Measuring the Impact of Information Technology and Electronic Business Systems in Government Settings: Lessons Learned in Support of E-Government Initiatives

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Background

- Client: Defense eBusiness Program Office (nee Joint Electronic Program Office), Defense Logistics Agency
- Client's interest: Assess Impact of eBusiness systems
  - Congressional oversight
  - GPRA
  - Rational planning
  - Negotiating for funding

Deployed Programs Should Have Measurable Consequences

- Focus on Impact, i.e. Indicators of
  - Cost
  - Quality
  - Time
  - Readiness
- De-emphasize process, e.g.
  - % time system up and running
  - # of users
  - Time to resolve user complaints

Questions Addressed

- *Specific*: Have particular programs done any good?
- *Broad*: Can we assess impact of operational eBusiness systems?
  - Obtain data
  - Draw conclusions about past performance
  - Provide insight for improvement
  - Recommendations to make future evaluation easier and more powerful

Programs Evaluated

- Electronic Document Access (EDA)
  - *Single* source for contracts, bills of lading, etc.
- Central Contractor Registration (CCR)
  - *Single* data base to ID all vendors
- DoD Emall
  - *Single* entry point for off-the-shelf commercial items

To Anticipate the Answers…

- Yes, we can evaluate the specific programs
- Based on this experience, we are confident many other eBusiness programs can be evaluated in operational settings
- The evaluation won't be comprehensive, but it will provide enough information to
  - Assess the value of an eBusiness program
  - Guide productive change

Overview of Lessons Learned

- Metrics
  - Needed at the right level of detail
  - Ownership and IT constraints
  - Few people have usable knowledge about data
- Methodology
  - Metrics can't help unless the right comparisons can be made
  - Multiple sources of data needed
  - Useful empirical analysis often available to help
- Program Logic
  - If the program works, what will be different?
  - Answer affects metrics and methods
- Adaptive Systems
  - Impact cannot be completely specified in advance
- Realistic Expectations
  - Obligation to provide accurate information
  - Guiding improvement requires understanding limits
  - Setting a program up for failure cripples further evaluation

Metrics

- At a high level metrics are obvious:
  - Cost
  - Quality
  - Time
  - Readiness
- Metrics not obvious at level of data one can
  - Find
  - Trust
  - Analyze
  - E.g. “cycle time” is not the same as “time from a contract being finalized to its arrival at DCMA”

Good Impact Are Metrics Hard to Find: Lack Incentives to Cooperate

- owners = *users*

  evaluation clients = *developers*
  - E.g. EDA should affect DFAS payment cycle time. EDA knows # of users, but DFAS has the payment data
- Users have disincentive to show productivity. Efficiency = smaller organizations
- Even when willing, time and effort are required

Good Impact Are Metrics Hard to Find: Very Few People Really Know

- Detail matters
  - E.g. data element definition (which can evolve), work-arounds, ability to detail by location or time frame
- There are probably only 2- 5 mid-level civil servants who work with a data base well enough to know the answers
- Identities of the experts hard to come by
  - Far removed from evaluators' POC
  - People change jobs
  - Functions keep changing

Good Impact Are Metrics Hard to Find: IT System Limitations

- IT systems are inflexible, can't provide data at needed level of granularity.
- As legacy systems are replaced, only aggregated data is brought over

Methodology

- Methodology
  - Logical structure in which metrics are embedded
  - Required to extract information from metrics
- Evaluation design requires iterations history/functioning of eBusiness program and opportunities afforded by data

- Logic models are used to work out these iterations.

Need to Combine Multiple Data Sources: Example From EDA Impact on Contract Processing Labor

Data	Use	Source
Historical data on DFAS workload	Contextual understanding	DFAS
Per-contract impact of EDA, time and $	Base numers for assessment	FOSSAC
Contract volume for DLA, Air Force, Army, Navy	Scale –up local impact to DoD	1- OSD CIO Office, 2- DD350 data base
% paperless transactions	Scale –up local impact to DoD	1- OSD CIO Office, 2- DD350 data base

Useful Empirical Work Can Often Be Found

- EDA
  - FOSSAC micro-level analysis of impact on contract labor.
  - Could be scaled-up to DoD by combining with transaction volume information from other sources.
- CCR
  - Treasury data on cost of data entry
  - Combined with paperless contracting transaction volume for overall analysis

Example Of How Evaluation Plan Can Change

Round 1 Interviews

- System should affect metrics *a*, *b*, and *c*
- Users collect this data
- System implemented incrementally
- Implementation timeline known
- Plan: multiple interrupted time series, compare within and across divisions

Implementation Schedule

	Time 1	2	3	4	5
Division 1	X				
Division2		X			
Division 3			X		
Division 4				X	
Division 5					X

Upon closer scrutiny, ugly reality intrudes

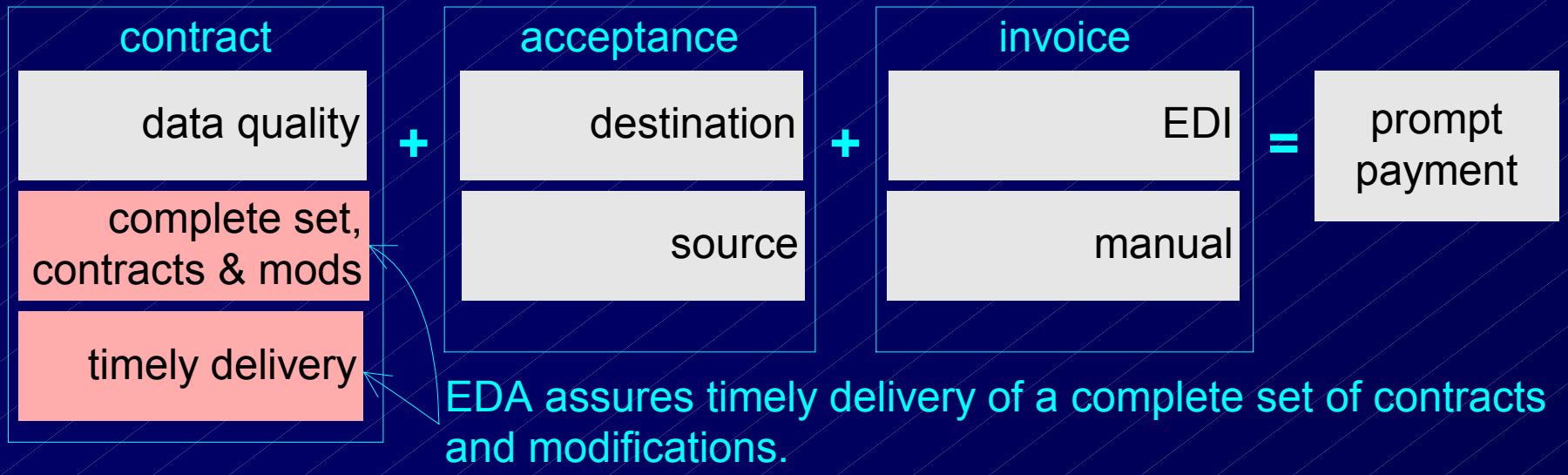
- Organizational change: Divisions merged, reorganized
- IT systems: Systems upgraded. Detailed data not carried over
- People: Not many experts in the old system left
- Data: Data could be extracted, but not by month

Logic Models Are Visual Representations Of Why An eBusiness Program Has Particular Consequences

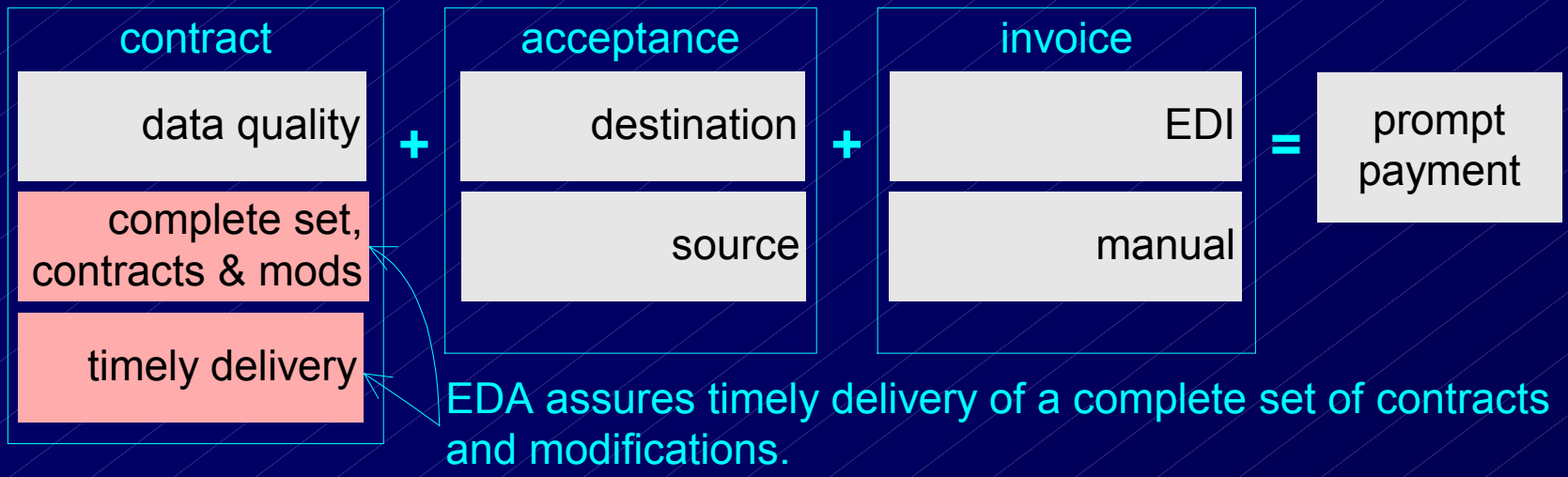
- Impact can be broader than indicated by meeting specific requirements for well defined users
- Proximate change may induce secondary change
- Timing of impact may vary, immediate to long term
- Outcomes may interact with each other
- Exogenous factors which affect impact should be identified
- Relationship diagrams help stakeholders reach consensus

Example: Model to Guide EDA Impact on Prompt Payment

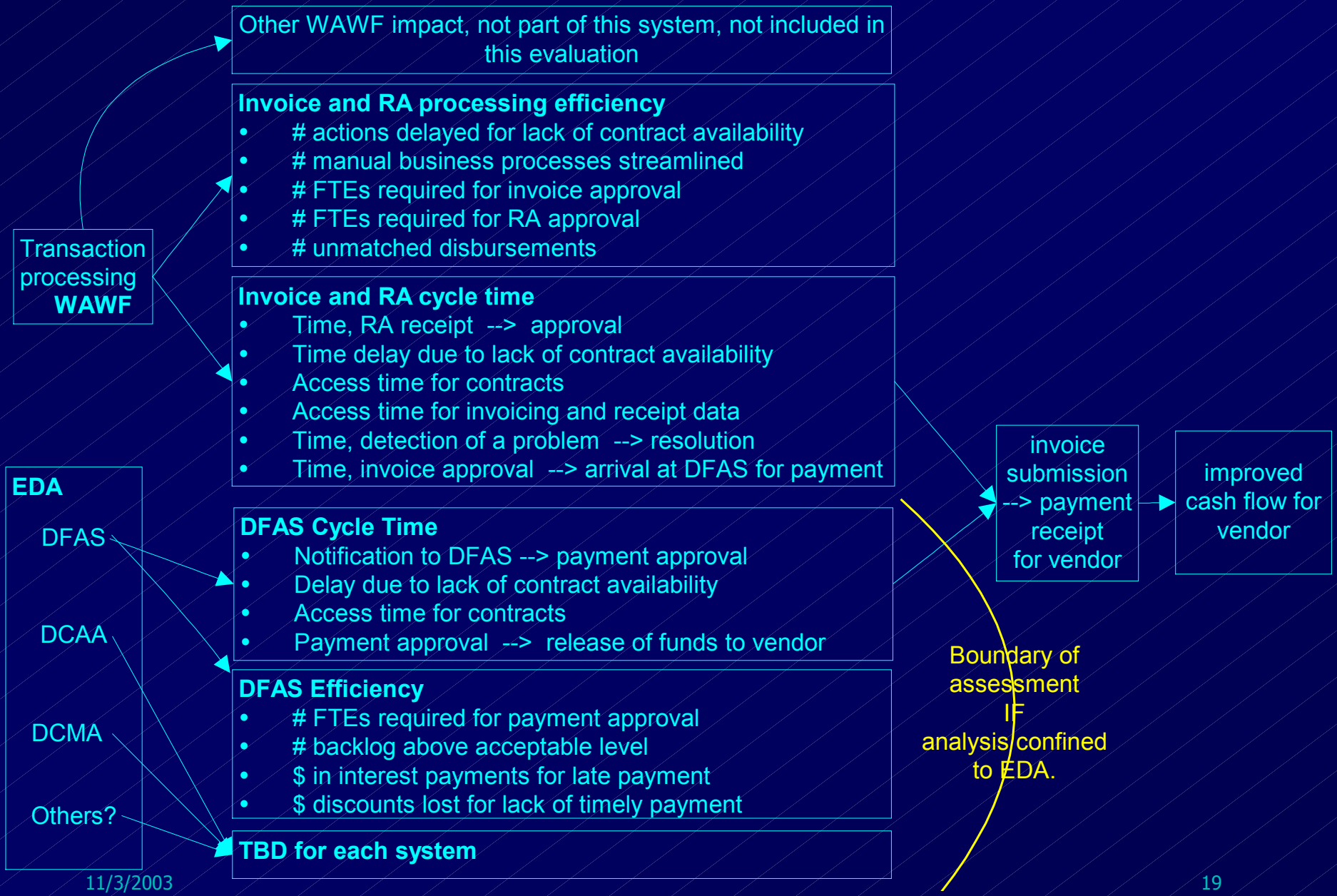
- Suggestion to use "prompt payment" as a metric for EDA
- Payment requires reconciliation of provisions in contract, acceptance notice, invoice
- EDA has direct impact on only two parts of this process



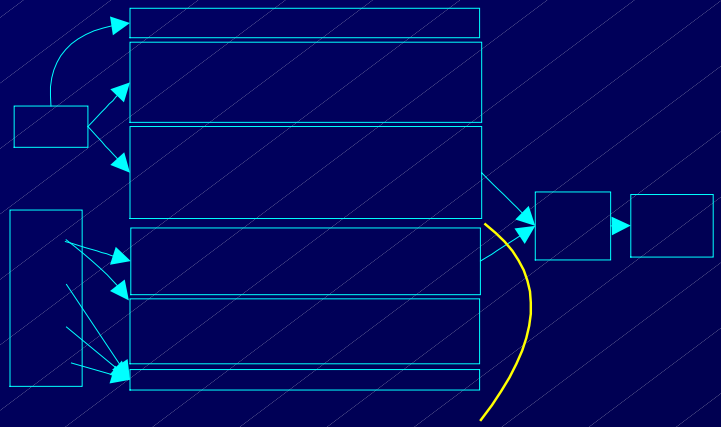
- No matter how good EDA is, payment will improve only if change also occurs in other parts of the system
- Assessing EDA impact on payment requires methodology to tease out contribution of EDA from other factors
- Payment *alone* would not be a fair criterion to judge EDA
- We can expect a direct impact of EDA on the contract process



Example: Higher Level View of EDA



- Developed earlier, when a greater # of evaluation possibilities were under consideration
- EDA affects many user groups
- Specific metrics for each group will differ E.g. “interest $” specific to DFAS
- Metrics can be combined. E.g. $ saved across all user groups
- EDA part of an eBusiness infrastructure
- Limits on impact if only part of the infrastructure is evaluated



Metrics + Methods + Models

	Data	**Methods**	**Conclusions / Recommendations**
Entire eBusiness Infrastructure	Standard output. Little special manipulation.	"Main effect" monitoring.	Assess overall functioning. No guidance for investment.
…			
Discrete eBusiness System	Fine level. Lots of special manipulation.	Need to ID, measure dependencies & interactions.	Direction for specific systems. No data on overall performance.

Adaptive Systems

- Complete set of metrics cannot be specified in advance because organizations adapt to innovation.
  - CCR role in Past Performance Information Retrieval System
  - Emall role in bidding system at the Naval Facilities Engineering Command
  - EDA role in contract information quality
- Implications for evaluation
  - Balance need for stable methodology and requirement to assess unanticipated change
  - Need to stay in close touch
  - As with data, it's hard to find the people who really know

Logic Models Help Explain Why A System Facilitates Change

Pre-CCR

System 1		System 2		System 3	
Referent	**Information**	**Referent**	**Information**	**Referent**	**Information**
A	1, 2, 3	α	4, 5	A	6, 7, 8
B	1, 2, 3	β	4, 5	B	6, 7, 8
C	1, 2, 3	Γ	4, 5	C	6, 7, 8

Even with information on the same entities, no way to cross reference

Post-CCR

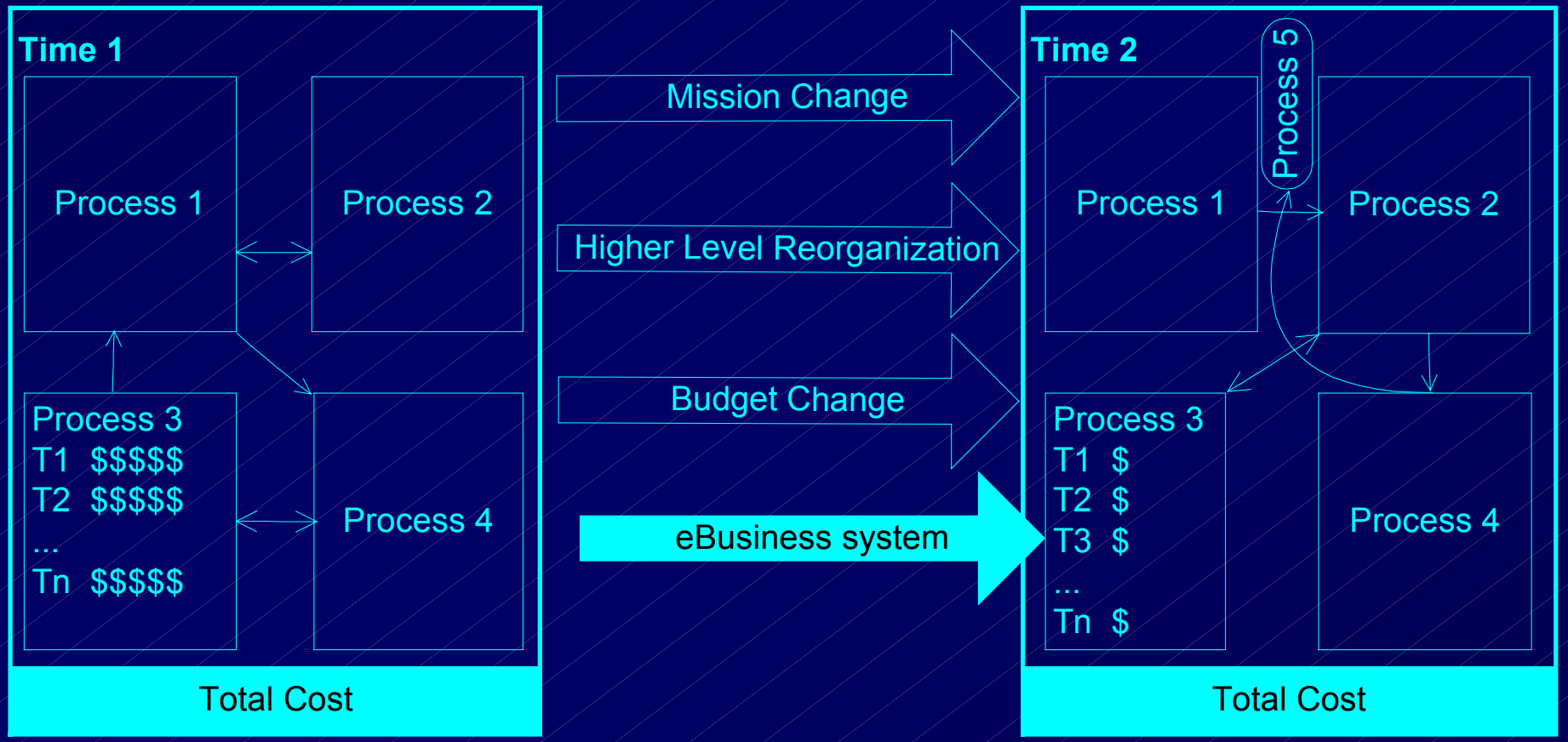
System 1		System 2		System 3	
Referent	**Information**	**Referent**	**Information**	**Referent**	**Information**
A	1, 2, 3	A	4, 5	A	6, 7, 8
B	1, 2, 3	B	4, 5	B	6, 7, 8
C	1, 2, 3	C	4, 5	C	6, 7, 8

Single index, data can be integrated across systems

Realistic Expectations

- eBusiness systems have boundaries of impact
- Decreased task cost/time may bring small overall change
  - Imperfect correlation, calendar time and cost
  - Complex dependencies and relationships among multiple contributors to resource consumption
  - Many powerful forces besides an eBusiness system
- Labor savings do not lead directly to reduction in budget or workforce
  - Work reallocated to other tasks
  - Overtime vs. regular hours
  - People spread across tasks
  - Contractual and political constrains

A Useful Picture To Illustrate These Points



- Obligation to provide honest, accurate assessment
- Success requires a delicate balance
  - Evaluation over the long term requires cooperation from the people being evaluated
  - Counterproductive to ignore impact boundaries and set programs up for failure
  - Programs should be accountable for what they promised to do
  - Information needed to
    - Make fundamental decisions – existence, mission, funding
    - Guide incremental improvement