Why only a quantitative ERM approach will help solve the problems you really care about

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### What is risk aggregation?

#### It means evaluating the effect of a set of risks, not just individually



1 risk – very small problem

Many risks – big problem



#### The probability of success is the probability nothing happens to cause the plan to fail



#### **Risk scores**

Probability score P: 1, ..., 5

Impact score I: 1, ..., 5

Severity Score S: = P \* I

That works OK only if both scales are linear

Then S is proportional to mean risk

|               |                              |                        | Chance          |            |               |                           |                                |  |  |
|---------------|------------------------------|------------------------|-----------------|------------|---------------|---------------------------|--------------------------------|--|--|
| Mu<br>ar      | Itiplying inc<br>thmetic cha | lices with<br>ance and | Very Low<br>(1) | Low<br>(2) | Medium<br>(3) | High<br><mark>(</mark> 4) | Very High<br><mark>(</mark> 5) |  |  |
| impact scales |                              |                        | 0.2             | +0.2       | 0.6           | 0.8                       | 1                              |  |  |
| Impact        | Very High<br>(5)             | \$10M                  | 5               | 10         | 15            | 20                        | 25                             |  |  |
|               | High<br>(4)                  | \$8M                   | 4               | 8          | 12            | 16                        | 20                             |  |  |
|               | Medium<br>(3)                | \$6M                   | 3               | 6          | 9             | 12                        | 15                             |  |  |
|               | Low<br>(2)                   | \$4M<br>+\$2M          | 2               | 4          | 6             | 8                         | 10                             |  |  |
|               | Very Low<br>(1)              | \$2M                   | 1               | 2          | 3             | 4                         | 5                              |  |  |



#### There is no ideal scaling

#### 1 in 5 same as 1 in 1000?

|                                      |                  |                   | Chance          |            |               |             |                  |                              |  |  |
|--------------------------------------|------------------|-------------------|-----------------|------------|---------------|-------------|------------------|------------------------------|--|--|
| A very common risk heat<br>map setup |                  |                   | Very Low<br>(1) | Low<br>(2) | Medium<br>(3) | High<br>(4) | Very High<br>(5) | Where do<br>repeatable risks |  |  |
|                                      |                  |                   | 0 - 0.2         | 0.2 - 0.4  | 0.4 - 0.6     | 0.6 - 0.8   | 0.8 - 1          | go:                          |  |  |
|                                      | Very High<br>(5) | >\$10M            | 5               | 10         | 15            | 20          | 25               |                              |  |  |
|                                      | High<br>(4)      | \$1M -<br>\$10M   | 4               | 8          | 12            | 16          | 20               |                              |  |  |
| Impact                               | Medium<br>(3)    | \$100k -<br>\$1M  | 3               | 6          | 9             | 12          | 15               |                              |  |  |
|                                      | Low<br>(2)       | \$10k -<br>\$100k | 2               | 4          | 6             | 8           | 10               |                              |  |  |
|                                      | Very Low<br>(1)  | <\$10k            | 1               | 2          | 3             | 4           | 5                |                              |  |  |

Exponential scale more practical, but P\*I now nonsense

And what to do when a risk impact spans 2+ categories?



#### **Risk scores and aggregation**

No maths for colours so usual way is to count the colours



How can we really compare?



## Why not just use the data you already have?

|        |                  |                   | Chance          |            |               |             |                  |  |  |  |
|--------|------------------|-------------------|-----------------|------------|---------------|-------------|------------------|--|--|--|
|        |                  |                   | Very Low<br>(1) | Low<br>(2) | Medium<br>(3) | High<br>(4) | Very High<br>(5) |  |  |  |
|        |                  |                   | 0 - 0.2         | 0.2 - 0.4  | 0.4 - 0.6     | 0.6 - 0.8   | 0.8 - 1          |  |  |  |
|        | Very High<br>(5) | >\$10M            |                 |            |               |             |                  |  |  |  |
|        | High<br>(4)      | \$1M -<br>\$10M   |                 |            |               |             |                  |  |  |  |
| Impact | Medium<br>(3)    | \$100k -<br>\$1M  | ţ               |            |               |             |                  |  |  |  |
|        | Low<br>(2)       | \$10k -<br>\$100k |                 |            |               |             |                  |  |  |  |
|        | Very Low<br>(1)  | <\$10k            |                 |            |               |             |                  |  |  |  |



It will ALWAYS be more accurate You DON'T have to know the numbers precisely



# You can run a Monte Carlo simulation in Excel

ModelRisk Basic is free: <u>www.vosesoftware.com</u>

Or use macros and make your own (don't)

ModelRisk Complete is not very expensive, and will save a lot of time

The basics take about 1 day to learn

You can always keep your heat maps – just drop the scoring!

|    | A      | В         | С         | D       | E          | F        | G    | Н        |        | J    |
|----|--------|-----------|-----------|---------|------------|----------|------|----------|--------|------|
| 1  |        |           |           |         |            |          |      |          |        |      |
| 2  |        |           |           |         |            |          |      |          |        |      |
| 3  |        |           | Investmer | nt 1    |            |          |      |          |        |      |
| 4  |        | Acceptabl | 9         |         | Total loss | 19919.82 |      |          |        |      |
| 5  |        | Worrying  | 35        |         |            |          |      |          |        |      |
| 6  |        | Scary     | 6         |         |            |          |      |          |        |      |
| 7  |        |           |           |         |            |          |      |          |        |      |
| 8  |        |           |           |         |            |          |      |          |        |      |
| 9  |        | _         | 1         | nvestme | nt 1       |          |      |          |        |      |
| 10 |        | 50        |           |         |            |          |      |          |        |      |
| 11 |        | 45        |           |         |            |          |      |          |        |      |
| 12 |        | 40        |           |         |            |          |      |          |        |      |
| 13 |        | 35        |           |         | _          |          |      |          |        |      |
| 14 |        | 30        |           |         |            |          |      |          |        |      |
| 15 |        | 25        |           |         |            |          |      |          |        |      |
| 10 |        | 20        |           |         |            |          |      |          |        |      |
| 17 |        | 15        |           |         |            |          |      |          |        |      |
| 18 |        | 10        |           |         |            |          |      |          |        |      |
| 19 |        | 5         |           |         |            | _        |      |          |        |      |
| 20 |        | 0         |           |         |            |          |      |          |        |      |
| 21 |        | Ac        | ceptable  | Worryi  | ng         | Scary    |      |          |        |      |
| 22 |        |           |           |         |            |          |      |          |        |      |
| 24 |        |           |           | VIow    | Low        | Med      | High | V High   |        |      |
| 25 |        |           |           | 0       | 0.2        | 0.4      | 0.6  | 0.8      |        |      |
| 26 |        |           |           | 0.2     | 0.4        | 0.6      | 0.8  | >0.8     |        |      |
| 27 | V High | 10000     | >10M      | 0       | 0          | 0        | 0    | 0        |        |      |
| 28 | High   | 1000      | 10000     | 3       | 13         | 10       | 1    | 1        |        |      |
| 29 | Med    | 100       | 1000      | 3       | 3          | 9        | 2    | 4        |        |      |
| 30 | Low    | 10        | 100       | 0       | 0          | 0        | 0    | 1        |        |      |
| 31 | V Low  | 0         | 10        | 0       | 0          | 0        | 0    | 0        |        |      |
| 32 |        |           |           |         |            |          |      |          |        |      |
| 33 |        | Investmer | Repeatabl | Prob    | Min        | Mode     | Max  | Loss     | Р      | 1    |
| 34 |        | Risk 1    | TRUE      | 1.1     | 60         | 90       | 130  | 0        | V High | Low  |
| 35 |        | Risk 2    | FALSE     | 0.5     | 70         | 1670     | 3010 | 1108.418 | Med    | High |
| 36 |        | Risk 3    | FALSE     | 0.2     | 200        | 1310     | 2080 | 0        | Low    | High |
| 37 |        | Risk 4    | TRUE      | 0.5     | 40         | 130      | 860  | 0        | Med    | Med  |
|    |        |           |           |         |            |          |      | -        |        |      |



## A simple Monte Carlo simulation and now we can compare













### And once you have embraced swapping scores for numbers ...

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### Thanks for watching!

Interested in Pelican? Email info@vosesoftware.com to arrange a chat