# Impact of Organizational Structure on Distributed Requirements Engineering

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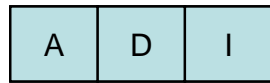
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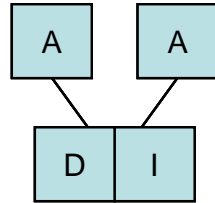
# Focus of [RE] Research on Distributed Projects

❖ Cultural Issues

❖ Distributed Requirements Elicitation
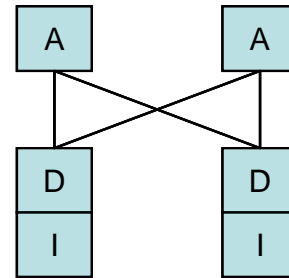
❖ Tooling

❖ Organizational Structure  NOT!

# Organizational Structures
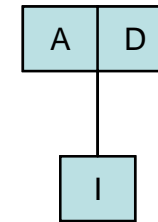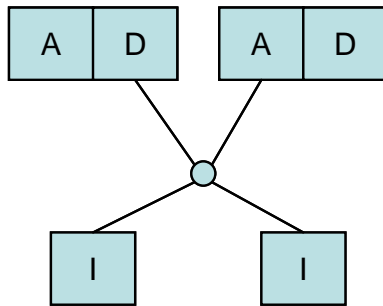


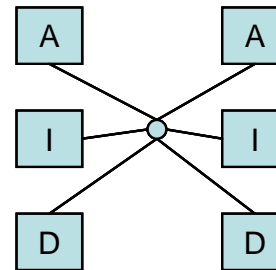1. single site

2. distributed analysis

3. distributed analysis and design

4. co-located analysis and design, one implementation site

5. multiple, co-located analysis and design sites, distributed implementation

6. Fully distributed analysis, design and implementation

Legend

A  Analysis

D  Design

I  Implementation/Manufacturing
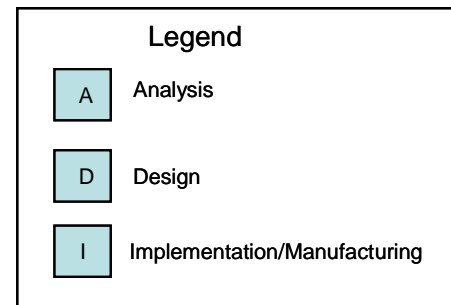
# Organizational Structure

➢ Organization refers to the leadership and/or management of a specific area.
  ➢ If two individuals, even in different locations, report to the same person then they are in the same organization.

➢ Disparate structures lead to all kinds of problems

Example: students at different universities participating in a distributed software project. They are in different organizations with differing objectives.

# Distributed Analysis

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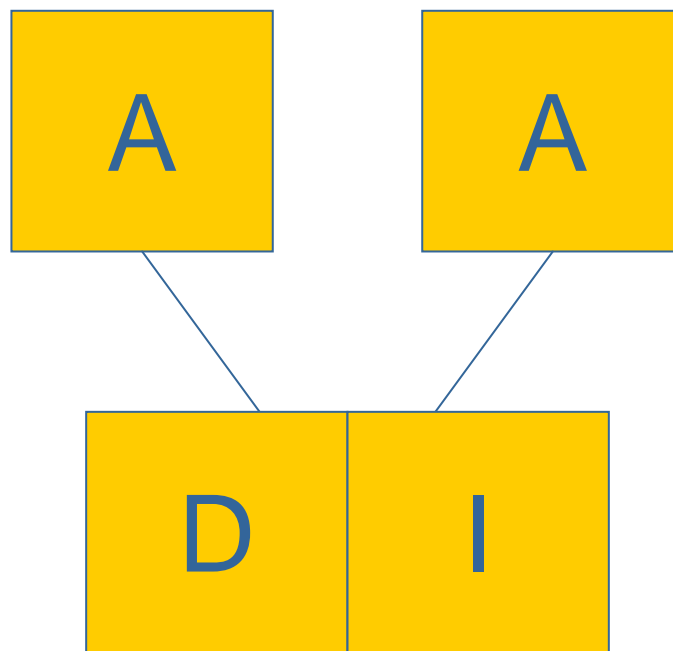
# Distributed Analysis Issues

❖ Technical Management

❖ Style Variation

❖ Cross-location review

❖ Change Management.

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# Technical Management

❖Lack Of A Coherent Set Of Processes or

❖Conflicting Processes
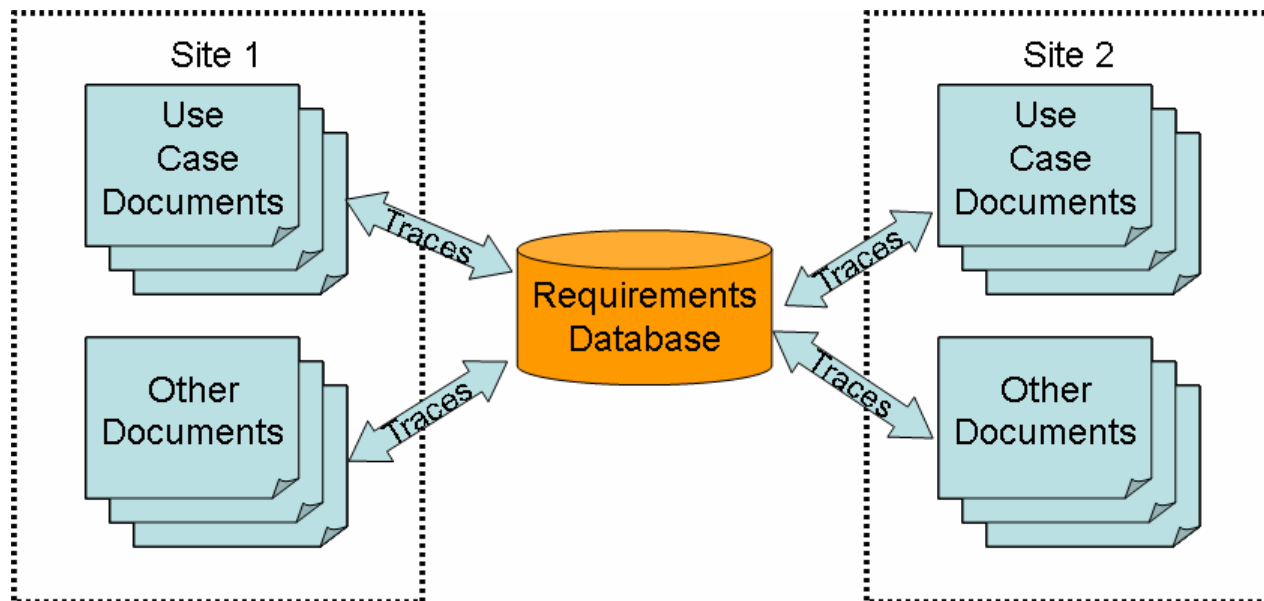
❖Missing Overall Leadership

❖Resource confusion

*An unintended  byproduct of this structure may be long delays between review cycles.*

# Style Variation

❖Analysis work products such as use cases, flow charts, etc. may be in different media, which can result in traceability problems.

# Cross-location review

❖Reviewers often do not have time to read the material

❖Requirements may not be at the right level

❖Poor traceability may make it difficult to check references

❖Writing style can be variable

❖Functional and non-functional requirements are typically elicited by different teams. Two sites may mean four or more roles capturing requirements with little or no cross review…

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Start

Now may be done at multiple locations!

Define Requirements
Engineering Team

Define Hazards
Analysis Team

Define Global
Analysis Team

Perform Detailed
Analysis

Perform Hazards
Analysis

Perform Global
Analysis

Business Model

Extract Functional
Requirements

Develop Risk
Mitigation Strategies

Produce Global
Analysis Document

Functional
Requirement...

Non-Functional
Requirement...

Architectural factors, issues
and strategies

Scope [Next Phase
of] Project

Done

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# Change Management Process
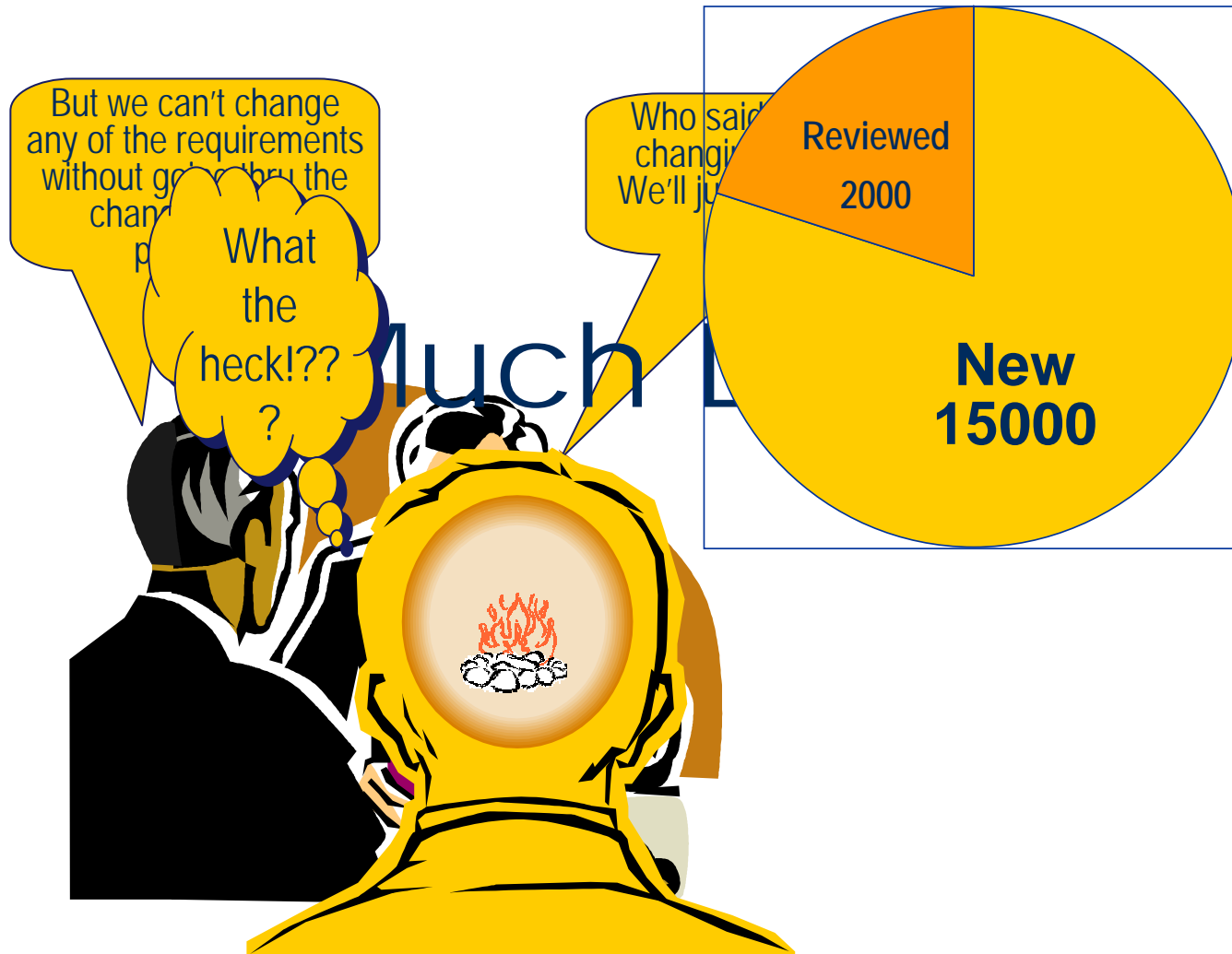
# Distributed Analysis and Design
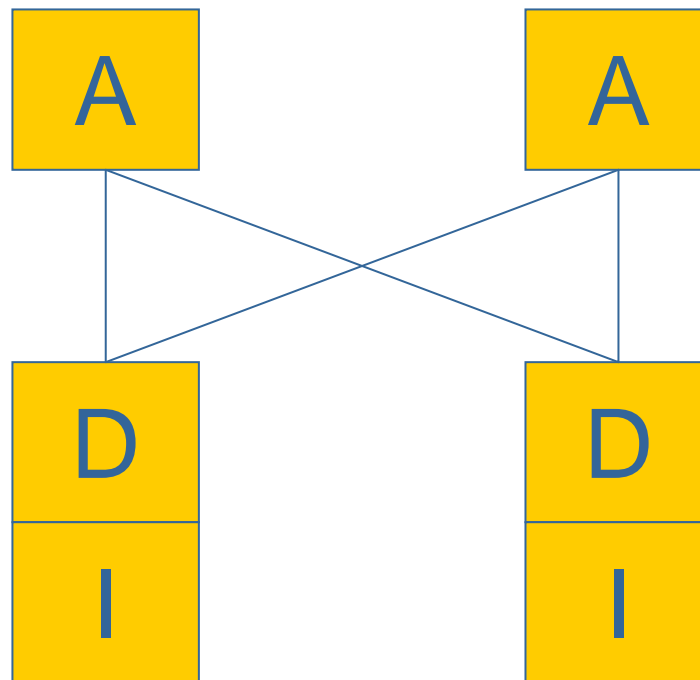
# Distributed Analysis & Design Issues

❑Analysts creating specifications for in-house projects may not have the requisite skills for creating sufficiently detailed specifications for outsourcing (e.g. too many assumptions, lack of completeness)

❑The designers and developers most likely have no knowledge of the domain, especially if this is the first collaboration

❑Time zone issues can interfere with communication

❑Cultural issues may also arise.

We don't have time. The designers can resolve that issue.

We don't have time, mark that as a "to be determined"

I've been working on this issue for a month and no one can tell me what it is supposed to do.

Later

Later

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# A distributed A/D Process that worked

✓Only one project manager and architect across multiple sites

✓PM/Architect were proactive in frequently visiting the sites

✓If there were issues the PM would go to site, and resolve them at site before leaving

✓PM would require briefings by distributed staff to see if they really understood their roles, their tasks and the domain.

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# A distributed A/D Process that did not work

✓Architects and leads at each site

✓PM/Architects rarely interacted personally

✓If there were issues the sites would argue

✓*The managers did not communicate well with each other.*

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# Separating Analysis from Design Can be Deadly

Installing control systems in power plants, I would typically get a requirements specification (RFP) in over six thick loose-leaf binders

I received an RFP for a taxation system for all the long distance phone calls initiating or completing in the U.S. on two pages

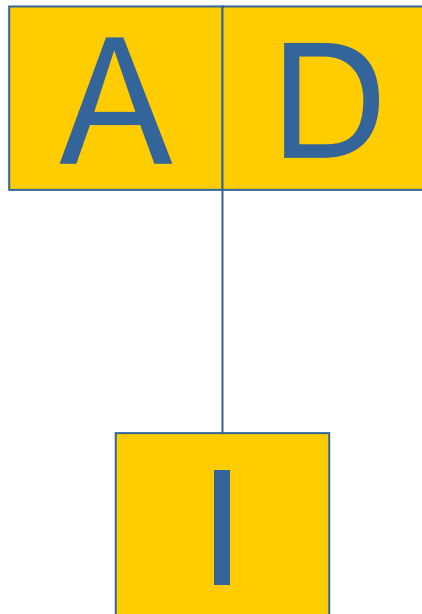Telecom Management was not used to outsourcing!

# Distributed Processes may not work well
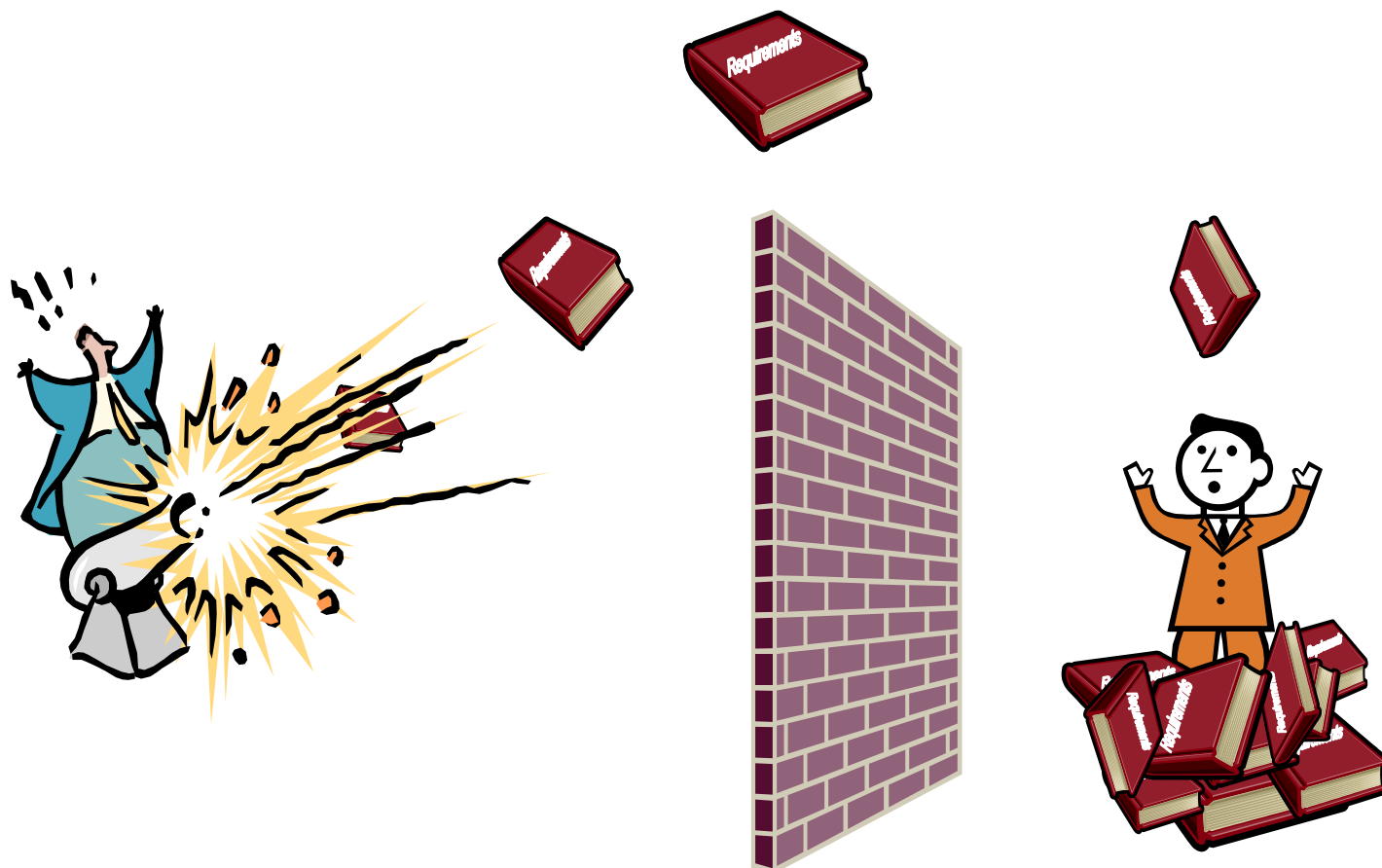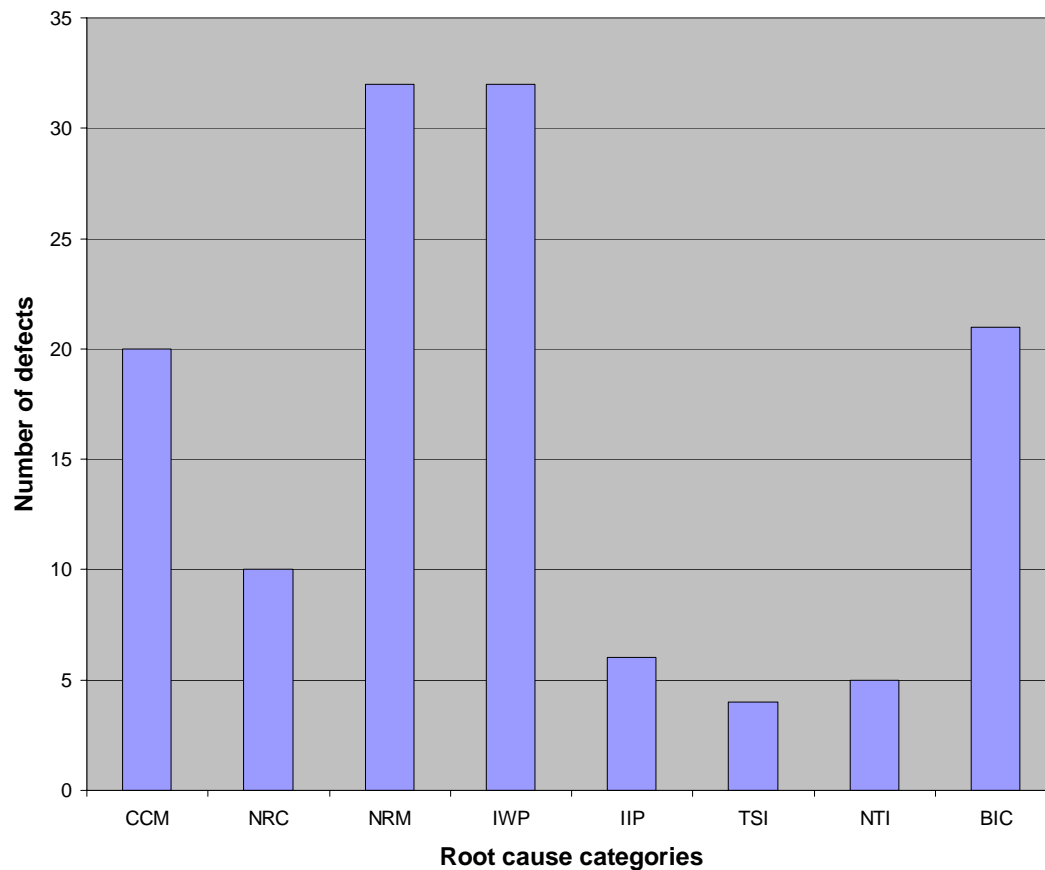
**Requirements Process**

**Outsourced Development**

# Outsourced Implementation

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# All bugs are implementation bugs  Not!

**Distribution of 85 CRP5 release defects by root cause**



**CCM** - Customer Changed mind

**NRC** - Not Recorded Correctly

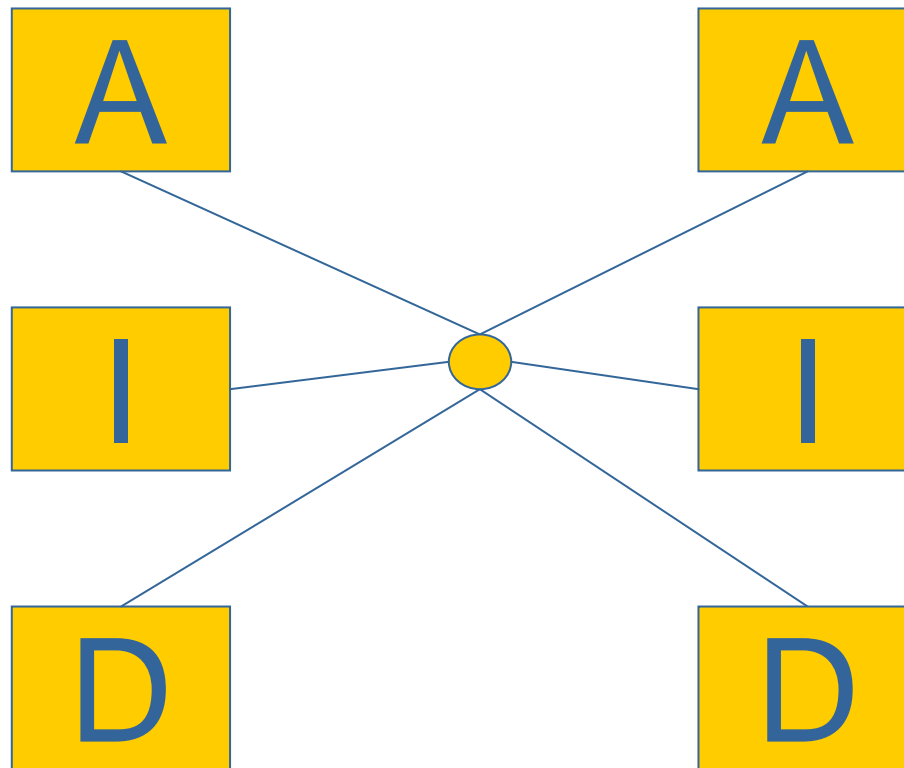**NRM** - Not Recorded Completely

**IWP** - Incomplete Work Package

**IIP** - Incorrect Implementation

**TSI** - Test Script Incomplete

**NTI** - No Time to Implement

**BIC** - Bug in Code

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# Completely Distributed

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## Distributed Analysis, Design And Implementation Issues

*"Unfortunately, the probability that a fully distributed project will have a positive outcome is low.  If $P_f$ is the probability of failure, then every increase in organizational complexity increases the probability of a negative outcome.*

$$P_f = f(P_a, P_d, P_i)$$

$P_a$ – Probability of failure because of analysis problems
$P_d$ -                 "                        "            design       "
$P_i$ -                 "                        "            implementation problems

# Potential Problems with Globalization

- Unqualified Project Architect (lacking in leadership and skill)
- Multiple or diffused chain(s) of command
- Core staff unskilled in handling distributed projects
- Lack of central, authoritative leadership in requirements engineering, especially in the area of customer management, resulting in poor coordination and cooperation of analysts
- Failure to follow the documented project processes.

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# Summary of Organizational Issues

❖ 2 - No cross-location reviews; varying documentation styles; weak configuration management

❖ 3 - 2 + communication difficulties between analysis and design organizations. Pushing detailed analysis to remote development organizations.

❖ 4 - Late feedback; requirements suitable for in-house development incomplete and confusing to remote sites.

❖ 5 - 3 + architectural inconsistencies due to poor communication or weak architectural management. Lack of coordination between development sites; difficulty planning integration testing.

❖ 6 - 5 + 4 + lack of overall central management leading to project spiraling out of control

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# Conclusions

□ On over 10 projects observed, organizational issues impacted project outcome more than any other factor

□ Skilled Staff was not enough

□ It never works first time around
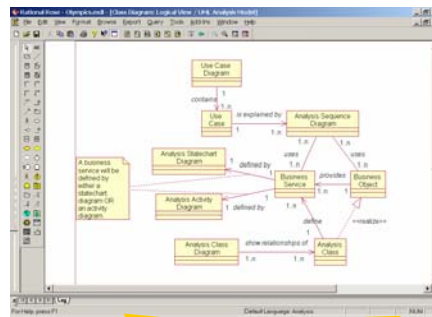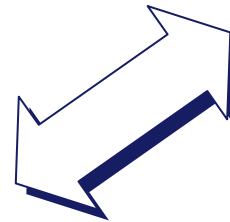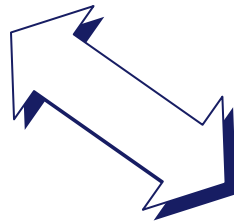
□ Global Development is not for the faint hearted.

# A Formula for Success

✓People who have done it before
✓Teams that have worked together before
✓Shared understanding of the domain
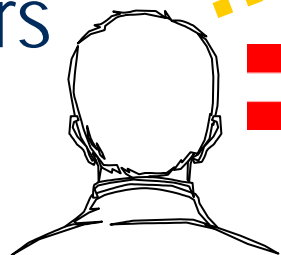✓A single coherent organization
✓Well defined distributed processes that
## *SCALE*
✓A single chain of command
✓Shared goals, and especially -
✓Management Paranoia.

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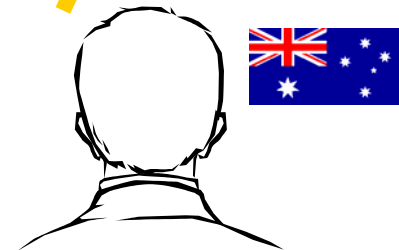
# A fully distributed project that worked.

Use Cases

Requirements

Developers

Architect

PM/Analysts

Subject Matter Experts

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# Discussion?

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