

Building Performance: Damage to Function
(DM to DV)

Functionality and Economic Impact

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Issues

- How (and how much) does building damage contribute to business interruption? $DM \square DV$
- How do decision-makers take into account functionality and downtime? $DV \square decisions$

How (and how much) does building damage contribute to business interruption?

Correlation Between Business Loss and Damage (Nisqually Survey)

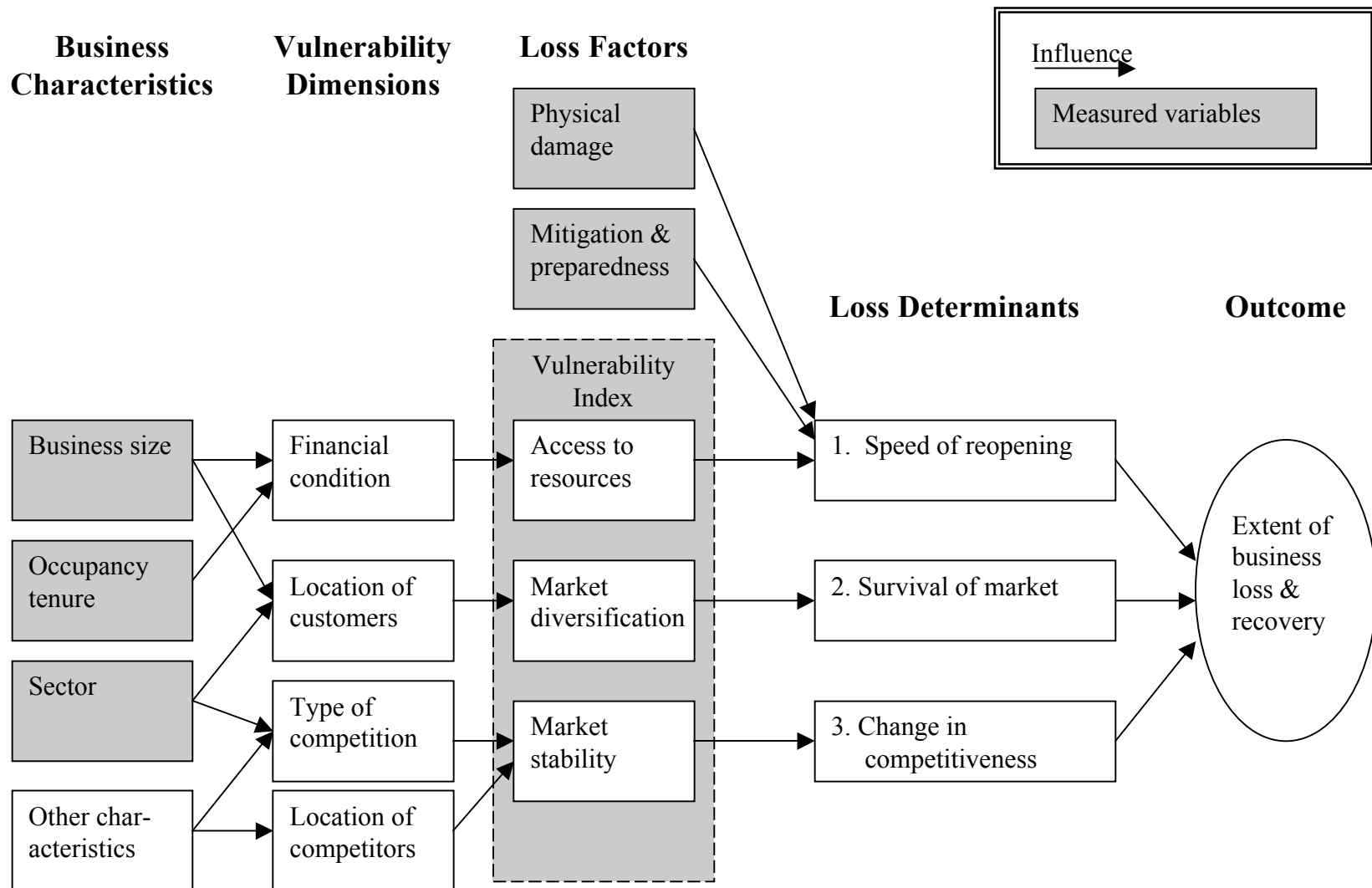
	<i>Building Tag Color</i>				<i>Composite Damage Index</i>	
	<i>Red</i>	<i>Yellow</i>	<i>Green</i>	<i>Not Inspect.</i>	<i>Signif. Dmg.</i>	<i>Insignif. Damage</i>
Sample size	10	27	54	14	47	60
Significant loss	80 %	70 %	69 %	57 %	77 %	62 %
Insignificant loss	20 %	30 %	31 %	43 %	23 %	38 %
Total	100 %	100 %	100 %	100 %	100 %	100 %

Difference stat. significant at 10% level? NO / YES

Some factors affecting business interruption

- Bl. dmg.*
 - Damage to building, nonstructural elements, and contents
- Other dmg.*
 - Lifeline disruptions, inc. transportation
- Business char.*
 - Business sector
 - Business size
 - Access to financial resources, inc. insurance
 - Flexibility, e.g., availability of alternative space
 - Entrepreneurship, e.g., finding new markets
- External factors*
 - Employee absenteeism
 - Ability to obtain supplies
 - Status of customers
 - Regional economic impact

Conceptual and Measurement Framework



Correlation Between Loss and Vulnerability (Nisqually Survey)

	<i>No. Vulnerability Factors</i>				<i>Overall Vulnerability</i>	
	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>High</i>	<i>Low</i>
Sample size	35	23	30	5	35	58
Significant loss	97 %	65 %	40 %	20 %	84 %	37 %
Insignif. loss	3 %	35 %	60 %	80 %	16 %	63 %
Total	100 %	100 %	100 %	100 %	100 %	100 %

Difference stat. significant at 1% level?

YES

Neighborhood Effects (Nisqually)

Most important recovery problem or need?

<i>Related to Own Business</i>	<i>Related to Neighborhood</i>
Financing (11)	Customer loss (11)
Permits for repair (5)	Street closure – lack of parking (11)
Dislocation (3)	Media perception (6)
TOTAL (19)	Ongoing repairs in area (6)
	Loss of 1 st Avenue parking lane (4)
	Return to status quo (parking/ attitudes) (2)
	TOTAL (40)

Implications for PBEE

- DM \square DV (economic impact*) is complex and highly context-dependent
 - *for building users
- Two strategies: *depending on decision-maker target?*
 - Gather more data and develop contextualized models
 - Focus on modeling downtime, rather than economic impact

How do decision-makers take into account
functionality and downtime?

Decision-Making Interviews (Nisqually Study)

- Current choice sets relate to code
 - When *buying*: 1. do nothing, 2. mitigate to code, 3. get insurance; when *renovating*: 1. develop code solutions, 2. reduce sections undergoing renovation
- Owners rarely use analysis, e.g. BCA
 - Exception: large corporations building new facilities

Decision-Making Interviews (cont'd)

- Life safety is primary concern
 - Owners assume that meeting code will ensure life-safety issues *and* substantially reduce risk of damage and downtime
- Downtime is a real concern but not part of the decision-making calculus
 - Considered qualitatively
 - Exception: critical facilities such as data centers
- Owners would like “raw” data on downtime (hours, days)
 - Can use in-house to estimate economic impact from lost rental income stream

Decision-Making Interviews (cont'd)

- Risk aversion (low risk or low capital?)
 - Depends on type of owner
 - e.g., small owners deal with more frequent event, e.g. 50% in 50 years, large investors concerned with catastrophic events
 - Depends on type of property
 - e.g., low rent v. high rent

Implications for PBEE

- PBEE (v. code) appropriate for only certain types of buildings, decision-makers, and decisions?
- Model downtime, not economic impact?
- PBEE information should be flexible? (e.g., performance metrics, time horizon, which scenario earthquake)