The Essential Toolkit for Process Scientists

Shazia Sadiq

The University of Queensland | Brisbane Australia

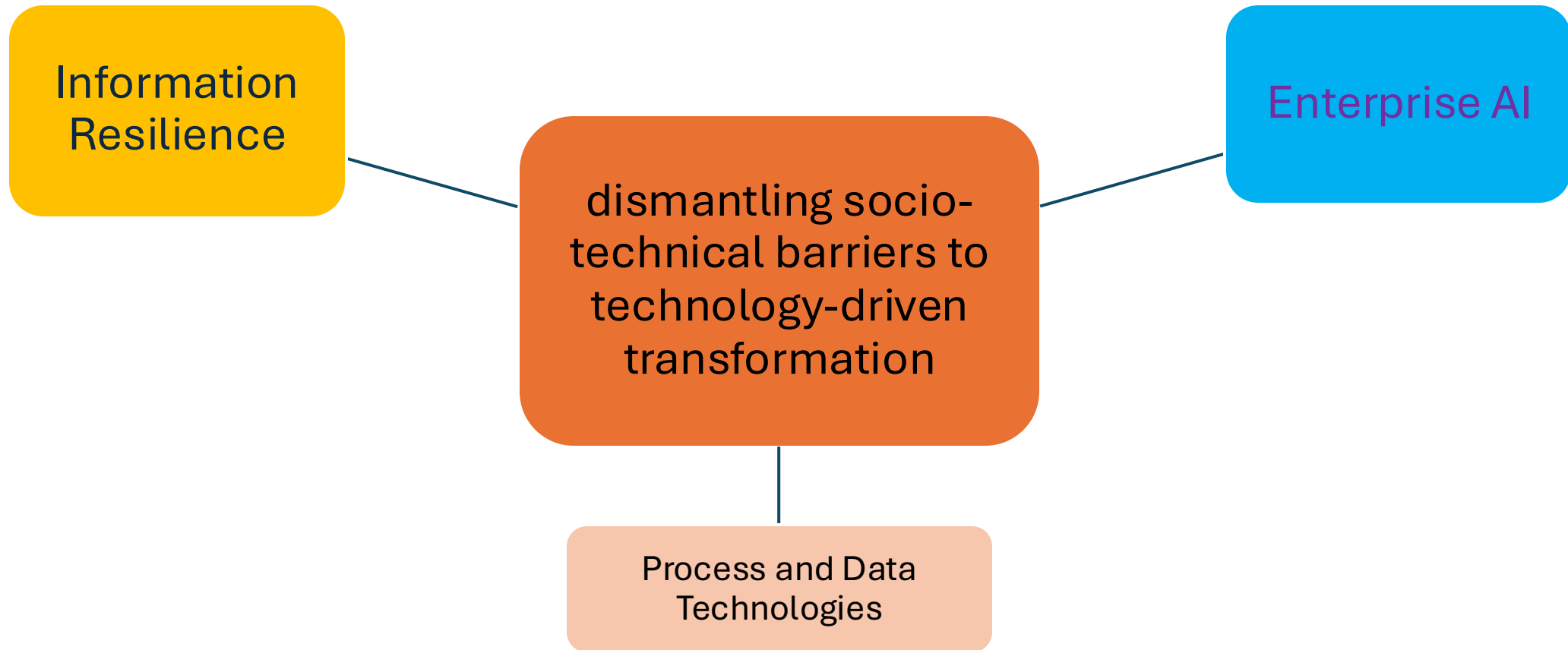BPM Seville 2 Sep 2025

About me ...

Information Resilience

Enterprise AI

dismantling socio-technical barriers to technology-driven transformation

Process and Data Technologies

arc training centre for information resilience

- CIRES is an Australian Research Council (ARC) Industrial Transformation Training Centre

- Commenced at the end of July 2021 and will run for 5 years with a total funding of $13.8M

- CIRES hosts over 50 staff including research leaders from computer science, mathematics, and business, research fellows, industry and international experts, PhD and Masters Students

- CIRES will train PhD students, Research Fellows, and Data Engineers, working collaboratively with our Partners to build workforce capacity in Australian organisations and help them achieve information resilience.
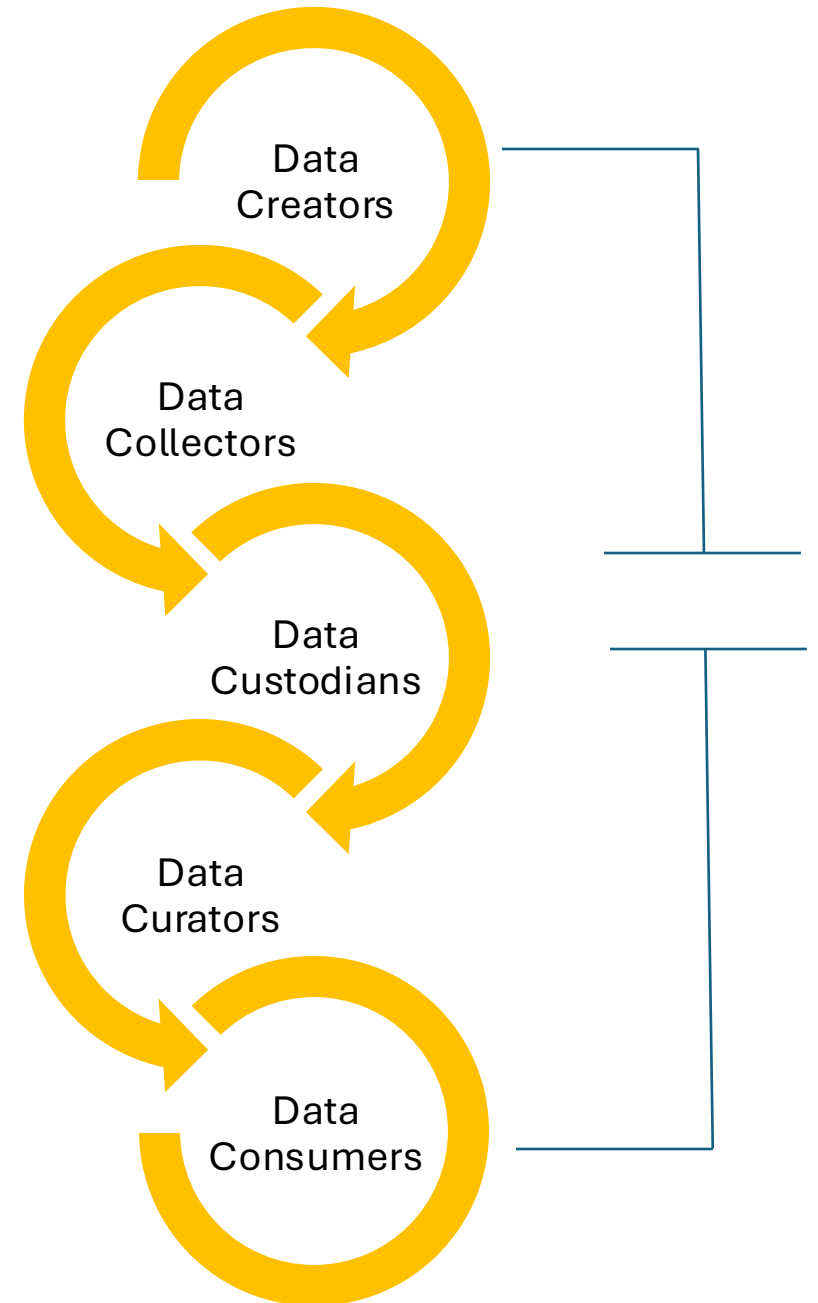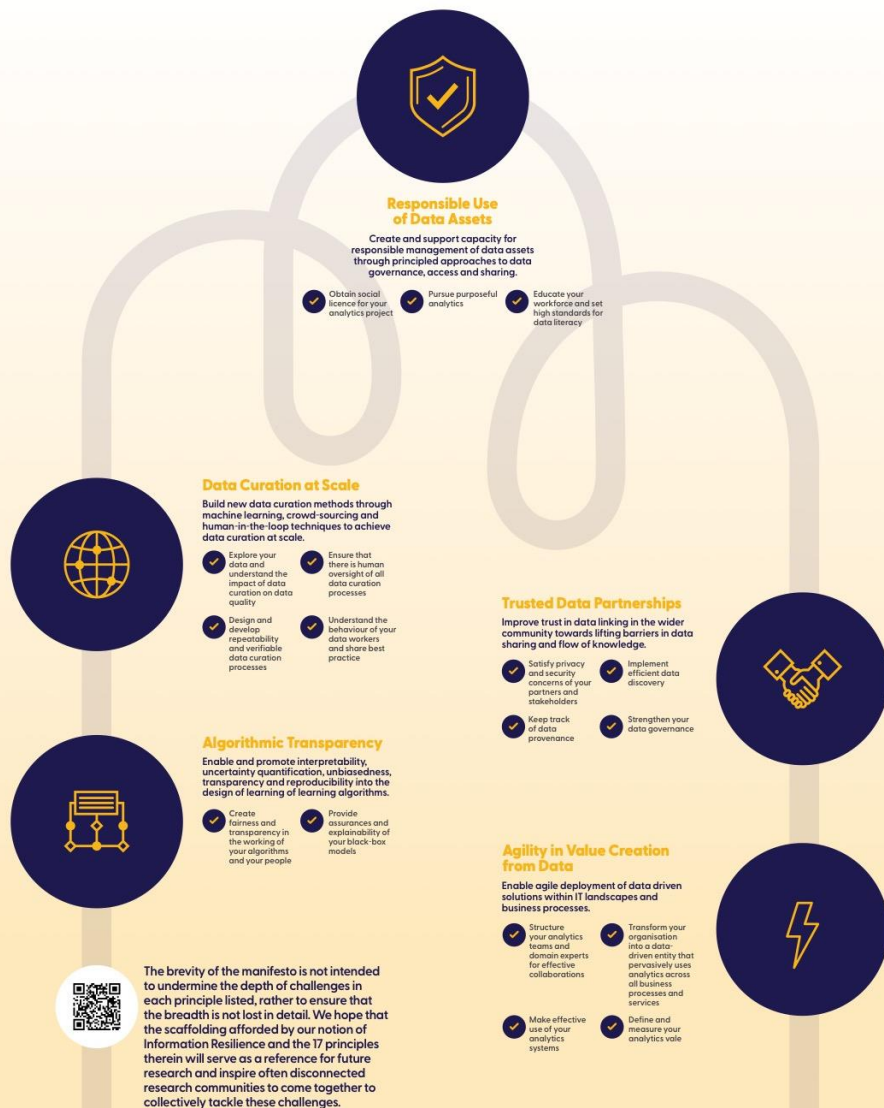
CIRES.org.au

4

Information Resilience

... the capacity of organisations to build, protect, and sustain agile data pipelines, capable of detecting and responding to failures and risks across the value chain in which the data is sourced, shared, transformed, analysed, and consumed.

Data Creators

Data Collectors

Data Custodians

Data Curators

Data Consumers

Manifesto for Information Resilience

We define Information Resilience as: The capacity of organisations to create, protect, and sustain agile data pipelines, that are capable of detecting and responding to failures and risks across their associated value chains in which the data is sourced, shared, transformed, analysed, and consumed. The CIRES multidisciplinary team, consisting of social scientists, database researchers, business experts, computer scientists, mathematicians, and information systems researchers, has assembled a Manifesto for Information Resilience, which outlines 17 principles.

arc training centre for **information resilience**

cires.org.au
cires@uq.edu.au

Responsible Use of Data Assets

Create and support capacity for responsible management of data assets through principled approaches to data governance, access and sharing.

- Obtain social licence for your analytics project
- Pursue purposeful analytics
- Educate your workforce and set high standards for data literacy

Data Curation at Scale

Build new data curation methods through machine learning, crowd-sourcing and human-in-the-loop techniques to achieve data curation at scale.

- Explore your data and understand the impact of data curation on data quality
- Ensure that there is human oversight of all data curation processes
- Design and develop repeatability and verifiable data curation processes
- Understand the behaviour of your data workers and share best practice

Trusted Data Partnerships

Improve trust in data linking in the wider community towards lifting barriers in data sharing and flow of knowledge.

- Satisfy privacy and security concerns of your partners and stakeholders
- Implement efficient data discovery
- Keep track of data provenance
- Strengthen your data governance

Algorithmic Transparency

Enable and promote interpretability, uncertainty quantification, unbiasedness, transparency and reproducibility into the design of learning of learning algorithms.

- Create fairness and transparency in the working of your algorithms and your people
- Provide assurances and explainability of your black-box models

Agility in Value Creation from Data

Enable agile deployment of data driven solutions within IT landscapes and business processes.

- Structure your analytics teams and domain experts for effective collaborations
- Transform your organisation into a data driven entity that pervasively uses analytics across all business processes and services
- Make effective use of your analytics systems
- Define and measure your analytics vale

The brevity of the manifesto is not intended to undermine the depth of challenges in each principle listed, rather to ensure that the breadth is not lost in detail. We hope that the scaffolding afforded by our notion of Information Resilience and the 17 principles therein will serve as a reference for future research and inspire often disconnected research communities to come together to collectively tackle these challenges.

Information Resilience: the nexus of responsible and agile approaches to information use

Shazia Sadiq[1] · Amir Aryani[2] · Gianluca Demartini[1] · Wen Hua[1] · Marta Indulska[1] · Andrew Burton-Jones[1] · Hassan Khosravi[1] · Diana Benavides-Prado[3] · Timos Sellis[2,4] · Ida Someh[1] · Rhema Vaithianathan[1] · Sen Wang[1] · Xiaofang Zhou[5]

Abstract

The appetite for effective use of information assets has been steadily rising in both public and private sector organisations. However, whether the information is used for social good or commercial gain, there is a growing recognition of the complex socio-technical challenges associated with balancing the diverse demands of regulatory compliance and data privacy, social expectations and ethical use, business process agility and value creation, and scarcity of data science talent. In this vision paper, we present a series of case studies that highlight these interconnected challenges, across a range of application areas. We use the insights from the case studies to introduce Information Resilience, as a scaffold within which the competing requirements of responsible and agile approaches to information use can be positioned. The aim of this paper is to develop and present a manifesto for Information Resilience that can serve as a reference for future research and development in relevant areas of responsible data management.

Keywords Information Resilience · Data quality · Responsible data science · Effective information use · Value creation

Amir Aryani, Gianluca Demartini, Wen Hua, Marta Indulska, Andrew Burton Jones, Hassan Khosravi, Diana Benavides Prado, Timos Sellis, Ida Someh, Rhema Vaithianathan, Sen Wang and Xiaofang Zhou are ordered alphabetically with equal contributions

✉ Wen Hua
w.hua@uq.edu.au

1 Introduction

Advancements in machine learning (ML) and artificial intelligence (AI) are being valued at contributing up to US$15.7 trillion [122] to the global economy by 2030. Walsh et al. [156] state that 'AI is enabled by data' and highlights the need for robust mechanisms for 'generating, sharing and

CIRES Visitor Scheme

arc training centre for information resilience

Students

The CIRES Visiting Student Scheme supports high calibre research students to spend 8-12 weeks at The University of Queensland (UQ) in Brisbane, Australia working with Centre researchers to conduct joint research work on areas of mutual interest.

CIRES will offer funding support of: AUD $5,000 for an 8-week visit, or AUD $6,000 for a 12-week visit

Next Round: 22nd March 2026

Researchers

We invite researchers from universities and research institutes to visit the Centre to participate and share research knowledge, through collaborative involvement in a research project. During the visit, the visitor will have the opportunity to connect with CIRES researchers including partners, and participate in the Centre's activities including reading groups, events, meetings, and workshops.

No deadlines, Apply anytime

Apply now:

https://cires.org.au/engagement/visitors/

Research Alliance for Enterprise AI

Enterprise AI refers to AI technologies developed to address business and organisational needs, in both public and private enterprises.

Enterprise AI contrasts with Consumer AI, which is designed for use by individuals, enhancing convenience in everyday tasks.
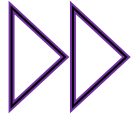
SCALE

Do more with less! Less data, less compute, new hardware paradigms and model architectures, and scale up by amplifying human potential

TRUST

Trustworthy by design! Beyond security and safety, Human AI teaming, Governance, Guardrails and Regulatory Compliance
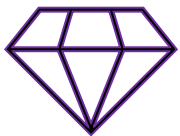
VALUE

A new take on productivity! Transformational value creation and measurement of customer experiences, products, services, business models and business processes

Today's talk

Change
Compliance
Comprehension

Not an exhaustive list for a Process Scientist, but you won't get very far if you ignore these
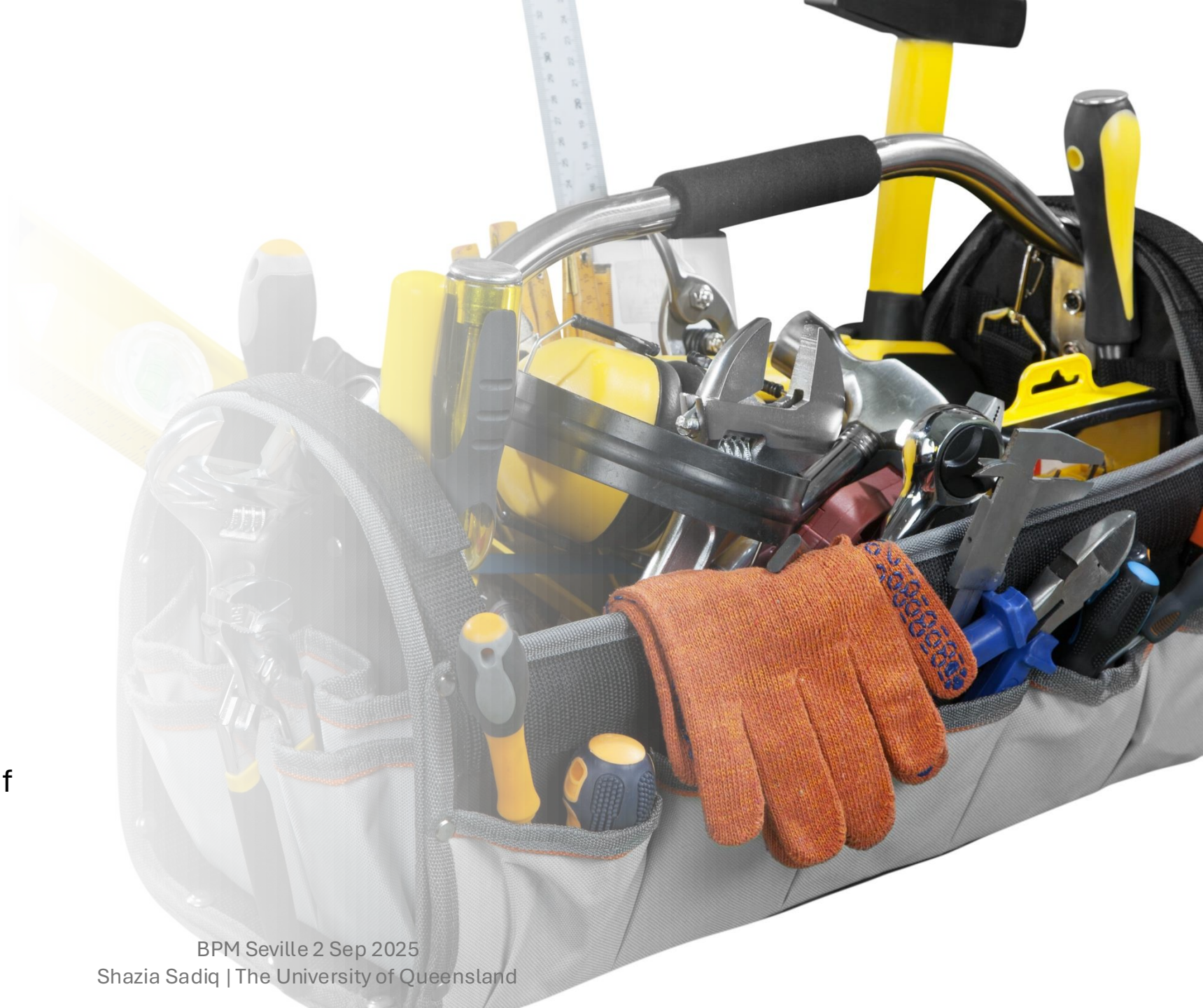
Change

... the only constant[1]

BPM Seville 2 Sep 2025
Shazia Sadiq | The University of Queensland

Reengineering Work:
Don't Automate, Obliterate

Michael Hammer

Despite a decade or more of restructuring and downsizing, many U.S. companies are still unprepared to operate in the 1990s. In a time of rapidly changing technologies and ever-shorter product life cycles, product development often proceeds at a glacial pace. In an age of the customer, order fulfillment has high error rates and customer inquiries go unanswered for weeks. In a period when asset utilization is critical, inventory levels exceed many months of demand.

The usual methods for boosting performance—process rationalization and automation—haven't yielded the dramatic improvements companies need. In particular, heavy investments in information technology have delivered disappointing results—largely because companies tend to use technology to mechanize old ways of doing business. They leave the existing processes intact and use computers simply to speed them up.

But speeding up those processes cannot address their fundamental performance deficiencies. Many of our job designs, work flows, control mechanisms, and organizational structures came of age in a different competitive environment and before the advent of the computer. They are geared toward efficiency and control. Yet the watchwords of the new decade are innovation and speed, service and quality.

It is time to stop paving the cow paths. Instead of embedding outdated processes in silicon and software, we should obliterate them and start over. We should "reengineer" our businesses: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance.

Every company operates according to a great many unarticulated rules. "Credit decisions are made by the credit department." "Local inventory is needed for good customer service." "Forms must be filled in completely and in order." Reengineering strives to break away from the old rules about how we organize and conduct business. It involves recognizing and rejecting some of them and then finding imaginative new ways to accomplish work. From our redesigned processes, new rules will emerge that fit the times. Only then can we hope to achieve quantum leaps in performance.

Reengineering cannot be planned meticulously and accomplished in small and cautious steps. It's an all-or-nothing proposition with an uncertain result. Still, most companies have no choice but to muster the courage to do it. For many, reengineering is the only hope for breaking away from the antiquated

Michael Hammer is president of Hammer and Company, an information technology consulting firm in Cambridge, Massachusetts. This article is based in part on work performed in association with the Index Group also a Cambridge-based consultancy.

1990

"automating existing processes, even with advanced technology is insufficient… companies must **radically rethink and redesign** their core business processes to achieve dramatic improvements …"

Hammer, M. (1990) Reengineering Work: Don't Automate, Obliterate. Harvard Business Review, 68, 104-112.

Hammer, Michael; Champy, James (1993). *Reengineering the Corporation: A Manifesto for Business Revolution*. New York, NY: HarperBusiness.

Change Management in BPM Research

Reichert, M., & Dadam, P. (1998). *ADEPTflex – Supporting Dynamic Changes of Workflows Without Losing Control.*

Rinderle, S., Reichert, M., & Dadam, P. (2005). *Correctness Criteria for Dynamic Changes in Workflow Systems – A Survey.*

Pesic M, Schonenberg M, Sidorova N, van der Aalst W (2007) *Constraint-based workflow models: Change made easy.*

…

Beerepoot, I., van de Weerd, I., Reijers, H.A. (2019). *The Potential of Workarounds for Improving Processes.*

Alexander Kraus, A., van der Aa. H. (2024) *Looking for Change: A Computer Vision Approach for Concept Drift Detection in Process Mining*

2009

Supporting 'Dynamic' Processes

"The economic success of an enterprise depends on its ability to *react to changes* in its environment in a quick and flexible way."

2009

Supporting 'Dynamic' Processes

Evolution

Adaptation
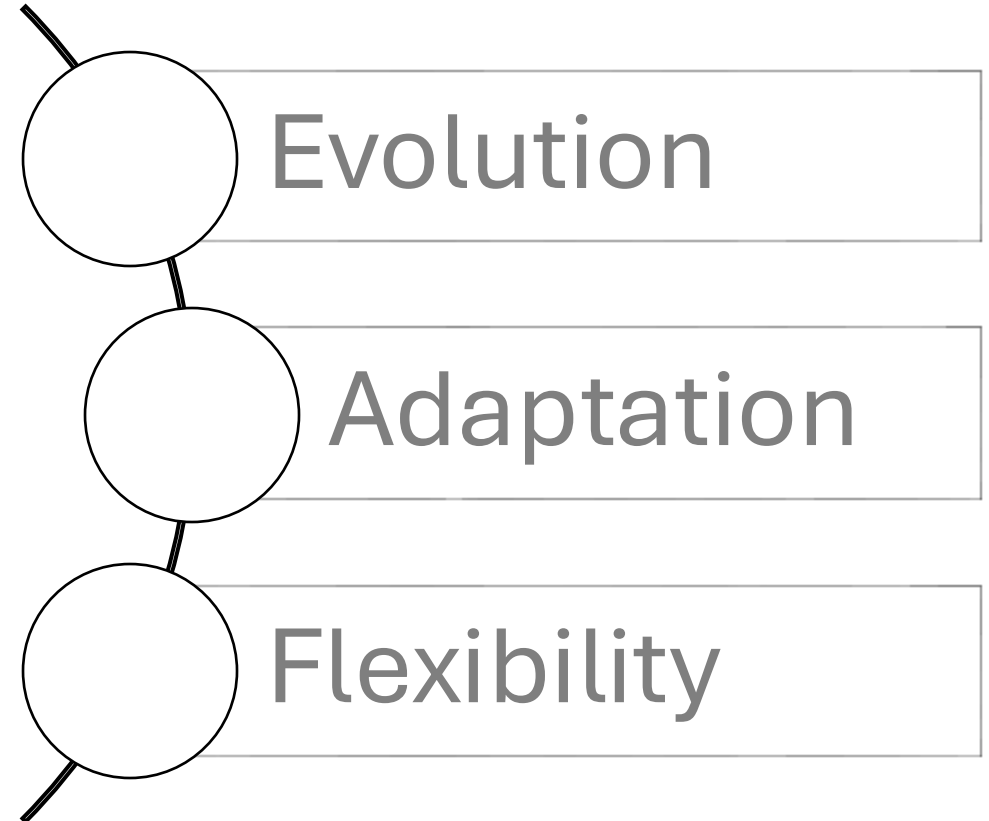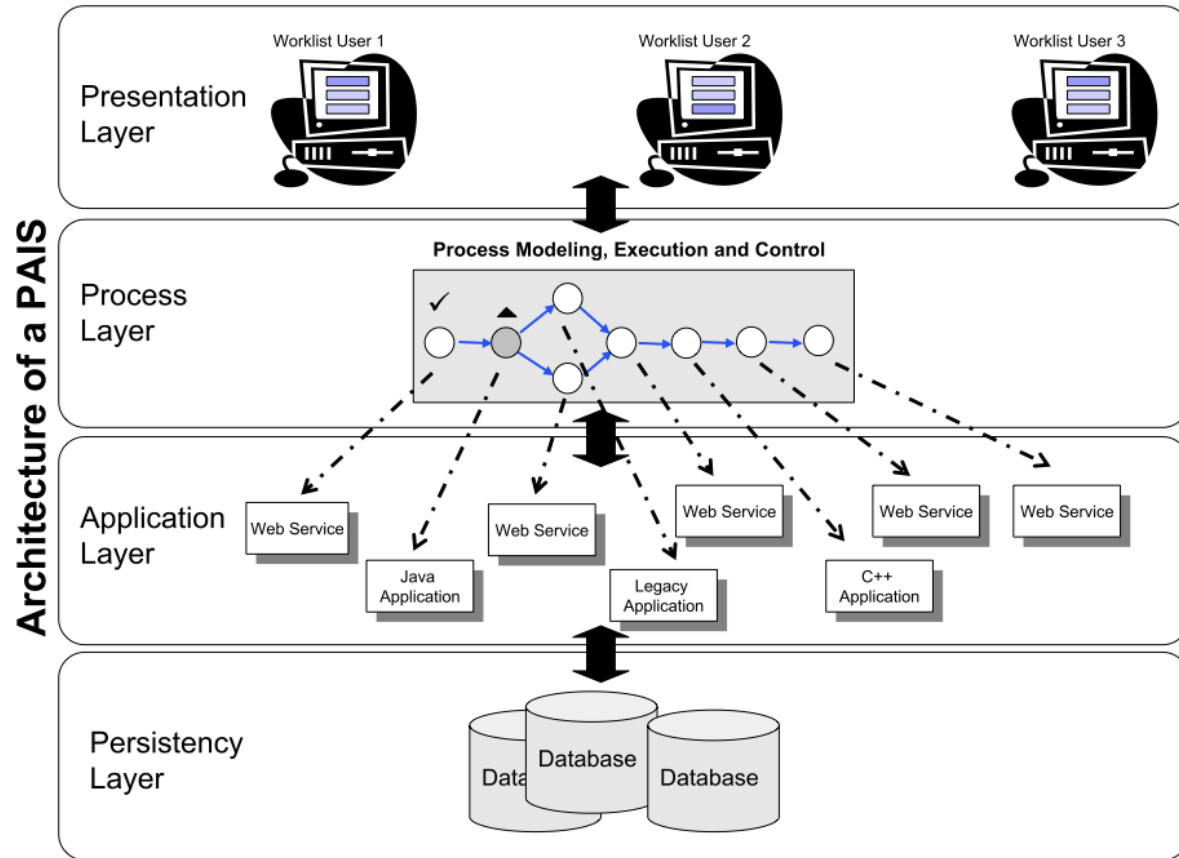
Flexibility

Supporting 'Dynamic' Processes
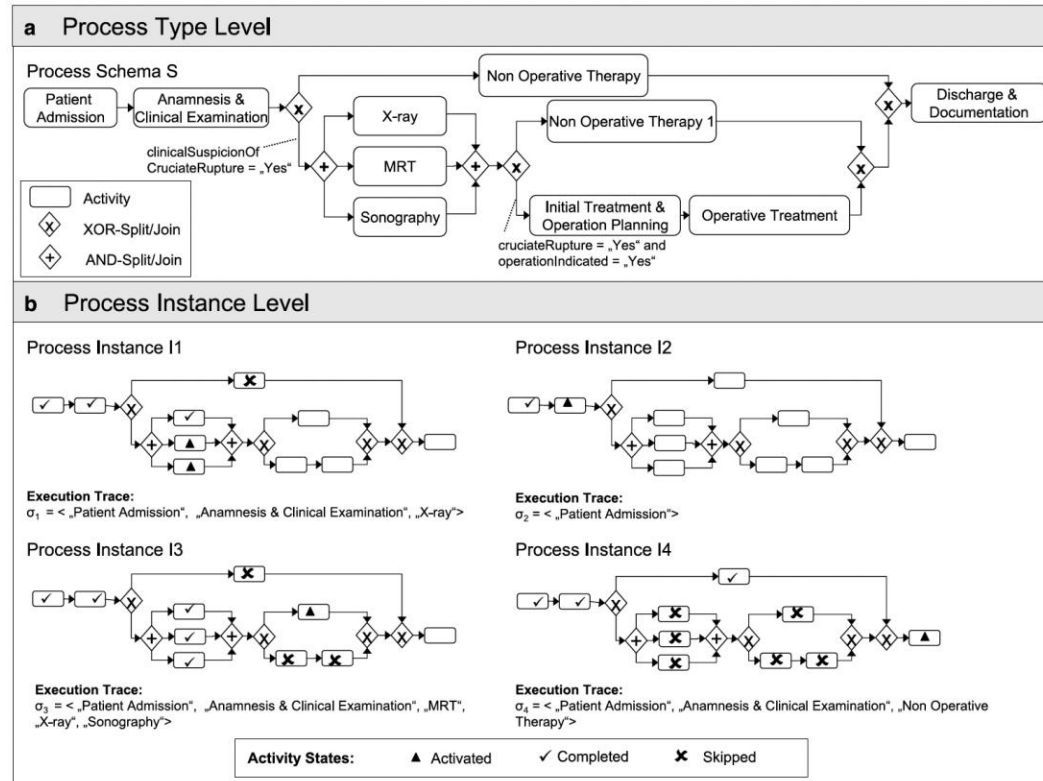
- **Evolution** is the ability of the implemented process to change when the business evolves
- **Adaptation** is the ability of the implemented process to handle exceptional cases
- **Flexibility** is the ability of the implemented process to execute on the basis of a loosely specified model

Process Variants – An Organisational Asset
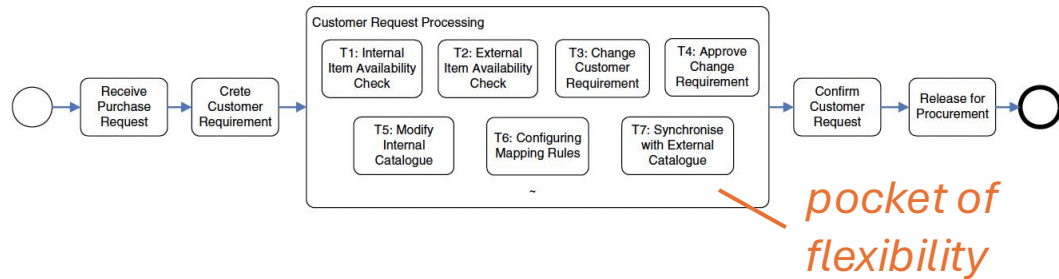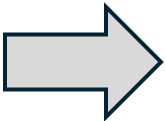
pocket of flexibility

o *Internal Item Availability Check T1 must be performed for all customer requirement cases;*
o *Based on operational guideline, maximal 6 activities can be selected for prompt customer response;*
o *The customer requirement can be adjusted according to case-specific conditions(T 3), but needs to be approved by a senior sales representative (T 4);*
o *In order to avoid inconsistency, manual modification to internal catalogue(T 5) and automatic synchronisation with external catalogue (T 7) should not be selected at the same workflow instance.*
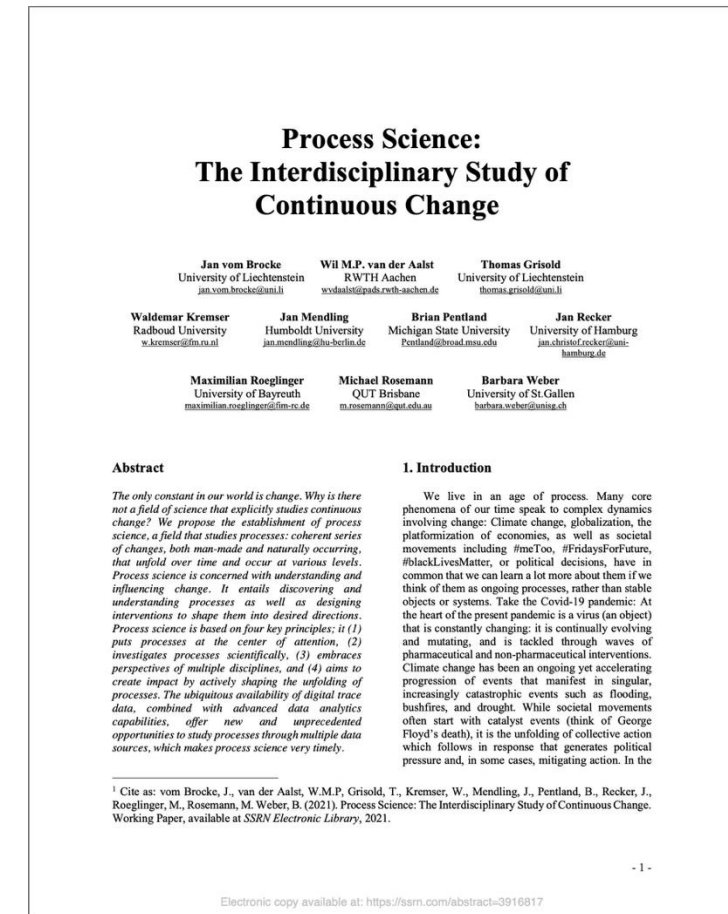
Business Process Constraint Network

Process Variants Repository

Sadiq, S., Orlowska, M. (2001). Pockets of Flexibility in Workflow Specification. ER 2001.
Lu, R., Sadiq, S. (2006). Managing Process Variants as an Information Resource. In BPM 2006.
Lu, R., Sadiq, S. (2007). On the Discovery of Preferred Work Practice Through Business Process Variants. In ER 2007.
Sadiq, S., Orlowska, M., Sadiq, W. (2005) Specification and validation of process constraints for flexible workflows. Information Systems, Volume 30, Issue 5, 2005.
Lu, R., Sadiq, S., Governatori, G., Yang, X. (2009). Defining Adaptation Constraints for Business Process Variants. In BIS 2009.
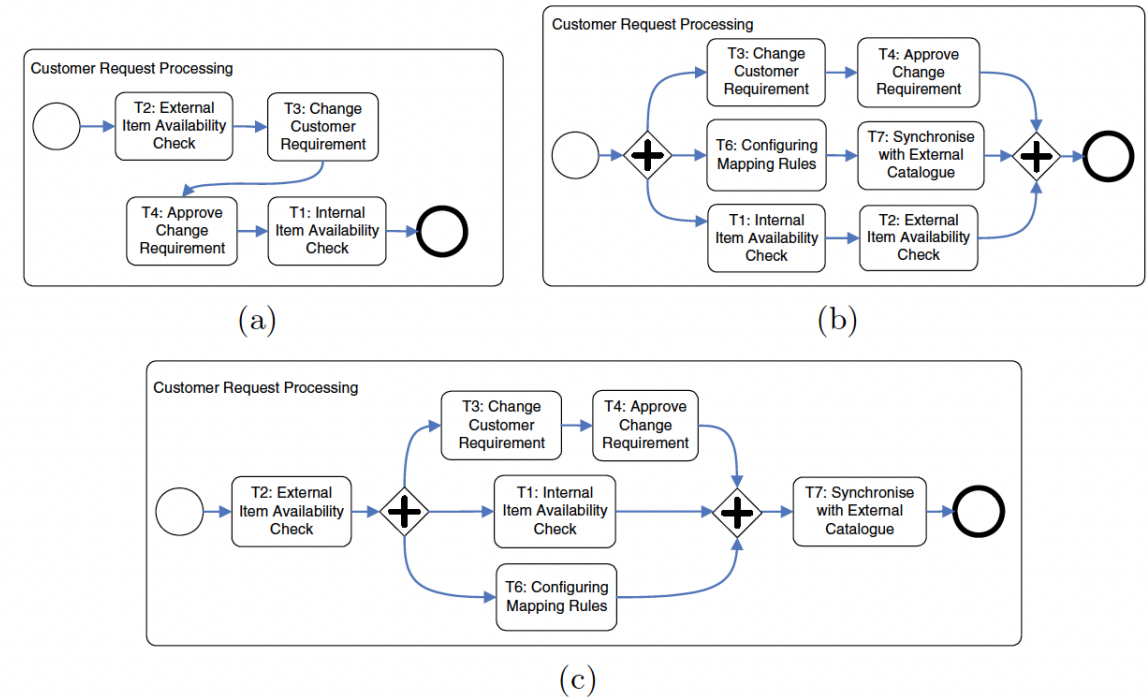
Process Constraints

- **Strategic constraints** define the tactical elements of the process e.g. approval of director required for invoices beyond a certain value.

- **Operational constraints** are determined through physical limitations of business operations, e.g. minimum time for warehouse offloading.

- **Regulatory constraints** are prescribed by external bodies and warrant compliance e.g. Sarbanes-Oxley Act for accounting practices.

- **Contractual constraints** define the contractual obligations towards business partners, e.g. maximum response time for service.

- **Mandatory**. Constraint *man* defines a set of tasks that must be executed in every process variant, in order to guarantee that intended process goals will be met.
- **Cardinality**. Constraint specifies the minimal *minselect* and maximal *maxselect* cardinality for selection among the set of available tasks.
- **Inclusion**. Constraint *inc* expresses the dependency between two tasks Tx and Ty, such that the presence of Tx imposes restriction that Ty must also be included.
- **Exclusion**. Constraint *exc* prohibits Ty from being included in the process variant when the Tx is selected.
- **Substitution**. Constraint *sub* defines that if Tx is not selected, then Ty must be selected to compensate the absence of the former.
- **Corequisite**. Constraint *cor* expresses a stronger restriction in that either both Tx and Ty are selected, or none of them can be selected, i.e., it is not possible to select one task without the other.
- **Exclusive-Choice**. Constraint *xco* is also a more restrictive constraint on the selection of alternative tasks, which requires at most one task to be selected from a pair of tasks (Tx, Ty).
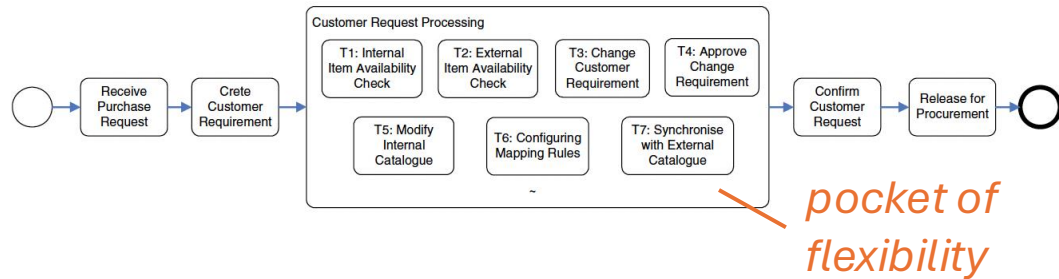
Sadiq, S., Orlowska, M., Sadiq, W. (2005) Specification and validation of process constraints for flexible workflows. Information Systems, Volume 30, Issue 5, 2005.
Lu, R., Sadiq, S., Governatori, G., Yang, X. (2009). Defining Adaptation Constraints for Business Process Variants. In BIS 2009.

Process Variants – An Organisational Asset

pocket of flexibility

o *Internal Item Availability Check T1 must be performed for all customer requirement cases;*
o *Based on operational guideline, maximal 6 activities can be selected for prompt customer response;*
o *The customer requirement can be adjusted according to case-specific conditions(T 3), but needs to be approved by a senior sales representative (T 4);*
o *In order to avoid inconsistency, manual modification to internal catalogue(T 5) and automatic synchronisation with external catalogue (T 7) should not be selected at the same workflow instance.*

Business Process Constraint Network

Process Variants Repository

Sadiq, S., Orlowska, M. (2001). Pockets of Flexibility in Workflow Specification. ER 2001.
Lu, R., Sadiq, S. (2006). Managing Process Variants as an Information Resource. In BPM 2006.
Lu, R., Sadiq, S. (2007). On the Discovery of Preferred Work Practice Through Business Process Variants. In ER 2007.
Sadiq, S., Orlowska, M., Sadiq, W. (2005) Specification and validation of process constraints for flexible workflows. Information Systems, Volume 30, Issue 5, 2005.
Lu, R., Sadiq, S., Governatori, G., Yang, X. (2009). Defining Adaptation Constraints for Business Process Variants. In BIS 2009.

Champions of Change

the mission of Process Science is to **"investigate and design ways to influence"** change for the better

2021

1990
Redesign for Change

2009
Respond to Change

2021
Influence Change

Change Management in the Age of AI

System
Solutions

*The Between
Times*
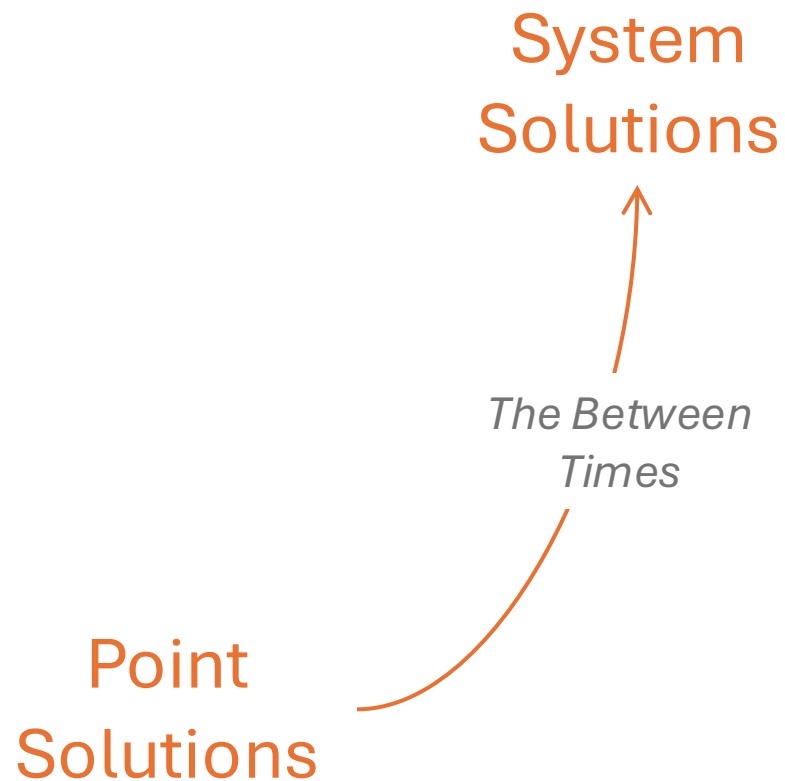
Point
Solutions

System Solution: An entirely different factory floor where the machine does not have to be close to the power source ...

A new organisation designed around AI capabilities

Point Solution: Saving fuel costs by swapping steam with electricity ...

A new way of predicting that is better, faster, cheaper

Agrawal, A., Gans, J., & Goldfarb, A. (2022). Power and prediction: The disruptive economics of artificial intelligence. Harvard Business Review Press.

BPM Seville 2 Sep 2025
Shazia Sadiq | The University of Queensland

Compliance

... by design

Bounded Rationality

our rational choices are limited by the information available to us, which is always incomplete, and there are cognitive limitations in processing that information and time constraints for decision making

Simon, H.A. (1990). Bounded Rationality. In: Eatwell, J., Milgate, M., Newman, P. (eds) Utility and Probability. The New Palgrave. Palgrave Macmillan, London.

BPM Seville 2 Sep 2025
Shazia Sadiq | The University of Queensland

25

Business Owner:
We're seeing strong demand in new markets, and I want to move fast to capitalize—especially with our new product line. If we delay, we risk losing momentum and revenue.

Business Owner:
I understand the risks, but agility is key in this space. Can we streamline the compliance checks to avoid slowing down our go-to-market strategy?

Compliance Officer:
Expanding quickly is exciting, but we need to assess regulatory requirements in each market. A misstep could lead to fines or reputational damage that outweighs short-term gains.

Compliance Officer:
We can prioritize high-risk areas and build a phased compliance roadmap. That way, we support growth while ensuring we're not exposed to legal or ethical breaches.

Compliance Aware Business Process Design

Sadiq, S., Governatori, G., Namiri, K. (2007). Modeling Control Objectives for Business Process Compliance. In: Alonso, G., Dadam, P., Rosemann, M. (eds) Business Process Management. BPM 2007.
Lu, R., Sadiq, S., Governatori, G. (2008). Compliance Aware Business Process Design. In: ter Hofstede, A., Benatallah, B., Paik, HY. (eds) Business Process Management Workshops. BPM 2007.
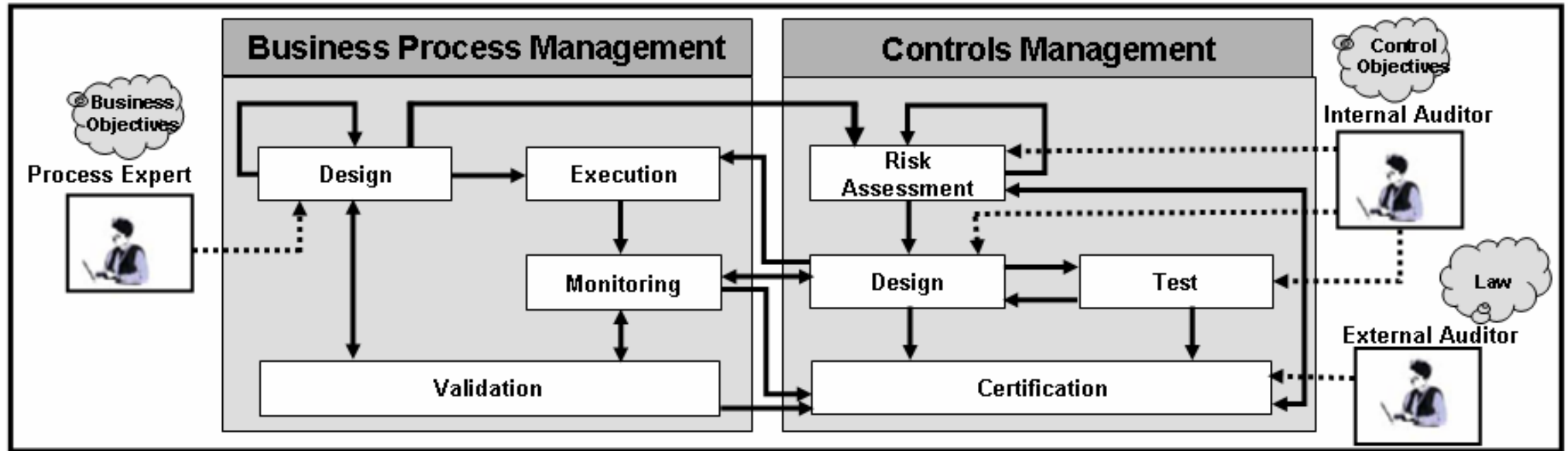
Elements of Compliance By Design

Controls Directory
and Modelling

Control objective: *prevent unauthorized use of purchase order process*
Risk: *unauthorized creation of purchase orders and payments to nonexisting suppliers*
Internal control: *The creation and approval of purchase orders must be undertaken by two separate purchase officers*

Augmented
Process Models

N. Lohmann (2013). *Compliance by design for artifact-centric business processes. ISJ Vol 38 (2013)*
Lu, R., Sadiq, S., Governatori, G. (2008). Compliance Aware Business Process Design. In:. BPM Workshops 2007.
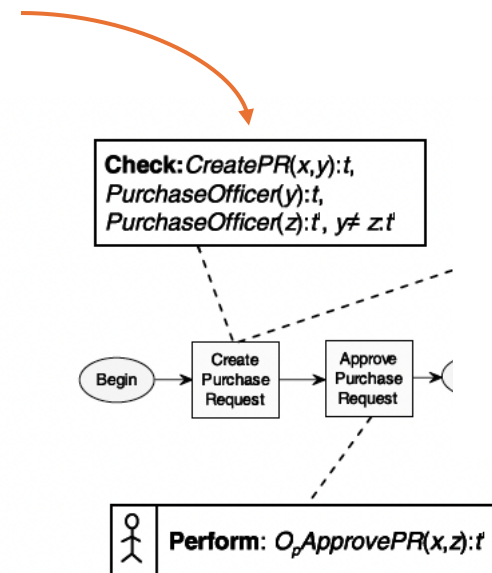
Compliance Aware Business Process Design

Ontological Alignment

Sadiq, S., Governatori, G., Namiri, K. (2007). Modeling Control Objectives for Business Process Compliance. In: Alonso, G., Dadam, P., Rosemann, M. (eds) Business Process Management. BPM 2007.
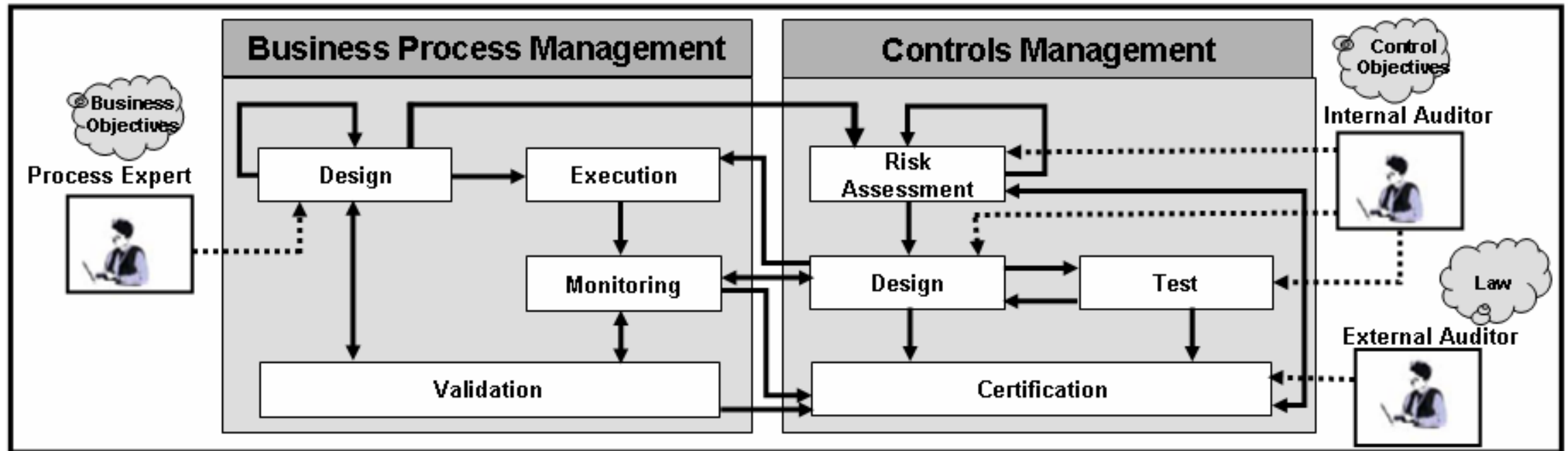
AI Standards and Regulations

Australia	Department of Industry, Science and Resources	Voluntary AI Safety Standard
China	China Aerospace Studies Institute	Interim Measures for the Management of Generative Artificial Intelligence Services
EU	The European Parliament	European Union Artificial Intelligence Act
Hong Kong	The Government of the Hong Kong Special Administrative Region of the People's Republic of China	Generative Artificial Intelligence Technical and Application Guideline
India	National Institute for Transforming India	Approach Document for India Part 1 – _Principles for Responsible AI
Japan	Ministry of Internal Affairs and Communications Ministry of Economy, Trade and Industry	AI Guidelines for Business
New Zealand	New Zealand Digital Government	Responsible AI Guidance for the Public Service: Gen AI
Philippines	Republic of the Philippines	An Act promoting the development and regulation of Artificial Intelligence in the Philippines
Singapore	Infocomm Media Development Authority of Singapore	Model AI Governance Framework for Generative AI
South Korea	South Korean Ministry of Government Legislation	Basic Act on the Development of Artificial Intelligence and Establishment of Trust
US	National Institute of Standards and Technology	Artificial Intelligence Risk Management Framework (AI RMF)

Compliance Themes in AI Standards and Regulations

Country	Data Protections
Australia	”...privacy policies to **include the collection, use and disclosure of personal or sensitive information by AI systems**, including for system training purposes”
China	[Abide by]..."Cybersecurity Law of the People's Republic of China", "Data Security Law of the People's Republic of China", and "Personal Information Protection Law of the People's Republic of China" ”legal obligations to protect the input information and usage records of users. They **must not collect unnecessary personal information, illegally retain identifiable input information and usage records of users**, or unlawfully provide such information and records to others.”
Hong Kong	"Service Providers must comply with...Personal Data (Privacy) Ordinance (PDPO) (Cap. 486) when collecting, processing, using, storing, retaining and deleting of user data including personal data...**must fully protect the privacy rights of Service Users**..." ”compliance with local and international data protection laws (such as the PDPO and European Union General Data Protection Regulation (GDPR)...is essential”
Japan	”...relevant laws, including the Constitution of Japan, **Intellectual Property Basic Act** and relevant laws, and Act on the as well as existing laws and regulations in individual fields pertaining to AI should be observed”

Emerging Challenges in Compliance Management

	INDUSTRY CHALLENGES	SOLUTIONS (by year)							
		2001	2002	2003	2004	2005	2006	2007	2008
Customers	Lack of Compliance Culture							1	1
Customers	High Cost								
Customers	Lack of Efficient Risk Management								
Customers	Difficulties in Creating Evidence of Compliance	1	1						
Customers	Lack of Perception of Compliance as a Value-add								
Customers	Non-proactive								
Customers	Lack of Understanding of its Relevance to Business						1	2	1
Customers	Lack of Communication among Staff								
Regulations	Frequent Changes in Regulations				1	1			1
Regulations	Legislation Weaknesses								
Regulations	Inconsistencies								
Regulations	Overlap in Regulations								
Solutions	Lack of Holistic Practices					4	1	6	3
Solutions	Lack of IT Support/Tools	2	1	1	1	1	5	1	3
Solutions	Lack of Compliance Knowledge Base			2			3	4	1

Emerging Challenges in Information Systems Research for Regulatory Compliance Management

Norris Syed Abdullah[1], Shazia Sadiq[1], and Marta Indulska[2]

[1] School of Information Technology & Electrical Engineering, The University of Queensland, 4072 Brisbane, Australia
{norris,shazia}@itee.uq.edu.au
[2] UQ Business School, The University of Queensland, 4072 Brisbane, Australia
m.indulska@business@uq.edu.au

Abstract. Managing regulatory compliance is increasingly challenging and costly for organizations world-wide. While such efforts are often supported by information technology (IT) and information systems (IS) tools, there is evidence that the current solutions are inadequate and do not fully address the needs of organizations. Often such discrepancy stems from a lack of alignment between the needs of the industry and the focus of academic research efforts. In this paper, we present the results of an empirical study that investigates challenges in managing regulatory compliance, derived from expert professionals in the Australian compliance industry. The results provide insights into problematic areas within the compliance management domain, as related to regulatees, regulations and IT compliance management solutions. By relating the identified challenges to existing activity in IS research, this exploratory paper highlights the inadequacy of current research and presents the first industry-relevant compliance management research agenda for IS researchers.

Keywords: Regulatory Compliance, Business Information Systems, Empirical Study.

1 Introduction

Compliance involves ensuring that business processes, operations and practice are in accordance with a prescribed and/or agreed set of norms. Even though predominantly viewed as a burden by organisations [1], failing to comply is no longer an option [2, 3]. Non-compliance may not only result in the possibility of losing customers and damaging reputation, but can also lead to legal action. A number of corporate scandals - Enron, WorldCom (USA), HIH (Australia), Societe Generale (France) and, most recently, Satyam (India), to name a few - have exhibited this situation.

In addition, there is a general consensus that there will be an upsurge of regulatory reform as a response to the events that led to the global financial crisis. Developing strategies to manage inevitable regulatory shifts that emerge from government and global reactions to the financial crisis is going to be high on corporate agendas in the coming years. This situation is bound to put pressure on organisations already struggling with the economic downturn.

Syed Abdullah, N., Sadiq, S., Indulska, M. (2010). Emerging Challenges in Information Systems Research for Regulatory Compliance Management. In: Pernici, B. (eds) Advanced Information Systems Engineering. CAiSE 2010.

BPM Seville 2 Sep 2025
Shazia Sadiq | The University of Queensland

33

The Alignment Problem

Representation

Reinforcement

Imitation

Fairness

Shaping

Inference

Transparency

Curiosity

Uncertainty

Christian, B. (2021). The alignment problem : how can machines learn human values? Atlantic Books.

Compliance by Design in the Age of AI

Process Objectives

Control Objectives

Search for Fairness

The COMPAS Example

- Risk Assessment Tool for Recidivism
- Wide-spread use in US counties from 2001 – 2016
- Bias against Black defendants called out in 2016
- Statistically sound, but issue of *fairness* unresolved

Comprehension

... the means and the end

Why should process scientists care

- Informed decision making
- cross-functional collaboration
- effective communication with employees and customers
- driving process improvement
- supporting skills development
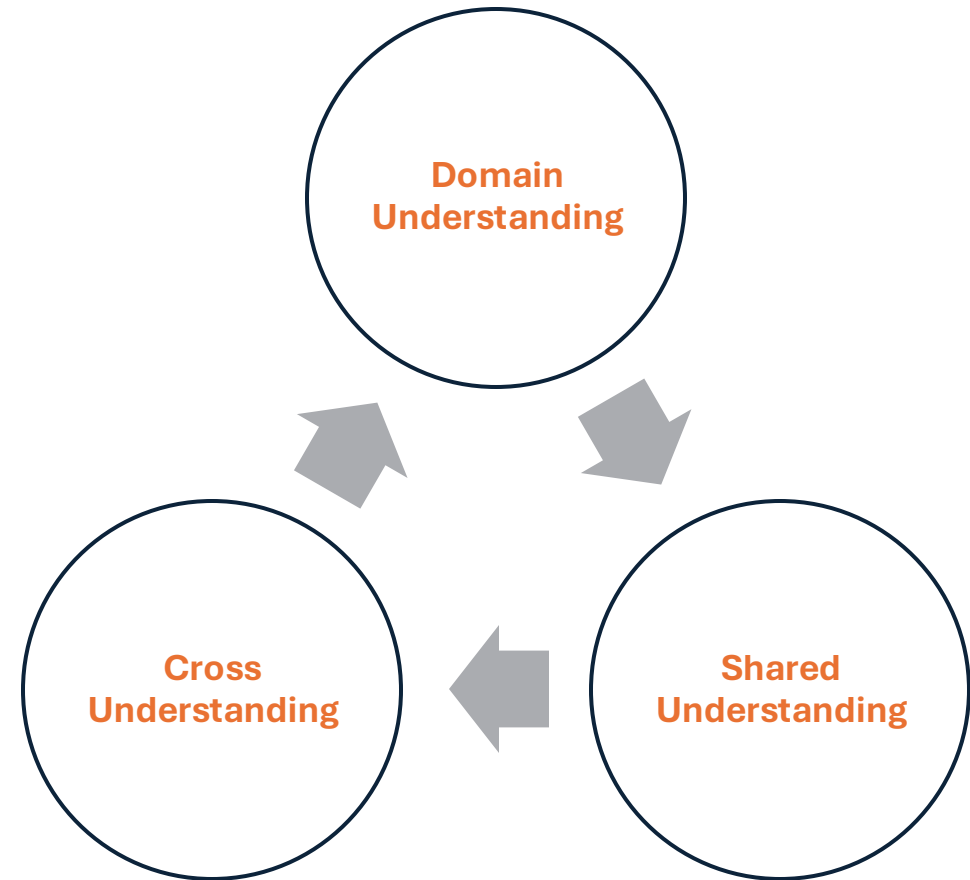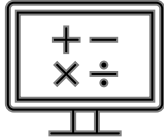
Comprehension

comprehend a BPMN diagram by identifying the sequence of activities and decision points

Understanding

know how a delay in one task affects downstream activities and customer satisfaction
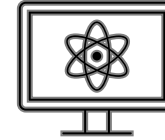
Learning

learn from past process failures and redesign processes to reduce bottlenecks and improve compliance

Understanding *Understanding*

Cognitive Load Theory
(Sweller 1988)

Model of Working Memory
(Baddeley 1992)

Cognitive Theory of
Multimedia Learning (Mayer
2002)

Theory of information
seeking motives
(Sharot & Sunstein 2020)

1988 · 1992 · 2002 · 2020

1972 · 1991 · 1995 · 2004

Human Problem Solving Theory
(Newell and Simon 1972)

Dual Coding Theory
(Clark and Paivio 1991)

Theory of Situation Awareness
(Endsley 1995)

Integrated Theory of the Mind
(Anderson et al. 2004)

Cognitive Fit Theory
(Vessey 1991)

Process Understanding

[1] Reijers, H.A., Mendling, J., Dijkman, R.M. (2011) *Human and automatic modularizations of process models to enhance their comprehension.*

[2] Mendling, J., Strembeck, M., Recker, J. (2012) *Factors of process model comprehension—Findings from a series of experiments.*

[3] Bera, P. (2012) *Does Cognitive Overload Matter in Understanding Bpmn Models?*

[4] Recker, J.C., Dreiling, A. (2007) *Does it matter which process modelling language we teach or use? An experimental study on understanding process modelling languages without formal education.*

- Process model factors relate to the metrics of the process models, such as modularization [1], block structuredness [1], and complexity [2].

- Individual factors, or personal factors, relate to the process model users, such as an individual's domain knowledge [3], modeling knowledge [4], modeling experience [1], and education level [1].

Information Integration

Process Models

Policy and Procedures

Enterprise Data

Enterprise Social Networks

Company Intranet

Emails

Project Management

Business Rules

- Inadvertent breach of required standards of operation

- Make ill-informed decisions

- Inconsistent, or even conflicting, understanding of the same process

- Hinder the effectiveness of process activities

- Risks of noncompliant process execution

The case of process models and business rules

The Sensemaking lens

Searching and
Encoding Phase
(Information foraging)

Task specific information
processing phase
(Information processing)
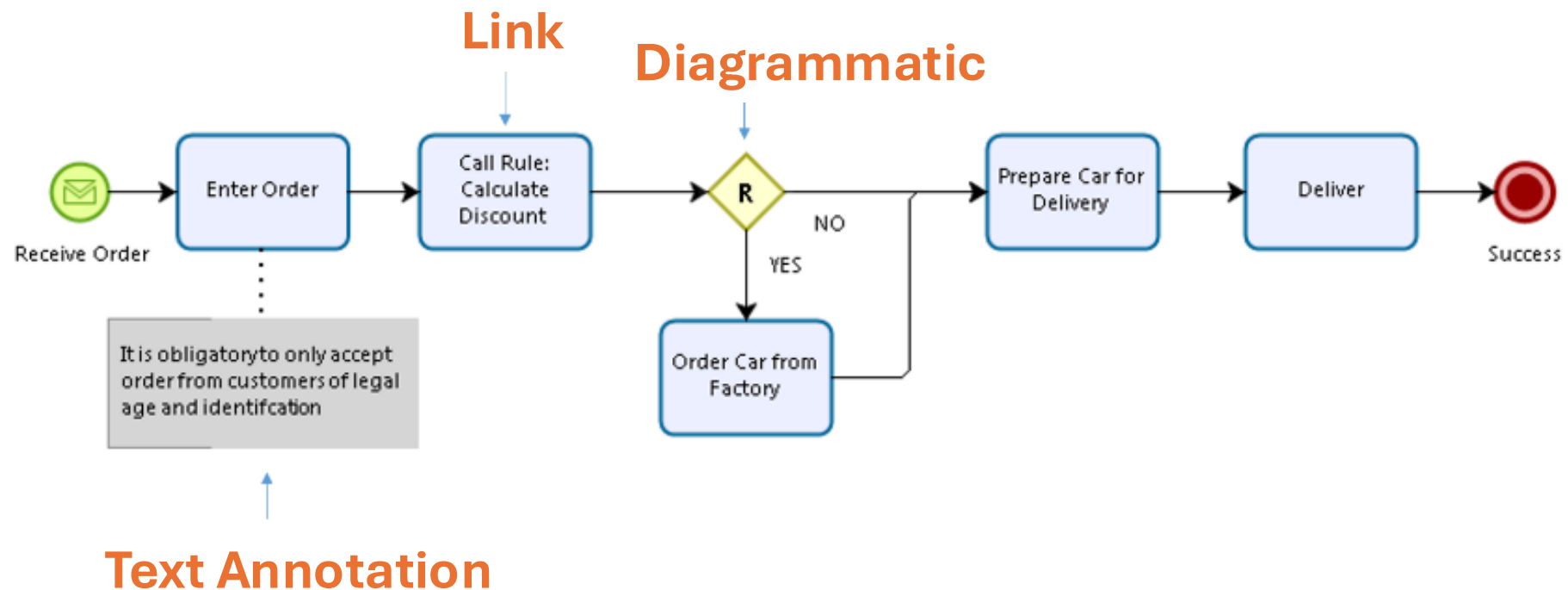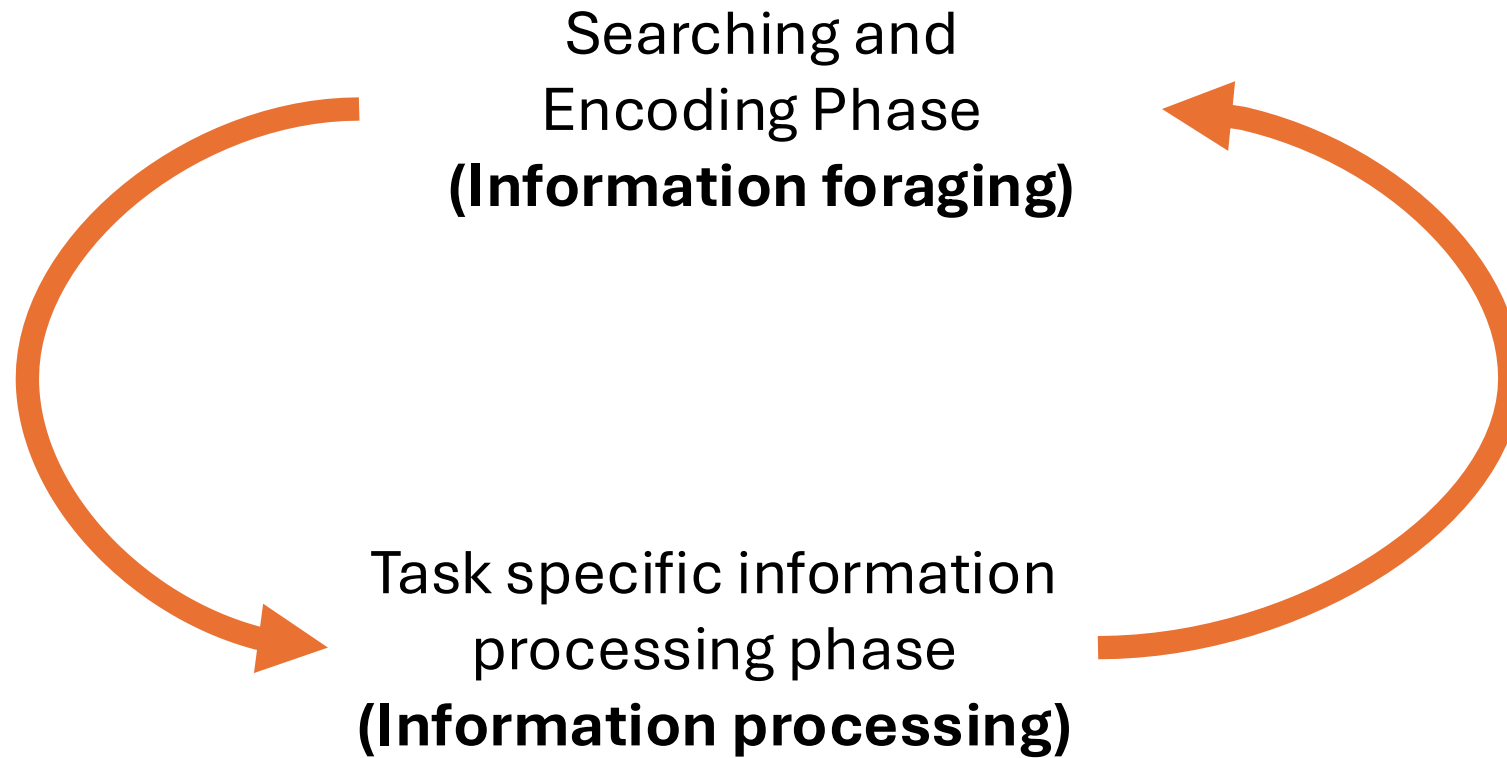
A Study of Sensemaking Behaviours in Integrative Tasks

- Controlled lab experiment, between subjects

- 75 university students with foundational knowledge in conceptual modeling (such as flowcharts, BPMN, UML or ER)

- Informationally equivalent models for three integration approaches with 25 participants per treatment group.

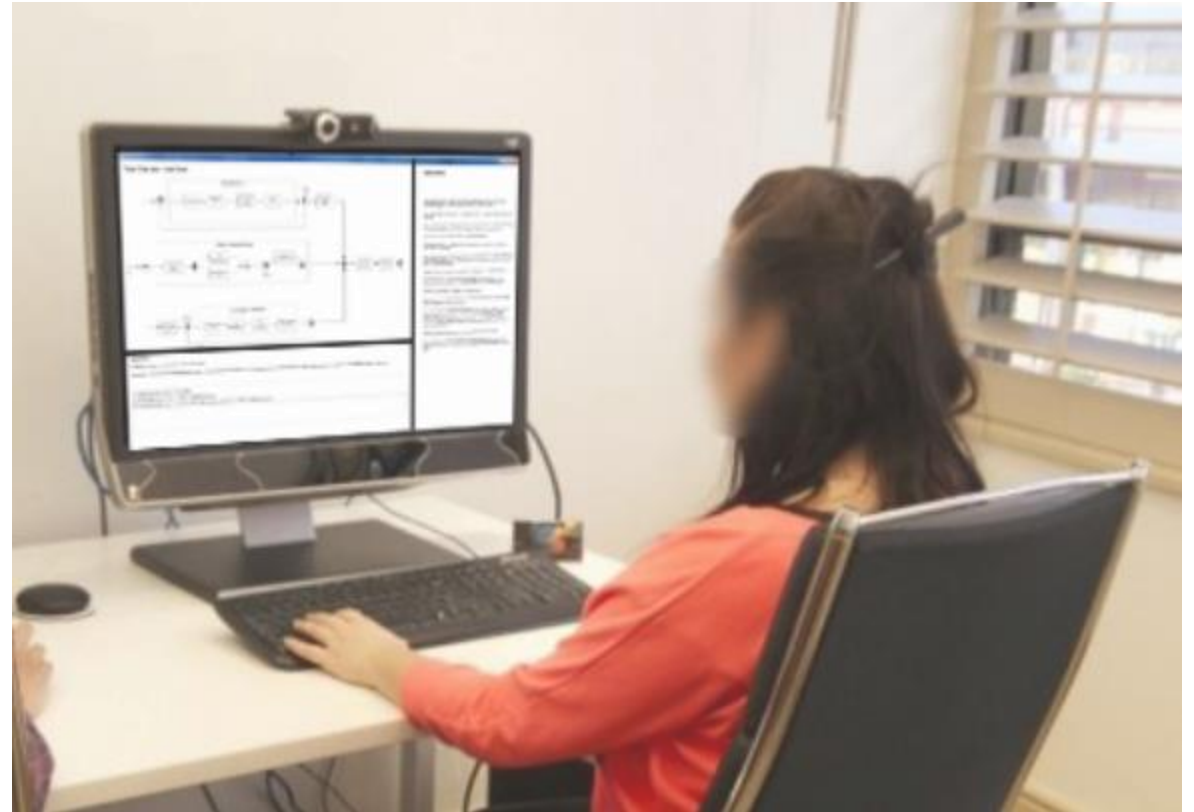- Experiment data: a pre-experiment questionnaire, eye tracking log data, task performance data, and post-experiment think-aloud

- Tobii Pro TX300 eye tracker: captures data on fixations, gaze, saccades, etc, with timestamps

- No limit on the experiment duration nor a word count limit on participants' answers

Wei Wang, Tianwa Chen, Marta Indulska, Shazia Sadiq, Barbara Weber. Business process and rule integration approaches—An empirical analysis on model understanding. Information Systems Journal 2021

Tianwa Chen, Shazia Sadiq, Marta Indulska. Sensemaking in dual artefact tasks – the case of business process models and business rules. ER 2020.
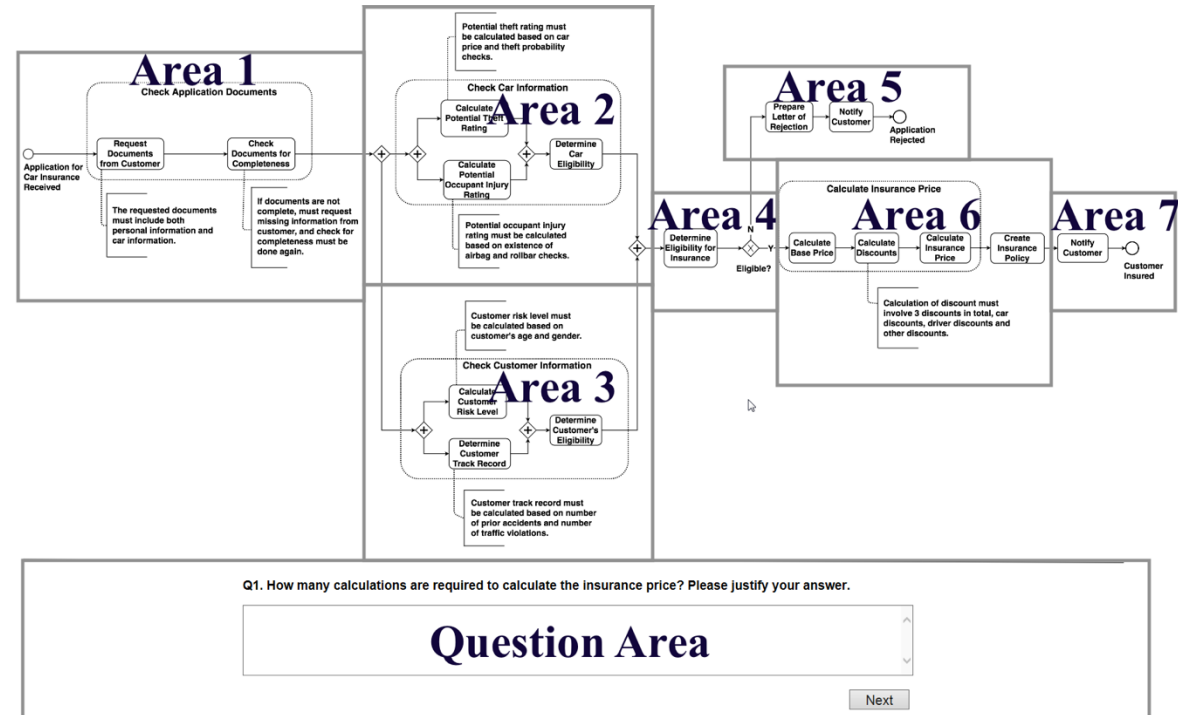
commences when the participant first fixates on the experiment area.

Searching and Encoding Phase
(Information foraging)

Task specific information processing phase
(Information processing)

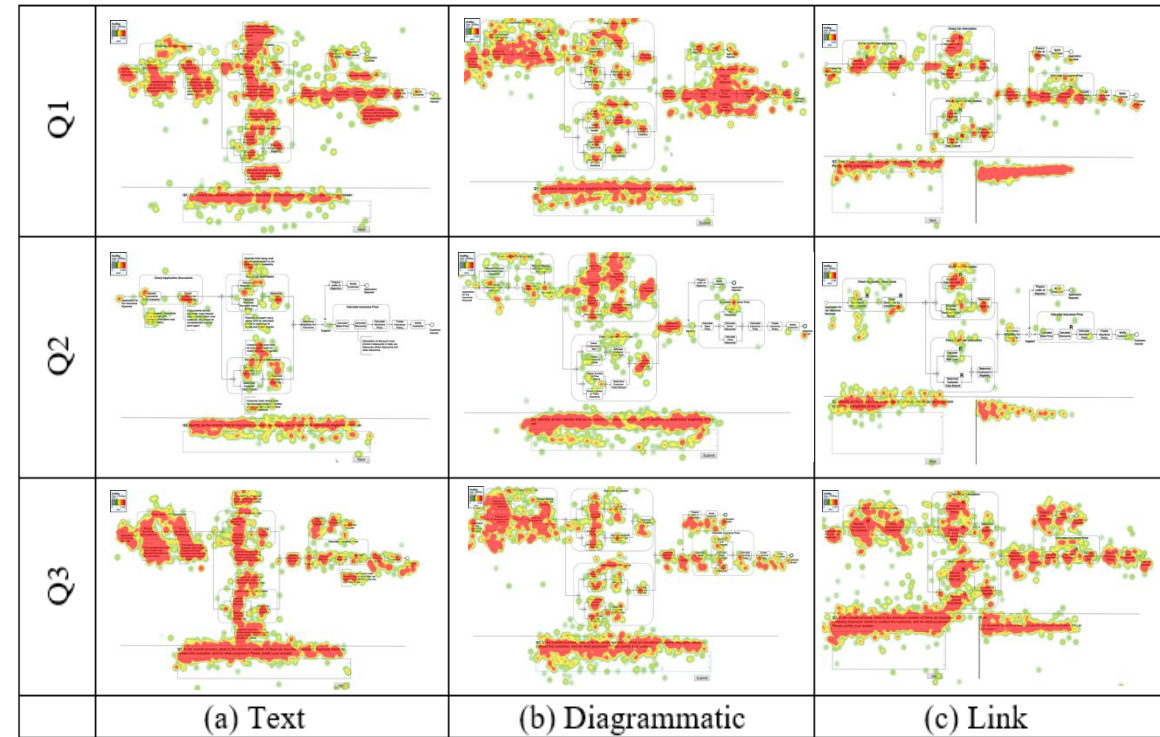commences when the participant starts to type the answer in the question area for the first time.

commences when the participant first fixates on the experiment area.

Searching and Encoding Phase
(Information foraging)
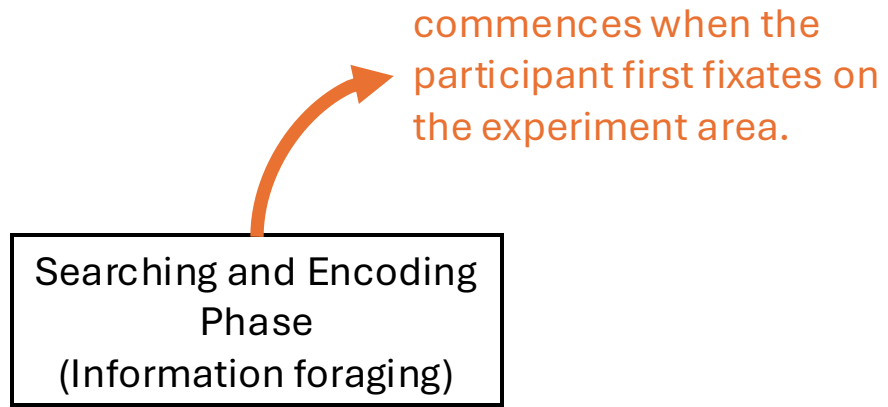
*showing best performers only, measured through mean fixation duration

*showing best performers only, transitions between question area and other AoIs

Task specific information processing phase (Information processing)

commences when the participant starts to type the answer in the question area for the first time.

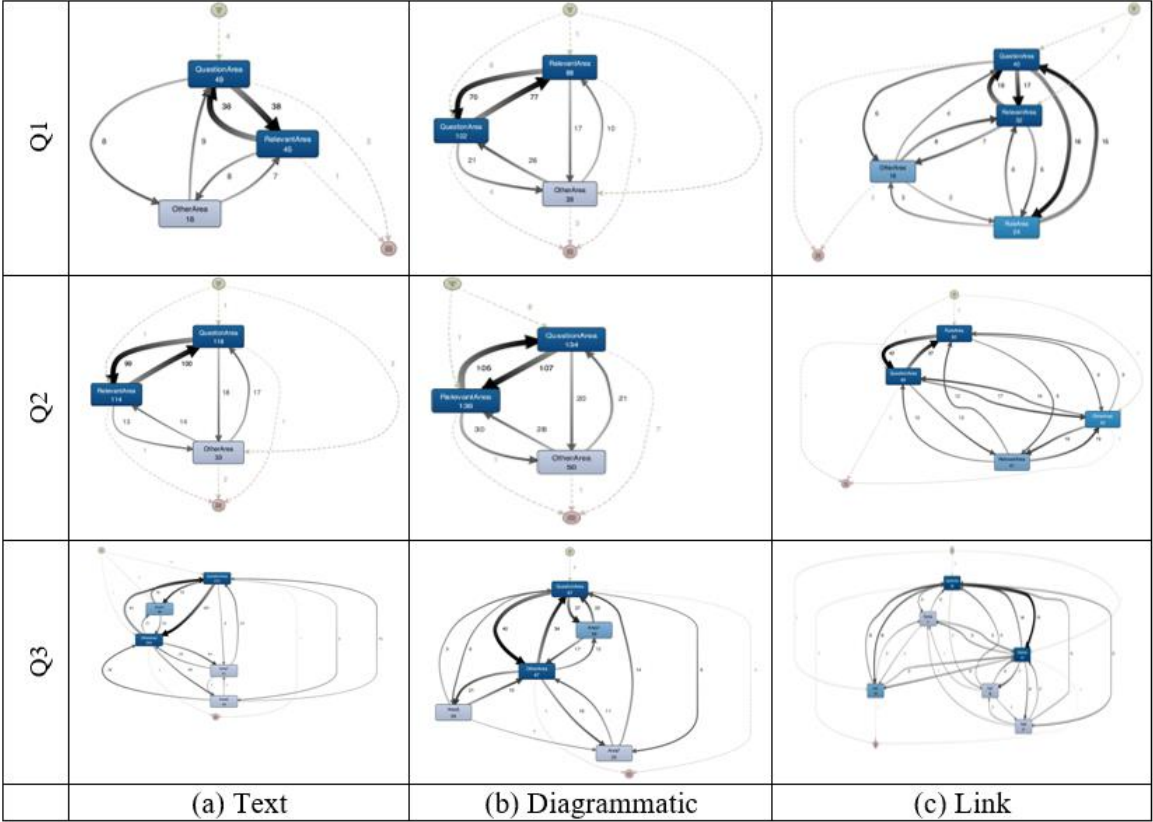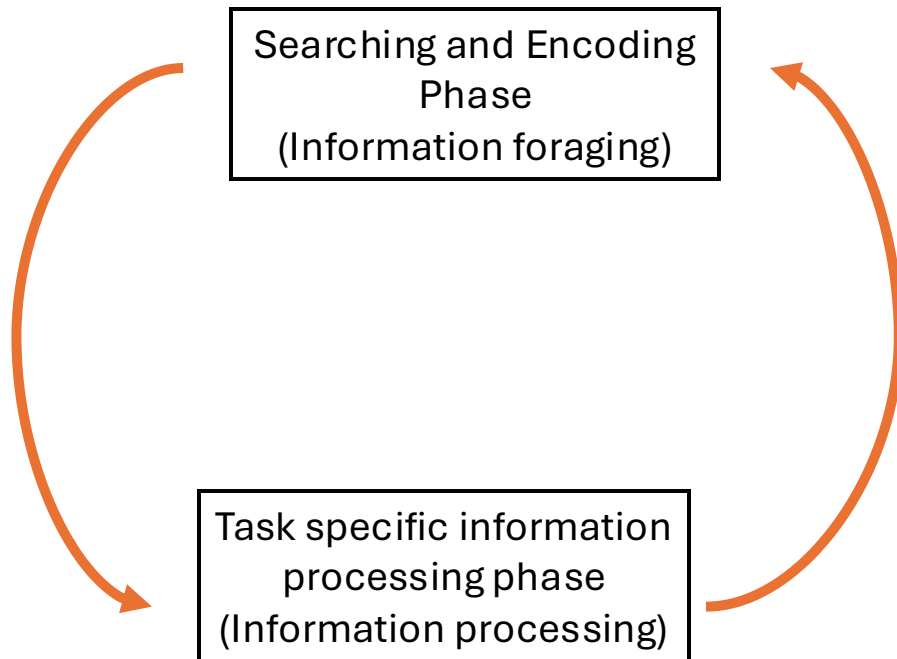**Sensemaking provides a useful lens** to study worker behaviour when dealing with **multi-artefact information tasks** (such as process models and rules)

Link representation shows better task performance in terms of accuracy and efficiency, especially as task complexity increases.

Diagrammatic representation has better task performance on local questions in terms of accuracy, but also requires the most effort in the initial information foraging phase.

Comprehension in the Age of AI

Amplify
Human
Work

Reliance   Trust

Skills
Erosion

Measuring and improving comprehension

in AI powered decision tasks such as

- hiring in recruitment processes

- credit scoring in loan processes

- dynamic pricing in retail processes

The Process Scientist's Toolkit

- **Comprehension** refers to the deep understanding of process dynamics, data, and context, thereby enabling process scientists to model, analyse, and interpret complex workflows.

- **Compliance** encompasses the ability to navigate regulatory and policy landscapes, ensure adherence to quality and ethical standards, mitigate risks, and embed governance into process design.

- **Change** highlights the capacity to lead transformation, foster innovation, and adapt processes in response to evolving markets, technologies, and stakeholder needs.

# Look to the past before we look at the future

A timeline from 1950 to 2020 showing the history of AI divided into three phases:

Birth of AI
- Information Theory – digital signals
- Cybernetics – thinking machines
- The Turing Test
- Symbolic reasoning

Focus on Specific 'Intelligence'
- Expert Systems (knowledge)
- Neural networks make a comeback
- Optical character recognition
- Speech recognition

Focus on Specific Problems
- Machine learning
- Deep learning – pattern analysis / classification
  - Big data: large databases
  - Fast processors to crunch data
  - High-speed networks

Below the timeline:
- Limited computer processing power
- Limited database capacity
- Limited networking capabilities
- Real-world problems are complicated
  - Image processing / face recognition
  - Combinatorial explosion

- Disappointing results
- Collapse of dedicated hardware vendors

Work to be done ....

- redefining process lifecycle management from discovery to monitoring with AI embedded in enterprise applications

- novel process modeling and design paradigms that support adaptation and innovation without letting the AI run rogue

- process improvement strategies alongside AI governance that influence change for the better

- promote human agency and transparency in AI enhanced processes for alignment with human values

- mitigating skills erosion for process workers with deep understanding of trust, reliance and productivity dynamics

Process Scientist in the Age of AI
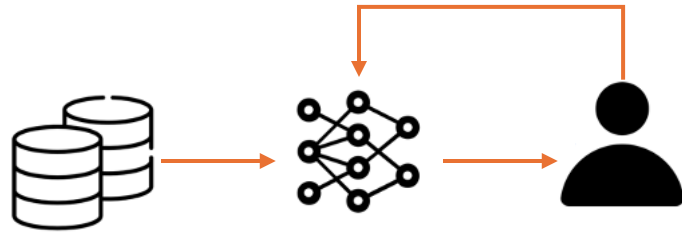
Model Centric AI
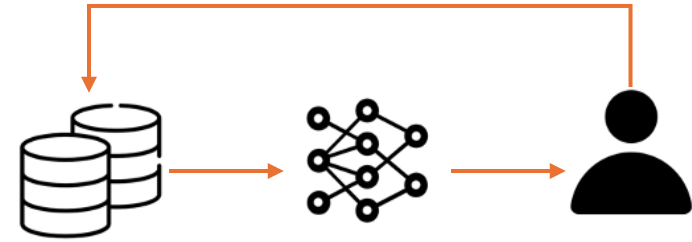
Data Centric AI

?

Process Centric AI

Acknowledgements

Solmaz Abdi, Norris Syed Abdullah, Rocky Chen, Tianwa Chen, Ali Darvishi, Gianluca Demartini, Dragan Gasevic, Guido Governatori, Lei Han, Helen Huang, Marta Indulska, Hassan Khosravi, Ruopeng Lu, Muhammad Elyas Meguellati, Zoran Milosevic, Felix Naumann, Maria Orlowska, Nova Sepadyati, Divesh Srivastava, Ida Someh, Manfred Reichert, Michael Rosemann, Stefanie Rinderle-Ma, Andri Setiawan, Felix Surbakti, Wei Wang, Barbara Weber,Ingo Weber, Barbara Wixom, Naiem Yageneh, Hongzhi Yin, Junliang Yu, Kai Zheng, Hui Zhou, Xiaofang Zhou

Thank you

Shazia Sadiq

The University of Queensland
Brisbane Australia

s.sadiq@uq.edu.au