

Planning and Improving Global Software Development Process Using Simulation

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GSD Workshop 2006
Shanghai, China
May 23, 2006

Presentation Outline



- ❑ Introduction
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- ❑ A Global Software Development (GSD) Simulation Model
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Introduction



- ❑ GSD is becoming a dominant paradigm.
- ❑ Main drivers
 - Reduction in development cost
 - Reduction in cycle time
- ❑ BUT GSD poses challenges and difficulties as well as benefits.
- ❑ To be successful, companies need to
 - Have strong project planning
 - Adapt current processes
 - Incorporate new methods, processes, and tools

Software Process Simulation Modeling (SPSM)



- ❑ A computerized model that is designed to display significant features and characteristics of a software process
- ❑ Be able to mimic the behavior of the process
- ❑ Improve and evaluate process performance

Benefits of SPSM



- Address project management issues
 - Strategic management
 - Planning
 - Control and operation management
 - Process improvement
 - Training and Understanding
- Support CMM
 - Level 2 & 3: define software development process
 - Level 4: quantitative process and product management
 - Level 5: technology and process change management

A GSD Simulation Model



- Hybrid simulation model combining system dynamics (SD) and discrete-event (DES)
 - Capture dynamic nature of project variables as well as the complex sequence of discrete-event activities
- Three major components
 - SD sub-model
 - DES sub-model
 - Interaction effect (IE) sub-model

GSD Model Components



□ SD sub-model

- Site-specific SD (for each development site)
 - Human resource, productivity, defect generation and detection rate
- Global SD
 - Planning and controlling

□ DES sub-model

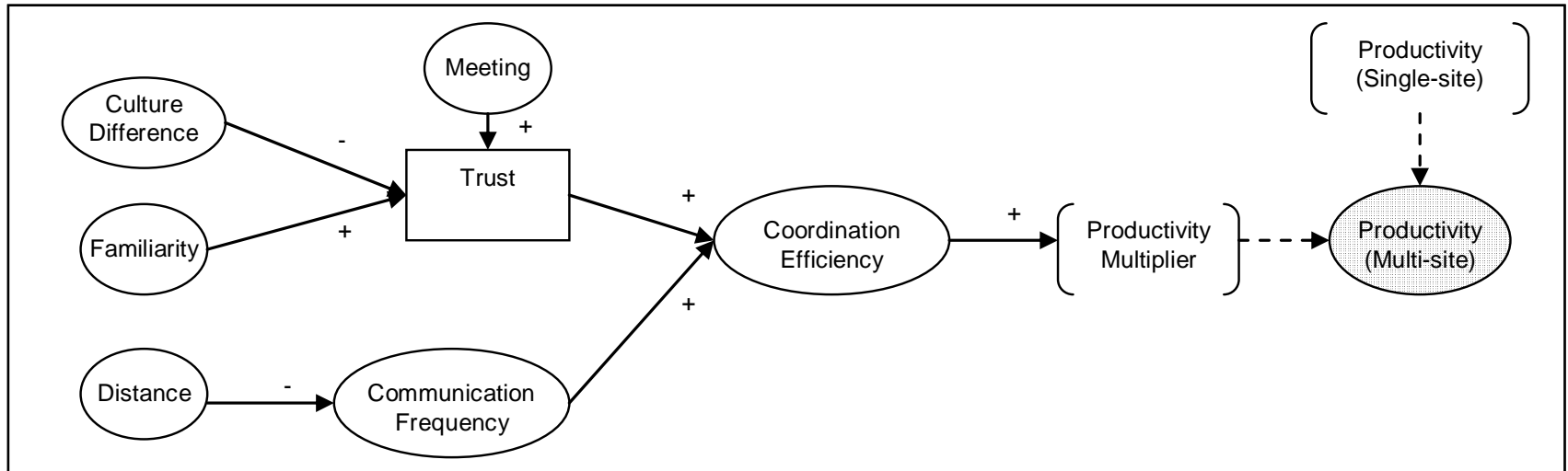
- Site-specific DES (for each development site)
 - Actual process steps / work product transfer
- Global DES
 - Project progress

GSD Model Components

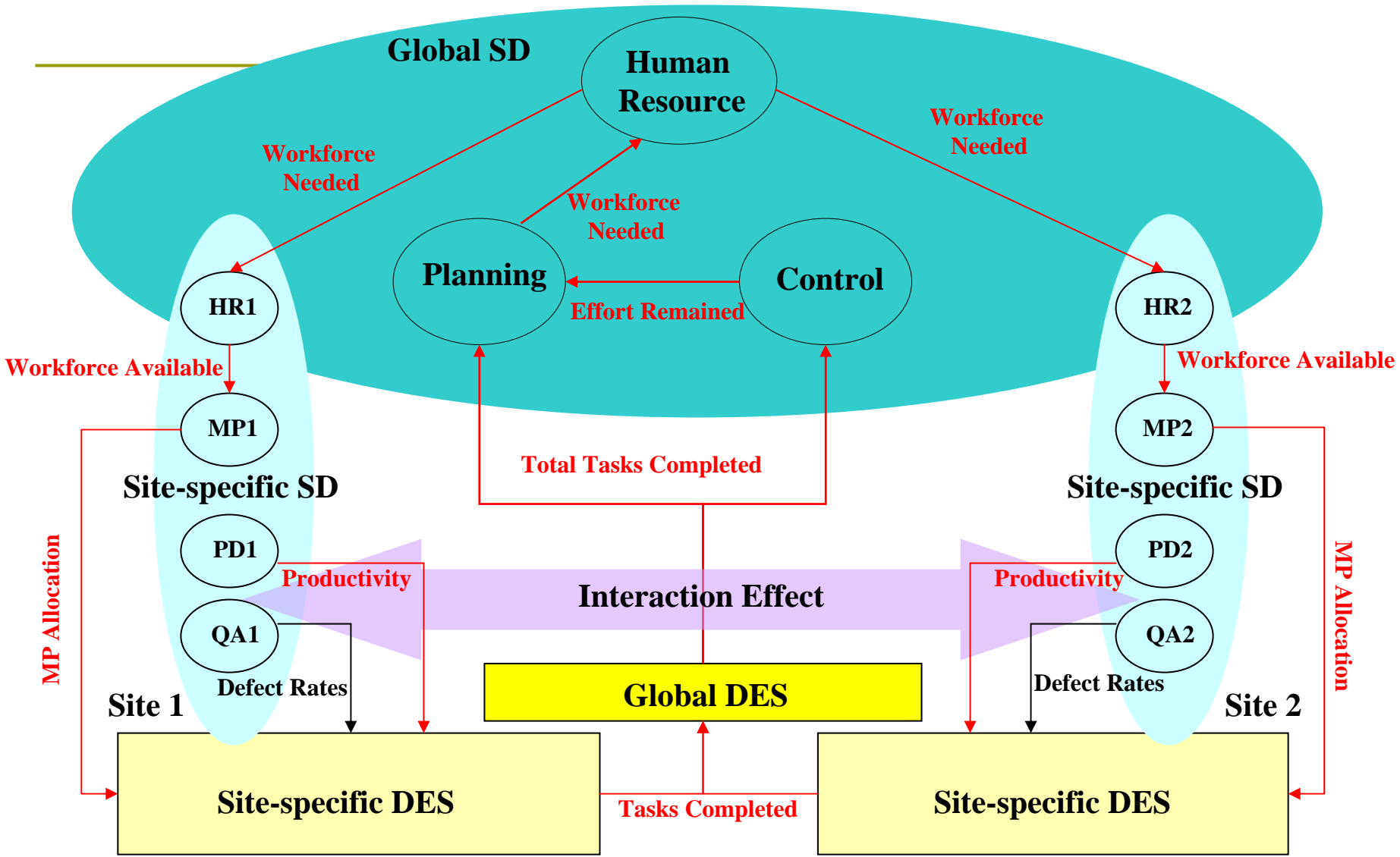


Interaction Effect (IE) sub-model

- Capture the impact of GSD factors on productivity and defect rate
- Use when staff from different sites need to work collaboratively



GSD Model Overview



HR = Human Resource MP = Manpower Allocation

PD = Productivity

QA = Quality Assurance

The Use of GSD Model



□ Project Planning

- What is the forecasted project performance?
- Should the work be distributed across multiple sites or should it be centralized at a single site?
- Which development site should be included?
- How should work be divided across sites?

□ Process Improvement

- What is the impact of adding an additional process step?
- Where should the testing be performed? Should it be centralized?
- Would it be worthwhile to implement new tools?

Example



- ❑ Which development site should be included in the project?
- ❑ 2 alternatives
 - Site A
 - ❑ Eight-hour difference (no overlap working hour)
 - ❑ Culture and language are different
 - ❑ Lower wage than Site B
 - Site B
 - ❑ Four-hour difference (50% overlap working hour)
 - ❑ Culture and language are the same
 - ❑ Higher wage than Site A

Example

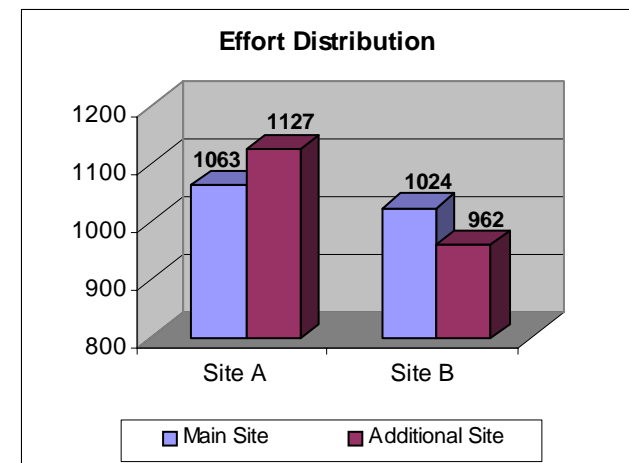


- ❑ It is not obvious which site is better
- ❑ Site A
 - Can benefit from 16 hour development per day
 - May have more coordination and communication problems → requires more effort
- ❑ Site B
 - Development hour per day is lower
 - Can use synchronous communication → improve coordination
 - Less communication problem



Example Result

- Using Site A requires more effort (204 man-days more)
 - Additional effort for coordination
 - Additional effort for rework due to miscommunication
- But we cannot automatically conclude that Site B will cost less since wage in Site A is lower.
- Additional effort mainly spent at Site A. If the wage in Site A is about 80% of the wage in Site B, the cost will be about the same.

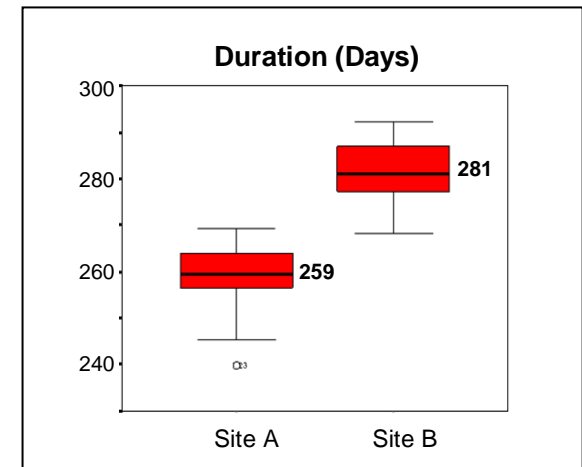


Example Result



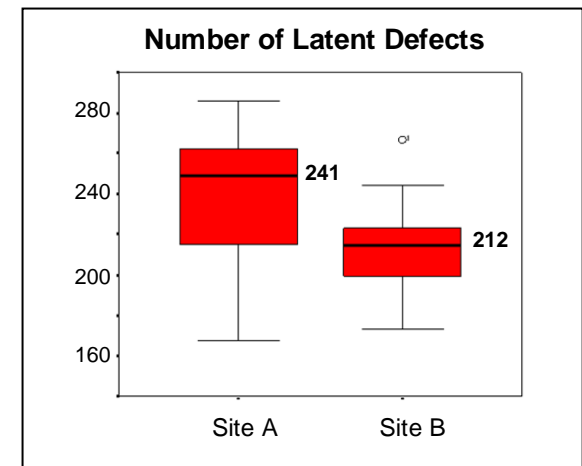
□ Duration

- The duration with Site A is about 22 days shorter than the duration with Site B



□ Quality

- The quality is higher when using Site B (lower latent defects - 29 lower)
- However, the difference is not statistically significant.



Discussion



- ❑ Neither Site A or Site B performs the best on all three performance measures.
 - Site A: shorter duration, but more effort and lower quality
 - Site B: better quality, lower effort, but longer duration
- ❑ Project manager has to make a trade-off and decide which option will better meet the objective.

Conclusion & Future Work



- Hypothetical results to illustrate how we can use GSD model to answer question of interest
- In the future, we will collect the real world data and work with experts to further calibrate and validate the GSD model



Question?

Thank you