Business Artifacts:
A Data-Centric Approach to Business Process Modeling & Management

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Outline

- Data: Critical to Business Processes
- Current BP Development & Management Practice
  - Challenges
    - Activity centric (e.g., Visio diagrams), data left to lower level design
- Business Artifacts:
  - Blending data with business processes
  - Business processes as lifecycles of business artifacts
- Overview of Research Focuses
- Conclusions
A business process is an assembly of one or more related activities (automated or manual) that collectively realizes a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships.

Example: Obtaining a Permit (Hangzhou HMB)
BP Management Systems (BPMSs)

Software systems to manage, support, and control:
- biz process models
- data *(documents, files, …)*
- enactments
- resources *(including human)*
- others *(e.g. support for auditing)*

BP “=” workflow in the wider sense

Traditional concept of workflow in 80’s to early 90’s restricted to mostly task sequencing
Mckinsey Global Institute, June 2011: Big data: The next frontier for innovation, competition, and productivity

- Availability of “big data” brings opportunities for improving productivity

15 out of 17 sectors in the United States have more data stored per company than the US Library of Congress.
Two observations

- A significant portion of big data generated from biz processes
- Productivity growth only obtainable via more efficient/effective biz processes

US health care
- $300 billion value per year
- ~0.7 percent annual productivity growth

Manufacturing
- Up to 50 percent decrease in product development, assembly costs
- Up to 7 percent reduction in working capital

US retail
- 60+% increase in net margin possible
- 0.5–1.0 percent annual productivity growth

Europe public sector administration
- €250 billion value per year
- ~0.5 percent annual productivity growth

Global personal location data
- $100 billion+ revenue for service providers
- Up to $700 billion value to end users

Source: MGI Analysis
Data: Critical to Business Processes

Current BP Development & Management Practice

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Business Artifacts:

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Overview of Research Focuses

Conclusions
Vanda Group

- Developing workflow systems for regional banks, credit unions, provident funds, ... (in China)
- Est. 60% of the market excluding national banks

Key obstacles:

- Training (engineer liquidity)
- Repetition of work, labor intensive  
  (could make more $\$ or ¥¥ and be more competitive)
- High maintenance cost

**developed** workflow application domains
Hangzhou Housing Management Bureau

- City population: 8.7 millions
- One division (~400 SMEs) deals with all real estate licenses, permits, titles, etc.
- 300,000 cases each year:
  - ~500 biz process models, 35% 1 day, 30% 7-9 days
- Contractor/in-house development of workflow systems (¥¥ millions for in-house only)

Challenges:
- Manage changes (policy, environment, ...)
- Serious lack of automation for design-development-maintenance

200,000+ for China CNR Corporation Limited

developing workflow application domains
Hospitals: RuiJin & SB Cottage

- Health care delivery: much of the $300 billion could be gained [MGI’11]
- Treatment workflows can fundamentally improve health care quality

Falling far behind:
- No workflows, conflicting “workflows”
- “Shaky” IT infrastructures

RuiJin has the largest IT team (40+ FTEs) among all hospitals in Shanghai

new IT divide?

wishful workflow application domains
BPM Application Challenges

- Lack of clear ways to combine various factors of biz processes
- Lack of workflow technology to support a variety of essential functions
  - Analysis, modifications, interoperation, ...
  - Needs holistic approach to BPM
- Long tail phenomenon is a “holy grail”
- Application domains work in isolation

Origin of the difficulties:
ill-suited modeling methodology
Typical Biz Process Modeling

- A bookseller example: Traditional control-centric models

```
Fill Shopping Cart  ID Customer  Shipping Preference  Payment information  Confirmation  Archive
```

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Typical Biz Process Modeling

- A bookseller example: Traditional control-centric models
- Multiple steps needed for each activity

Hard to reason, find useful views: missing data
Business Analytics (Biz Intelligence)

Extract-Transform-Load

- Data Warehouse
  - inventory
  - catalog
  - cust_db

- Analysis

Missing Biz Processes

Activities
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Four Kinds of Data in Biz Processes

- **Business data** essential for business logic
  - Examples: *items, shipping addresses*

- **Enactment status**: the current execution snapshot
  - Examples: *order sent, shipping request made*

- **Resource usage and state** needed for BP execution
  - Examples: *cargo space reserved, truck schedule to be determined*

- **Correlation** between processes instances
  - Example: 3 *warehouse fulfillment process instances for Jane’s order*

- **Traditional biz process models** barely capture data
Business Artifacts

- **A business artifact** is a key conceptual business entity that is used in guiding the operation of the business
  - *fedex package delivery, patient visit, application form, insurance claim, order, financial deal, registration, ...*
  - both “information carrier” and “road-maps”

- Technically, it includes two parts:
  - **Information model:**
    - data needed to move through workflow
  - **Lifecycle:**
    - possible ways to evolve

✔ Very natural to business managers and BP modelers
Example: Restaurant Processes

Artifacts
- Guest Check
- Kitchen Order
- Receipt
- Cash Balance

Activity
- Create Guest Check
- Add Item
  - Pending KOs
  - Ready KOs
- Prepare & Test Quality
- Open GCs
  - Pending GCs
- Update Cash Balance
  - Ready KOs
  - Cash Balance
- Payment
  - Pending Receipts
  - Closed GCs
  - Disagreed Receipts
- Recalculate Receipt
  - Archived Receipts
  - Archived GCs
- Prepare Receipt
- Create GC

Example:
Restaurant Processes
- GC
- KO
- RC
- CB

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Artifact-Centric Biz Process Models

**Informal model** [Nigam-Caswell IBM Sys J 03]

**Systems:** BELA (IBM 2005), Siena (IBM 2007), EZ-Flow (ArtiFlow) (Fudan-UCSB 2010), Barcelona (IBM 2010)

**Formal models**

- **State machines** [Bhattacharya-Gerede-S. SOCA 07][Gerede-S. ICSOC 07]
BP Models: Data Abstraction to Artifacts

Four classes of Biz process models:

- **Data abstraction** models: data mostly absent
  - WF (Petri) nets, BPMN, UML Activity Diagrams, …

- **Data-aware** models: data present (as variables), but storage and management hidden
  - BPEL, YAWL, …

- **Storage-aware** models: schemas for persistent stores, mappings to/from data in BPs defined and managed manually
  - jBPM, …

- **Artifact-centric** models: logical modeling for biz data, automated modeling other 3 types, data-storage mapping
  - GSM, EZ-Flow
Case Study: IBM Global Financing

- Finance HW, SW & services for global clients
  - $38B asset base, financing >$40B/year, 125K clients

- Business challenges
  - Country “silos” inhibited integration & annoyed clients
  - Failed to produce end-to-end “tangible model”
  - Efficiency/cost control need global performance metrics
  - Need a globally standard process w/ local variations

- No results after 2 year efforts with traditional approach

- A preliminary artifact design after a 3-day workshop with 15 business SMEs from IGF

- 6 weeks of design refinements lead to final design
  - Also, a blueprint for transformation of IGF operations
Case: Hangzhou Housing Management

- **Problem:** Cannot handle ad hoc changes effectively
  - Regulation and policy changes (some temporary)
  - Temporary changes in response to, e.g., disaster

- **Example:** A green channel for projects of flood victim resettlement omits reviewing tasks

![HHMB’s Workflow System Diagram](chart.png)
Artifact-Centric BPs are Easier to Change

- Biz process = biz artifacts = state machine lifecycle + BP change rules
- BP change rules conservatively extend workflow
  - Could be temporary, non-schematic
- Rules allow biz processes to respond to situations with many more options
- Estimated labor savings:
  - 9% for Hangzhou HMB (preliminary study) or 38 out of 400 FTEs

[Xu-S.-Yan-Yang-Zhang CoopIS 2011]
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Research Challenges

- Unifying holistic conceptual models
- Design tools (analysis, verification, optimization)
- Runtime support, manage changes
- Reasoning, business analytics (informatics), process mining
- Interoperation
Conclusions

- Biz process modeling: a foundation for BP management
  - Many challenges: old and new
  - Data are essential and play prominent roles for BPs
- Biz artifact centric approach promising
- Two alternatives:
  - As a BPM design methodology/tool, e.g., accompanying jBPM
  - Full-fledged BPMS, one possible aim: install and use as easy as mySQL
- Biz artifacts: a very active research topic
Thank you!