Conducting Industry Relevant Research at University

James Gibson
School of IT and Computer Science
University of Wollongong NSW Australia
jgibson@uow.edu.au

Abstract. Industry leads Business Processing Systems research as it has the strategic imperative and resources to be effective. Academic research is faced with three challenges: firstly, how to do effective research in an area of such broad scope, secondly, how to make research relevant to practice, thirdly how to spend limited resources effectively. This paper defines the research framework for effective academic research being pursued at the University of Wollongong by the Software Effective Process group. The framework aims to build a core research team, promote strong synergy with existing research areas, and create academic and industry relevant research. We report on the results to date of our pilot program and seek feedback and advice to help us refine our approach.

Introduction

Both Industry and Academia have roles to play in the definition, implementation and evaluation of Business Process Systems (BPS). As academic researchers, we have limited resources and staff but still want to make a worthwhile contribution. Focus and synergy is essential. We must apply triage to select tasks which have the best outcomes not only for the individual but also for the group.

In this paper, we present a research framework. This framework is intended to give us guidelines to choose between possible courses of action, and to best direct our efforts. The framework touches only lightly on the actual research areas, rather it is a set of rules for how to choose research and manage research, and build synergies both within academia and to industry. Such a framework is important as it provides an antidote for the short term, operational approach currently encouraged by Australian universities key performance indicators.

It is hoped that this research framework will give structure to long term, strategic research with the aim of promoting productivity, communication and interaction amongst researchers in this area with practice relevant outcomes.
The framework

The framework guides us in the difficult task of picking winners for our BPS research. It covers three areas:

1. Choosing research.
2. Attracting industry.
3. Managing our research effort.

The framework consists of a set of statements. It is not a prescriptive document nor is it complete. Rather, it is a focus for ongoing discussion and iterative development. Statements are not set in concrete, if there is a competing consistent assertion with sufficient counteracting evidence then this will be adopted. The framework is not complete, it is a philosophy on how to conduct research in this area, it can be added to and changed as we make mistakes and learn, not a detailed definition of how this research will be conducted.

Choosing Research Areas.

Concentrate on business domain solutions

Business strategy is about creating, re-creating and sustaining organizational forms that will enable a process of strategic response appropriate to life on the edge of chaos. What is important is the ability to create and effect new structures and processes quickly and at low cost. (Sauer 2003)

Traditional software engineering processes promote either agile or ceremonial development lifecycles in the technical domain. Almost all such processes encourage further requirements elicitation during technical implementation. The transformations between the business and technical domain cause unavoidable inefficiency and risk; and no business benefit. These processes are a historical legacy of a technology push approach to systems implementation. They are fundamentally flawed because they work in the wrong domain.

![Figure 1: Traditional Approach to solving Business Domain Problems](image)

Try to fix it here!!!

Reverse Engineer

Magic Happens

Business

Technical
Business Process Systems demand that the solution be expressed in the business domain, not the technical domain. These systems promise an order of magnitude increase in productivity by largely avoiding the technical domain. Enterprise is wary of such systems as they have no proven track record and it is hard to distinguish capability from marketing at this early stage. Improved business process understanding, maturity in systems frameworks and industry resolve promise success.

*Statement:* We will research the evolving business domain approaches as they promise the greatest benefit. Traditional software engineering approaches will only be used for comparison.

**Concentrate on process oriented solutions.**

There are two business domain approaches. Development can be seen as the logical extension of existing coding languages, or as a totally new ‘process oriented’ language with its own conceptually different syntax and semantics running on a process execution engine.

![Process Engine Approach](image1)

**Figure 2. Comparing Process Engine to Coding Approaches**

A process engine executing a process oriented language allows separation of domain versus system implementation. Technology no longer drives development. The process engine approach renders technology subservient and relegates it to being the glue binding autonomous and legacy systems. In contrast, a coding approach expresses business requirements in the technical domain and drives technical complexity throughout the solution. Process oriented approaches provide a compelling argument that they will be more productive, maintainable and agile than ‘coding’ solutions.

*Statement:* Our research will focus on process-oriented business domain systems. Other approaches will form the basis for comparative studies.
**Apply theory to understand complexity**

Process oriented approaches have a strong unifying paradigm. The paradigm underpins the development of execution engines, Process Query Languages, process activity monitors, and supporting CASE tools. This paradigm is based upon Pi calculus and Petri nets. It finds expression in the underlying software engineering meta-models and system executable architectures. Understanding this paradigm provides the analytic lever to express and understand not only process oriented systems but also emerging web services and other standards.

*Statement:* We will manage complexity by evolving a consistent paradigm; which will guide our analysis.

**Attracting Industry Participation**

“In theory, there is no difference between theory and practice,
In practice, there is”

**Target national strategic objectives**

The Australian government has identified areas of national strategic importance which includes supply chains and health. Strategic alliances in these application areas are required as we cannot address them by ourselves. The alliance must demonstrate a strong understanding of application area theory and issues. Our role in the alliance is to provide the theoretical horsepower and pragmatic capability to reason about and realise these applications.

*Statement:* Targeting national strategic objectives will stimulate research and make the decision making process by grant authorities as simple and attractive as possible.

**Identify suitable industries**

There are three types of industry involvement. Each can be addressed by different partners in the alliance:

1. *Application industries.* Industry partners from customer systems. Examples being Transport companies, Health Care, or major manufacturers
2. *Solution seeking industries.* More localised industry partners with a specific, usually decision based, problem. For example, trying to solve transport fleet allocation and res-scheduling.

---

1 JAN L.A. VAN DE SNEPSCHEUT. Dutch-American computer scientist and educator (1953 - 1994)

Statement: We will work with our alliance to put together a complementary set of industry partners.

Provide tangible outcomes

Industry partners want results, not just blue sky theories. We will provide the pragmatic software engineering capability to implement, deploy and test such systems.

Statement: We will provide tangible deliverables based on sound theory

Structuring the Research Effort.

This research is centred on the primacy of the business process model. We assert that the model has primacy. The model is defined as:

“A description of the system which captures domain specific requirements expressed within an executable meta-model”

The model is built by taking a consistent view of many issues including enterprise strategic direction, stakeholder intent, risk management and maximisation of efficiency. Simulations can be applied to scope the process and resources required. The system is implemented from the model.

Figure 3. Relationship between the model and research areas.
The figure above shows the relationship between the model and the research areas. Emphasis on the model is intended to decouple research into ‘bite sized’ chunks and avoid fragmented many-to-many research relationships.

1. The ‘As Is’ model represents the business processes currently performed by the enterprise.
2. The ‘As Desired’ model represents the target set of business processes which the company intends to migrate to.
3. ‘Aspect Oriented Synthesis’ represents the integration of many diverse issues to form the model specification.
4. ‘Enabling Technology’ is the underlying technical infrastructure which implements the model and supports non-functional requirements.

*Statement:* Research must relate to the model, its implementation and its metrics.

**Take a team approach**

There is a prevailing research culture in many Australian Universities. The culture insists on isolated, individual work; particularly when working towards a PhD. This individuality arises from the mathematical history of algorithmic computer science research.

This paper rejects this isolationist culture. BPS is a software engineering problem, requiring both breadth and depth of talent. This breadth combined with limited resources means we must choose research topics wisely so it benefits both the individual and the group. We will take a systems approach to defining research areas. Areas interact so synergy is achieved, and are constrained to critical issues of general impact, thus guaranteeing active and committed input from the team. An area leader is responsible for academic leadership and exploring inter-area synergy. Publications are expected to be co-authored.

*Statement:* We will work in a collegial environment on strategic areas. There is synergy between areas, and we expect robust contribution both from within and across areas. This will lead to many co-authored papers.

**Accept we are naive**

Initially, researchers in this area will be naïve, traversing a steep learning curve, and exploring many wrong paths. It is important to have the freedom to move quickly and adopt and discard approaches rapidly. Learning progresses best by taking standpoints and testing ideas. Decisions are forced by milestones on pragmatic projects. This ensures theory and understanding become a concrete foundation for later research.
Statement: We are beginners before we are experts. We create integrated standpoints to be tested by pragmatic application and found wanting. We make progress via our mistakes.

Form Research Alliances

We require an alliance between process research, decision systems and the application domain.

1. *Process systems* tell us when to take an action or decision, what information exists at this point, and the flow. It acts as the systems integration. It does not tell us how to make a decision.
2. *Decision support systems* tell us how to make choices, apply rules, and negotiate optimal outcomes amongst independent agents within the context of process.
3. *Application domain.* To evaluate and exercise process and decision systems we need an application domains. The application domain is describable by concepts in the other domains.

Statement: We will form alliances with complementary research groups and will lead the process and systems integration effort.

Call in expertise.

Process provides the context for specialist areas such as security and legacy system integration. When required, we will delegate to the specialist areas rather than become specialists ourselves.

Statement: There exist subsets in the process-oriented area but outside our area of expertise. Call in this expertise and work in tight collaboration.

Contribute to an Open Source project.

Targeting an open source project provides business, technical, and mentoring benefits. It allows us to make pragmatic progress whilst still referencing emerging standards where possible.

1. *Business benefits.* There will be a commercial battle in the BPS space. Open source has a different group of supporters and has the potential to form an enduring sizeable niche for business development without getting crushed.
2. *Technical Benefits.* Participating in development gives insights into how these systems really work and a framework from which we can develop extensions. Concrete experience will help us define meta-models helping us to understand and evolve standards.
3. **Peer review.** It will provide active external review and mentoring by people to whom pragmatic outcomes matter.

*Statement:* Our strategic aim is to be a leading research and development group within the Open Source community. We will acknowledge and understand other approaches, but will not allow ourselves to be distracted.

**Experiments are required**

Experiments must be conducted for three reasons.

1. No system or process is usable unless it supports human factors issues and can cope with the fact that enterprise system development is a ‘wicked problem’ which cannot be resolved with traditional analytical approaches (Rittel and Webber 1973).

2. Experiments force researchers to make pragmatic decisions. These decisions mitigate a tendency to ‘analysis paralysis’ due to complexity and divergence in this area. These decisions then provide concrete foundations for further research.

3. Pragmatic outcomes demonstrate competency and provide a direct link to industry.

*Statement:* We will work in iterations of theory and practice. Theory and research determines our next step, practice and experience clarify and make concrete our concepts.

**Results to Date**

In the nine months since this strategy was proposed the following has occurred:

1. The Software Effective Process Group has been formed and research begun. The group consists of a systems architect plus specialists in middleware, query languages, testing, and decision systems. Supporting this team are four honours students plus one third year student project group. This gives a total of fourteen people working on interlinked research.

2. An alliance is established with the Decision Systems Laboratory [www.dsl.uow.edu](http://www.dsl.uow.edu)

3. An alliance is established with the Supply Chain Research Centre at the University of Wollongong.

4. A research laboratory has been established. This laboratory acts as a ‘software process’ container and allows target processes to be researched and tested. Tools are also available for knowledge management and teamwork.

5. Research laboratory commissioned and is now investigating jBPM. More information is available at [www.dlab.uow.edu.au](http://www.dlab.uow.edu.au)

6. Industry partners have been identified and linkage grants are currently under negotiation.

7. A series of papers outlining the strategic direction, research areas, research synergy and supporting dynamic laboratory infrastructure have been written. These are available for comment on [www.dlab.uow.edu.au](http://www.dlab.uow.edu.au)
A major ongoing challenge is changing the academic culture. The culture supports individual academic research and impedes team-based pragmatic collaboration. This proposal assists in integrating both viewpoints to the benefit of both computer scientists and software engineers.

More results and additional information will be available at time of presentation.

**Conclusion**

This paper presented a framework to conduct software engineering research into process-oriented systems within an Australian University. The framework provides a philosophy on how one should conduct such research; recognises the importance of theory and practice; and highlights alliances between faculties, across Universities and with industry. Such a framework is important as it provides an antidote for the short-term, operational approach currently encouraged by Australian universities key performance indicators. The direction provided by the framework is proving effective and results are already evident. Significant results will take time, agility is required and much will be learnt through experience. Discussion is welcomed on any aspect of this paper.

**References**

