskforce on Climate-related Financial Disclosure: The 2017 Final Report from the Task Force for Climate-related Financial Disclosure (TCFD 2017)

European Bank for Reconstruction and Development (EBRD): *Advancing TCFD guidance on physical climate risks and opportunities* (EBRD 2018)

Cambridge Institute for Sustainability Leadership (CISL): *Physical risk framework Understanding the impacts of climate change on real estate lending and investment portfolios.* (CISL 2019).

TCFS 2019 Status Report 2019: (TCFD 2019).

Institutional Investor Group on Climate Change (IIGCC): *Understanding physical climate risks and opportunities – a guide for investors* (IIGCC 2020)

Bank of England (BOE): Discussion paper for the 2021 *Biennial Exploratory Scenario* (BES) on the financial risks from climate change. (BOE 2019b).

NUMBER OF ASSETS

1,053

NUMBER OF ASSETS ASSOCIATED WITH EACH ARCHETYPE

+ HIGH RISE OFFICE STRUCTURE	105
+ LOW RISE OFFICE STRUCTURE	948

HAZARDS ANALYZED FOR THE XDI ANALYSIS

- ✓ RIVERINE FLOODING
- ✓ OVERLAND FLOODING
- ✓ COASTAL INUNDATION
- ✓ SOIL SUBSIDENCE
- ✓ EXTREME HEAT
- ✓ FOREST FIRE
- ✓ EXTREME WIND
- ✓ FREEZE THAW

HAZARD CONTRIBUTION TO FAILURE PROBABILITY

This section shows which hazards are contributing to the risk of disruption (Failure Probability) in the portfolio and how this changes over time when stress tested under RCP8.5. Failure Probability provides an insight into impacts on an asset which may cause the asset to stop working, but may or may not cause damage.

The table shows the average failure probability per asset in each year. The pie charts show the change over time in the relative contribution of each hazard to the aggregate average Failure Probability. **

OBSERVATION

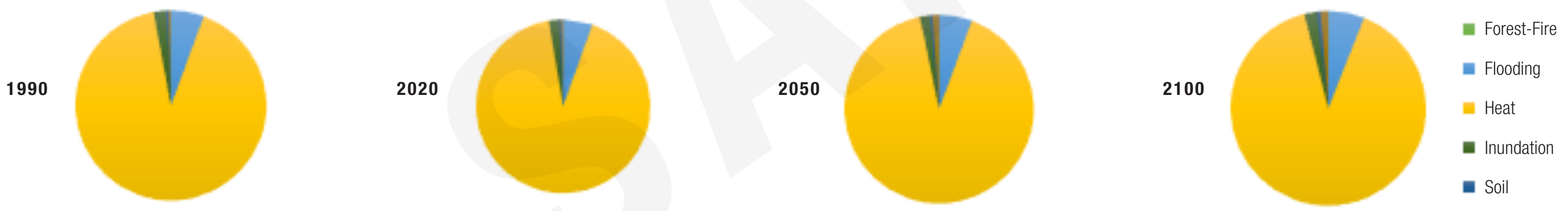
During the modelling period, the hazards Extreme Heat and Riverine Flooding should be considered material causes of disruption to the portfolio.**

BREAKDOWN OF HAZARD CONTRIBUTION TO FAILURE PROBABILITY

HAZARD	1990	2020	2050	2100	% INCREASE BETWEEN 1990 AND 2100
Riverine Flood	0.799%	0.942%	1.231%	1.810%	126%
Coastal inundation	0.299%	0.315%	0.364%	0.622%	108%
Forest Fire	0.004%	0.004%	0.005%	0.007%	75%
Soil Subsidence	0.063%	0.073%	0.103%	0.189%	200%
Extreme Heat	13.113%	15.970%	19.992%	27.369%	108%

The contribution of each hazard to asset failure probability, aggregated across the portfolio of the company's owned or used physical property assets for years 1990, 2020, 2050 and 2100. RCP 8.5 only.

BREAKDOWN OF HAZARD CONTRIBUTION TO FAILURE PROBABILITY



Average Annual Failure Probability (%) across all assets in each year*

***How is this calculated**

The failure threshold of each asset's components, design and materials with respect to each hazard is compared to the statistical probability of being exceeded by the hazard in a specific year. The contribution to Failure Probability from each hazard is summed and averaged across the full asset portfolio.

****Caveats in Using this Result**

Failure Probability treats all causes of failure equally, so a flooding event which might cause one month of closure is treated equally to heat disruption to electronic systems that may last only a few hours. To consider the effects of different types of disruption, consider using Productivity Loss which includes different periods of closure associated with different hazard events.

Failure Probability also treats the relative importance of all assets equally. To consider the impact on assets of higher or lower value, consider using Technical Insurance Premium (or Average Annual Loss) which is based on the asset replacement value, which may also be a proxy for the asset's contribution to company revenues.

ASSET PORTFOLIO RANKED BY FAILURE PROBABILITY

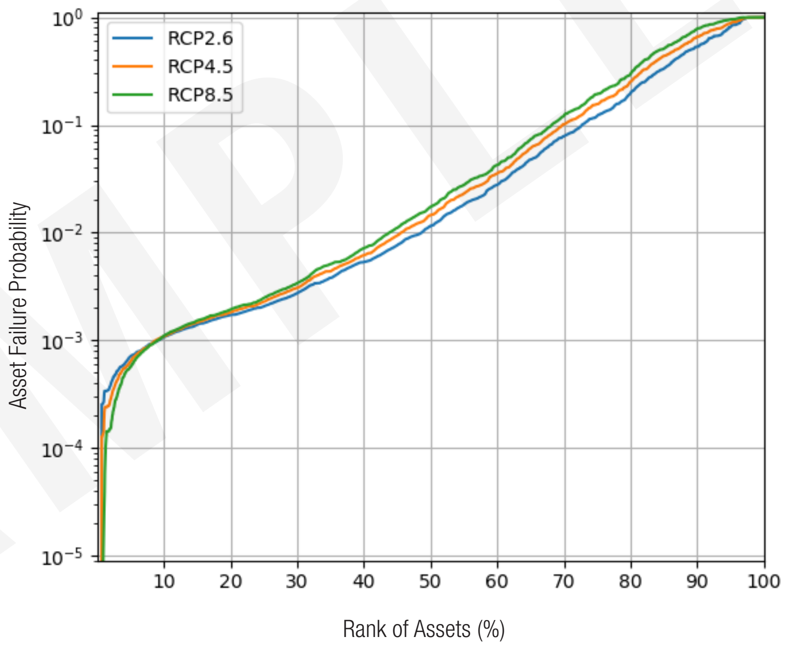
This section shows the proportion of assets which are at risk of disruption (Failure Probability) from all hazards in the year 2050, with comparison across three RCP emissions scenarios. Failure Probability provides an insight into impacts on an asset which may cause the asset to stop working, but not cause damage.

Each asset within the entire portfolio is ranked according to its annual Failure Probability (the probability of an event occurring that exceeds its design thresholds)*, and plotted against all other assets in the portfolio.

OBSERVATION

This result shows that for the year 2050 the proportion of assets with a significant annual Failure Probability (greater than 10% per year) is 28%, 30% and 33% for RCPs 2.6, 4.5 ad 8.5 respectively.

OVERALL ASSET FAILURE PROBABILITY DISTRIBUTION (LOGARITHMIC SCALE)



Assets ranked by annual probability of an Asset Failure event occurring in the year 2050 across all hazards with comparison across RCP 2.6, 4.5 and 8.5. The x-axis shows the ranking as a percentage of all assets rather than number of all assets.

***How is this calculated**

The failure threshold of each asset's design and engineering components are compared against the statistical probability of a hazard event occurring that exceeds that threshold in a specific year. The probability of exceeding the threshold is calculated for each asset, and the assets are ranked from lowest annual FP% to highest annual FP%. The process is repeated for three RCP scenarios. For ease of comparison,

Caveats in Using this Result

Failure Probability treats all causes of failure equally, so a flooding event which might cause one month of closure is treated equally to heat disruption to electronic systems that may last only a few hours. To consider the effects of different types of disruption, consider using Productivity Loss which includes different periods closure associated with different hazard events.

Failure Probability also treats the relative importance of all assets equally. To consider the impact on assets of higher or lower value, consider using Technical Insurance Premium (or Average Annual Loss) which is based on the asset replacement value, which may also be a proxy for the assets contribution to company revenues.

BENCHMARKING: MAXIMUM VAR%

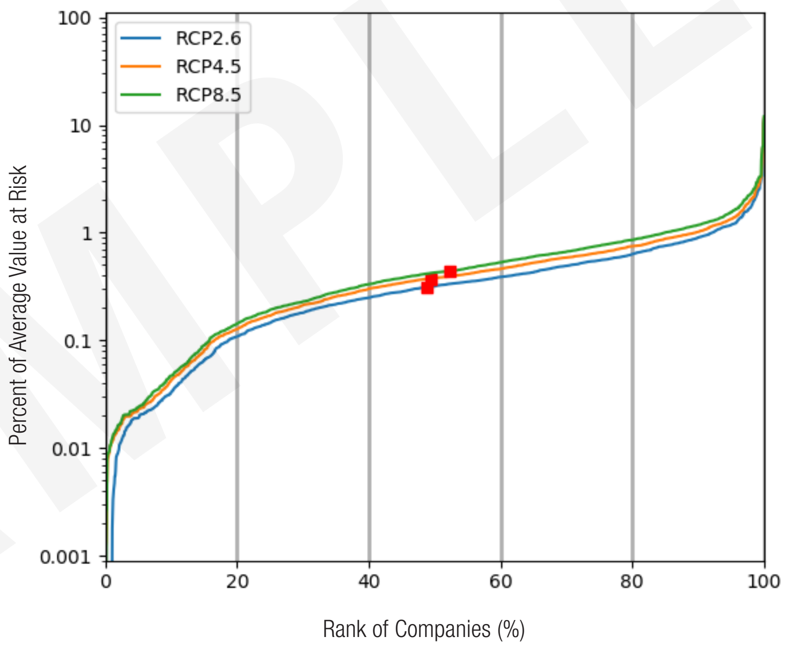
This section shows the position of the company analysed ranked within a cohort of 2000 listed equities. The company is ranked based on the Maximum Average Value-at-Risk* for all owned and used properties, expressed as a percentage of asset replacement costs, for emissions scenario RCP8.5 to 2100.

For portfolio stress testing, the maximum VAR% is selected because climate models can have considerable variability over time; frequency and severity of some hazards may decrease for periods while others increase. The Maximum VAR% is useful because it provides a single insight into the peak stress (damage) on each asset from extreme weather and climate change observed in the modelling results.

OBSERVATION

This result shows that, the target company ranks in the middle quintile of climate change physical risk based on average VAR%, when compared to a representative set of listed equities comprising 2,000 companies and approximately 2 million global assets. Specifically, 52 percent of the set of companies have a lower VAR% risk profile, and 48 of the set of companies have a higher VAR% under RCP8.5.

OVERALL PERCENT OF VALUE AT RISK DISTRIBUTION (LOGARITHMIC SCALE)



The company (red mark) is ranked against a set of 2,000 listed equities based on the maximum observed Value-at-Risk for all owned and used properties as a percentage of asset replacement costs, for 2050.

***How is this calculated**

The annual average loss (AAL) incurred as a result of direct physical damage is computed for each physical asset attributed to the company analyzed. This is expressed a fraction of the asset replacement costs, referred to as the Value-at-Risk percentage. The maximum VAR% observed over the time period 1990 to 2100 is obtained, and from this, an average calculated across all assets.

Caveats in Using this Result

While VAR% is an indication of the risk of, and resilience to, disruptive physical damage to the asset, it does not include disruptions due to non-damaging events such as heat extremes or loss of external (supply chain) critical infrastructure services, nor does it account for the different outage times caused by different extreme weather and climate change events.

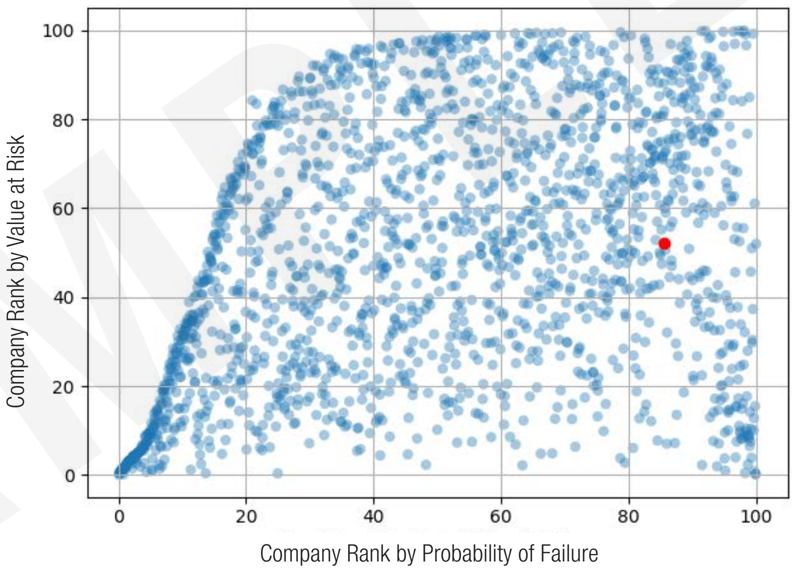
To consider impacts on asset or business disruption, consider using Failure Probability or Productivity Loss.

This section shows the position of the company analysed ranked within a cohort of 2000 listed equities comprising approximately 2m assets, using annual average Failure Probability (%) and average annual Value at Risk (%). The graph provides a combined insight into the position of the company in comparison to its peers with respect to both damage risk and disruption risk. Companies in the bottom left show high resilience to both damage and disruption and companies in the top right are at high risk of both physical damage and disruption. This result also shows the quintiles of each indicator.

OBSERVATION

The company is in highest quintile of average Failure Probability. Within the referenced set, the company is in the middle quintile of Annual average Value-At-Risk Percentage.

TARGET COMPANY BENCHMARKED AMONGST COHORT OF 2000 LISTED EQUITIES FOR YEAR 2050



The scatter plot shows where the organisation sits within the reference set of companies set. The red dot represents the target company.

***How is this calculated**

The Average Failure Probability is based on annual probability of an event exceeding the failure thresholds from each hazard for an asset or asset component, averaged across the full company portfolio.

Caveats in Using this Result

Average Failure Probability treats all disruptive events neutrally, while in practice some events will be cause more sustained disruption that others – e.g. short duration failures during a heat-wave versus the impacts of flooding which will take longer to fix. To account for the duration of an outage, use Productivity Loss.

APPENDIX: TABLE OF 100 HIGHEST RISK PROPERTIES

RANKING (HIGHEST TO LOWEST VAR%)	ASSET ID	VAR%	COUNTRY
1	2152610942	0.763	NLD
2	2151475457	0.763	NLD
3	2151472588	0.763	NLD
4	2151963440	0.763	NLD
5	2120292755	0.760	USA
6	1243757752	0.757	USA
7	2015477861	0.756	USA
8	1114928304	0.754	USA
9	2015468057	0.753	USA
10	1218425937	0.753	USA
11	2015527098	0.742	USA
12	2111425813	0.739	USA
13	2015519863	0.738	USA
14	1217019353	0.734	USA
15	1128313126	0.733	USA
16	1264217845	0.712	USA
17	1128313123	0.699	USA
18	2152157116	0.680	NLD
19	2015482066	0.677	USA
20	2015485704	0.675	USA
21	1117597507	0.669	USA
22	9010400344	0.647	POL
23	2151444602	0.646	POL
24	1121720771	0.642	USA
25	2151460227	0.638	TUR
26	2029432795	0.638	USA
27	1131297648	0.638	USA
28	2151692454	0.638	NLD
29	1229103050	0.638	USA
30	1229031526	0.638	USA
31	2162448161	0.638	AUS
32	2014056699	0.638	USA
33	2129182756	0.638	USA
34	2021419274	0.638	USA
35	2112283248	0.638	USA
36	2122001711	0.638	USA
37	2015802184	0.638	USA
38	2019145207	0.638	USA
39	2152210862	0.638	THA
40	2016917866	0.638	USA
41	2172419396	0.638	PHL
42	2152290023	0.638	THA
43	2020284239	0.638	USA
44	2157603722	0.638	THA
45	2151509632	0.638	THA
46	2162051483	0.638	AUS
47	5000071108	0.638	AUS
48	2160821986	0.638	AUS
49	1124622993	0.638	USA
50	2124547679	0.638	HKG
51	2160687514	0.638	ITA
52	2018950682	0.638	USA
53	1121295838	0.638	USA
54	1225739165	0.638	USA

*Top 100 High Risk Properties are listed by XDI Asset ID. Please contact XDI for asset specific analysis.

APPENDIX: TABLE OF 100 HIGHEST RISK PROPERTIES

RANKING (HIGHEST TO LOWEST VAR%)	ASSET ID	VAR%	COUNTRY
55	1243757789	0.638	USA
56	1230987024	0.638	USA
57	2033912040	0.638	SWE
58	2164388193	0.638	ITA
59	1398133349	0.638	USA
60	2122190188	0.638	RUS
61	2142338772	0.638	IND
62	1218059148	0.638	USA
63	2153900039	0.638	TUR
64	2175248716	0.638	THA
65	2019896364	0.638	USA
66	2157582319	0.638	HUN
67	1129882540	0.638	USA
68	1242476284	0.638	USA
69	5000071181	0.638	AUS
70	2021532044	0.638	USA
71	1217365951	0.638	USA
72	1249362475	0.638	USA
73	2163214614	0.638	IND
74	1400529251	0.638	USA
75	2154430381	0.638	USA
76	1220255198	0.638	USA
77	2115784561	0.638	RUS
78	1243760666	0.638	USA
79	2172986943	0.638	MYS
80	2172975859	0.637	MYS
81	2171244399	0.637	MYS
82	1131296601	0.637	USA
83	1120210520	0.637	USA
84	2016250296	0.637	USA
85	1115989954	0.637	USA
86	2015359039	0.637	USA
87	1137987406	0.637	CAN
88	1123239031	0.637	USA
89	9010600359	0.637	POL
90	1128313253	0.637	USA
91	1137998038	0.637	CAN
92	2156485452	0.637	AUT
93	2157078682	0.637	AUT
94	2160873843	0.637	ITA
95	1137393160	0.636	CAN
96	1115927254	0.636	USA
97	9010500343	0.636	POL
98	2109408793	0.636	POL
99	2060046545	0.636	MYS
100	1217391954	0.636	USA

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