A Proposal and Evaluation of a Design Method in Design Science Research

Francis Gacenga, Aileen Cater-Steel, Mark Toleman and Wui-Gee Tan
University of Southern Queensland, Toowoomba, Australia
Gacenga@usq.edu.au
Aileen.Cater-Steel@usq.edu.au
Mark.Toleman@usq.edu.au
Wui-Gee.Tan@usq.edu.au

Abstract: Information Systems (IS) design science literature offers a plethora of findings on various aspects, such as the general steps in design science, problem identification, objectives of solutions, and evaluation of the artefacts. However, there appears to be a dearth of guidance on the design of the artefact itself, that is, on design *per se*. Information Technology Service Management (ITSM) practitioners report challenges in measuring and reporting the performance of ITSM. This area is identified as significant and lacking in research. We are developing a framework for performance measurement of ITSM investments in organisations. The ITSM performance measurement framework (PMF) will provide a basis of standardisation and performance comparison for organisations implementing ITSM. The focus of this paper is the design methodology for the PMF framework. Our work considers literature from IS design science and disciplines outside IS. Previous IS researchers developed frameworks that guide the IS design research process but they do not provide details of the design process. We extend their work by narrowing the focus on the design step found in IS design science approaches giving a detailed treatment of the design step and delve further into the design literature broadly. Of course, design is a very creative endeavour and may not be solely process driven. Using a design process from outside IS design science advocating "designerly ways of knowing" we apply the integrative Matching Analysis Projection Synthesis approach. We integrate an IS design science research framework with a macro cycle of analysis-projection-synthesis and a micro cycle of research-analysis-synthesis-realisation to create an approach for designing the PMF. Outcomes of the evaluation are also described and discussed. The design process proposed was of limited success but may be useful for other IS researchers seeking guidance on how to design the artefact in an IS design science project.

Keywords: design science research, IT service management, performance measurement framework, mixed methods research, matching analysis projection synthesis approach

1. Introduction

In a research project to develop a performance measurement framework (PMF) for IT service management (ITSM) we employ a multi-paradigmatic and multi-method approach that includes design science research (DSR). Our review of Information Systems (IS) design science literature did not uncover specific advice on the design step that is required in most DSR frameworks. The objective of this paper is to highlight the silence on design in DSR and to propose a design approach for our particular project. As well as being the research project that motivated the need to identify more concrete and detailed guidance for the design step in DSR, the ITSM PMF serves as an example application of DSR and the design approach proposed.

ITSM is *a customer-oriented approach used by IT practitioners to manage IT operations organised around IT services*. ITIL® is the most widely used ITSM framework and is based on a library of books that offer "best practices" for ITSM. ITIL is a lifecycle-based, process-oriented framework that organizations can use to create, design, deliver and maintain customer-focused IT services.

This project addresses an area that has been identified as significant and lacking in research. ITSM practitioners report challenges in measuring and reporting the performance of ITSM. We are developing a framework that can be used for performance measurement of ITSM investments in organizations. The framework will provide a basis of standardization and performance comparison for organizations implementing ITSM and could be used to show a relationship between ITSM investment and benefits from this investment. Our project develops a PMF for ITSM, an IT service management tool. The research contributes to IS design theory by describing the "design decisions and design knowledge that are intended to be manifested or encapsulated in an artifact, method, process or system" (Gregor 2002). The research contributes to the existing ITSM body of knowledge by addressing the gap that currently exists in ITSM performance measurement (Lahtela et al. 2010), performance measures and methods.

The focus of this paper is on the design methodology for the ITSM PMF. The project uses a multi-paradigmatic and mixed-methods approach based on behavioural science and design science paradigms. The mixed-methods approach is suitable to the project as it addresses the theoretical challenge using science and, based on the empirical knowledge gained, develops a practical solution using design science.

We use the Information Systems Design Research (ISDR) approach as proposed in Peffers et al. (2008) as a foundation. An overview of the design research process model and behavioural science research methods are shown in Figure 1.
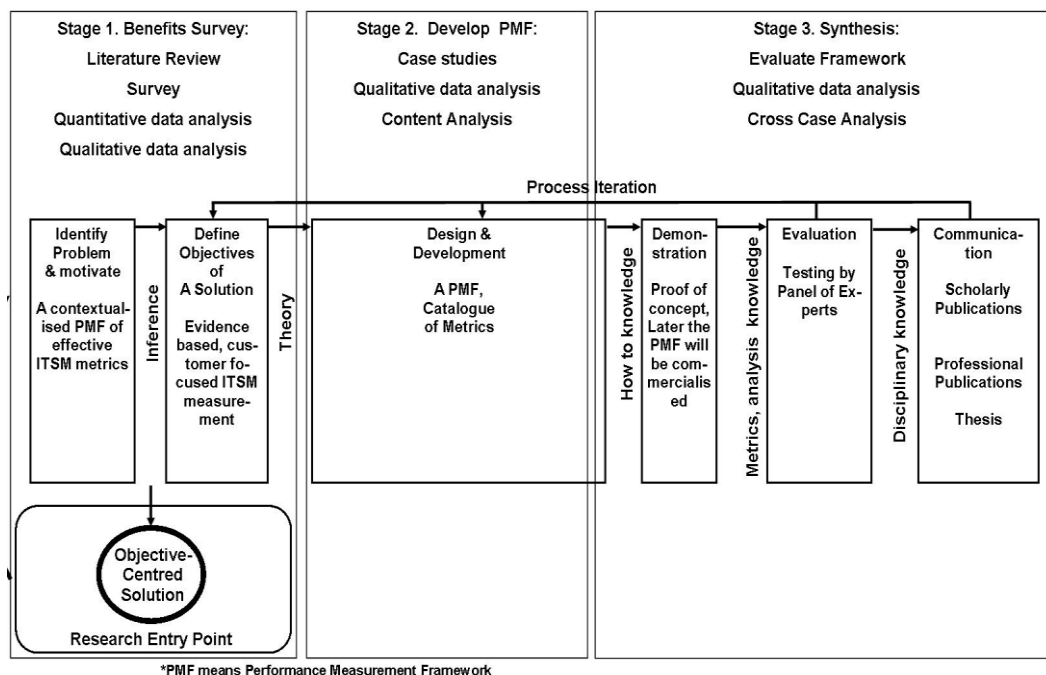
Figure 1: Initial design science method process model (Based on Peffers et al. 2008)

In stage one we begin with a systematic literature review followed by a survey. In stage two we conduct case studies and develop the ITSM PMF artefact. In stage three we evaluate the prototype PMF and enhance it through further design and development.

The paper is structured as follows. First the IS design science literature is reviewed. The gap in the literature is explained, followed by our proposal to overcome the gap/limitations. We describe how the proposed design approach is implemented, and evaluated. In the discussion section, we reflect on the outcomes based on use of the proposed approach. Finally, a summary and limitations are provided in the conclusion.

2. Review of IS design science literature

According to Hevner et al.'s (2004) article, "design science creates and evaluates IT artefacts intended to solve identified organizational problems". The study by Gregor and Jones describes design science as a sub-strand of a collection of constructive research approaches with a common emphasis of the central role of the artefact (2007). Peffers et al. (2008) prescribe six processes for design science: identify problem, define objectives of a solution, design and development, demonstration, evaluation, and communication. A case for leveraging design theory to improve the transparency and rigor of design research is demonstrated by Piirainen and Briggs (2011) who integrate the framework in Hevner et al. (2004) and Peffers et al. (2008) as well as the design theory in Walls et al. (1992) with that offered in Gregor and Jones (2007). Patas and Goeken's article suggests interplay between behavioural and design-oriented research can be improved and draws a distinction between empirical and theoretical knowledge as well as non-artefact-centric and artefact-centric knowledge (2011).

A review of the IS design literature provides guidance on how to organize IS design research. We found that literature was available on design science research steps (Carlsson 2006; Hevner and

Chatterjee 2010; Hevner et al. 2004; March and Smith 1995; Offermann et al. 2009; Peffers et al. 2008; Piirainen et al. 2010), problem identification (Wieringa 2010), objectives of a solution (Carlsson 2007), evaluation (Cleven et al. 2009; Pries-Heje et al. 2008), project management (vom Brocke and Lippe 2010) as well as evaluations of studies using design science (Samuel-Ojo et al. 2010). Design science studies providing the actual specifics of the design step are summarized in Table 1 which extends Peffers et al. (2008) and Offermann et al. (2009). In a number of design science studies the design and build steps are not clearly demarcated.

Table 1: Design step in the IS design science literature

Author(s)	Design & Development Focus
Cole, Purao, Rossi & Sein (2005)	Build (model, instantiate)
Hevner, March, Park & Ram (2004)	Iterative search process, artefact
March & Smith (1995)	Build
Nunamaker, Chen & Purdin (1990-1)	Understand the studied domain, application of relevant scientific and technical knowledge, creation of alternatives, and synthesis and evaluation of proposed alternative solutions
Takeda, Veerkamp, Tomiyama & Yoshikawa (1990)	Suggestion, development
Vaishnavi & Keuchler (2008; Vaishnavi and Kuechler 2009);	Suggestion, development
Walls, Widmeyer & El Sawy (1992)	Design method, meta design
Offermann, Levina, Schonherr & Bub (2009)	Design artefact, literature research
Peffers, Tuunane, Rothenberger, & Chatterjee (2008)	Design and development
Sein, Henfridsson, Purao, Rossi & Lindgren (2011)	Building, intervention and evaluation
McLaren, Head, Yuan & Chan (McLaren et al. 2011)	Design and evaluation

We considered the approaches summarized in Table 1 for the design step of our project but each lacks detailed guidance. The build step offered in Cole et al. (2005) includes the steps "model and instantiate" and advocates using software engineering principles such as effective tools and reuse.

Advice on the design step offered in Hevner et al. proposes an iterative search process that would result in the artefact. The article concedes that "given the wicked nature of many IS design problems it may not be possible to determine the relevant means, ends or laws" and suggest that a way out, "is to search for satisfactory solutions" (2004).

Emphasis on building the artefact is highlighted in March and Smith, though the article does not provide details on what "build" entails. The article states that "build refers to the construction of the artefact, demonstrating that such an artefact can be constructed" (1995).

Advice on systems design in Nunamaker and Chen (1990) states that "design involves the understanding of the studied domain, the application of relevant scientific and technical knowledge, the creation of various alternatives, and the synthesis and evaluation of proposed alternative solutions". They did not give details on how to apply relevant scientific and technical knowledge in creating the alternatives or how to synthesize them.

The process model in Peffers et al. (2008) is synthesized from process elements found in seven studies taken from IS and other disciplines. In the model, design and development "includes determining the artefact's desired functionality and its architecture and then creating the actual artefact" (Peffers et al. 2008). The article further suggests that moving from objectives to design and development requires "knowledge of theory that can be brought to bear in a solution" but does not explain how this can be done.

A computable design process model for CAD systems in Takeda et al. (1990) presents a descriptive model, a cognitive model and a computable model. The cognitive model proposes a five-step cycle that includes "suggestion" and "development". Suggestion entails generating "key concepts that solve the problem" and development "to construct candidates for the problem from the key concepts using various types of design knowledge" (Takeda et al. 1990). The article further identifies object and action levels as distinct levels in the designer's mental activity. The approach was adapted in Vaishnavi and Keuchler (2008) and we also find it useful as a conceptual guide though it does not address the practical design issues we faced.

An elaboration on IS design theory such as the systems development lifecycle (SDLC) with emphasis on building and testing IS theories is provided by Walls et al. (1992). Their design science research framework proposes design method and meta design in the design stage. However, it lacks detail on how to conduct these steps.

Based on the work in Peffers et al. (2008) a three-process framework entailing problem identification, solution design and evaluation is proposed in Offermann et al. (2009). The article considers Matching Analysis Projection Synthesis (MAPS) but concludes that "for IS design science, it seems that methodology hasn't advanced as far as to propose different methods for each process step" (2009). The article then proposes, in its IS design research framework, a design step split into artefact design and literature search. Details are not provided on how to perform the artefact design.

Our work, like that in Peffers et al. (2008) and Offerman et al. (2009) considers literature from IS design science as well as outside IS design. The approaches in Peffers et al. and Offerman et al. develop frameworks that guide the IS design research process and do not delve into the details of the design process. The action design research method proposed in Sein et al. (2011) based on action research advocates evaluation performed "in authentic settings" using the design steps of building, intervention and evaluation. The article describes building the artifact and does not distinguish this from design.

To summarize, IS design science literature delivers a rigorous and systematic process on the general IS design research approach but offers little guidance on the design and development step at the heart of creation of the artefact. Design is a creative endeavour and may not be solely process driven. Few articles in IS design science describe the design step in detail or give much guidance on design *per se* perhaps because design needs much 'right brain' as well as 'left brain' activity (Tovey 1984) and tends to be context specific. However there are design principles that have been espoused over the years.

3. Design gap in IS design science

Design is defined as "a goal-directed thinking process by which problems are analysed, objectives are defined and adjusted, proposals for solutions analysed, objectives are developed and the quality of those solutions is assessed" (Roozenburg and Eekels 1995). The gap in IS design science is identified by Offermann et al. who state, "artefact design is a creative engineering process. Not much guidance is provided in IS literature" (2009). The gap is described as the lack of design foundations in the axiomatic statements of the formal sciences, the empirical approaches of the natural sciences and the hermeneutic techniques of the humanities (Jonas 2007). The subject and object of design science is design and using the definition of Roozenburg and Eekels, design is "to conceive the idea for some artefact or system and/or to express the idea in an embodiable form" (1995).

Design science lays emphasis on systematic, testable and communicable methods. However it is instructive to reflect on the differences between design science and the science of design and engineering as highlighted in Cross (2002). In our reflections we grappled with the question of whether design needs to be scientific and whether design science advocates that design is scientific. These questions are captured by Cross (2002) who observed "a desire to 'scientise' design can be traced back to the 20th-Century Modern Movement in design". There were aspirations to produce works of art and design based on scientific methods of objectivity and rationality. These aspirations to scientise design surfaced strongly again in the 'design methods movement' of the 1960s.

We heed the advice in Osterle et al. on the design step, that "artefacts should be created through generally accepted methods, be justified as much as possible and be contrasted with solutions already known in science and business" (2010).

4. Our approach to the design problem

Designer-researchers are viewed as a possible solution to the design problem (Cross 2002). Designer researchers combine scientific methods with "designerly ways of knowing" (Cross 1982). The article identifies five aspects of designerly ways of knowing: "Designers tackle ill-defined problems. Their mode of problem-solving is solution-focused. Their mode of thinking is 'constructive'. They use 'codes' that translate abstract requirements into concrete objects. They use these codes to 'read' and 'write' in 'object languages'" (Cross 1982).

We reviewed literature on the design step outside IS design science (Archer 1984; Chow and Jonas 2008; Cross 2002; Eekels and Roozenburg 1991; Roozenburg and Eekels 1995) and identified detailed design processes that would be useful for IS design science. There is a large body of design literature and we refer to the works by Bayazit (2004) and Cross (1993) for a summary review of forty years of design research which describe research from the early roots: De Stijil, the Bauhaus; to first generation design methods: Horst Rittel, Morris Asimov, L. Bruce Archer, Christopher Alexander on patterns, and Herbert A Simon; to second generation design methods; and finally to scientific research in design.

According to the research in Chow and Jonas (2008), after the first generation methods were rejected, the postmodernist attitude of no methods was followed by strong adoption of scientific methods for design research. The article argues that the current situation regarding methodology in design research is characterized by unproductive dualisms and proposes a generic process model, Matching Analysis Projection Synthesis (MAPS). We also considered an alternative design cycle and process proposed in Archer (1984) and a similar one in Roozenburg and Eekels (1995) which entails analysis, synthesis, simulation, and evaluation conducted in iterations of specification, design, properties and comparison.

We opted to adopt MAPS as the design guide for the design step in our project as MAPS is similar to the concepts of 'the true', 'the ideal' and 'the real' matching realism which is the underlying philosophy of the project. MAPS also presents an integrative design research medium as well as flexibility.

5. Designing a performance measurement framework for ITSM

In Table 2 we outline how we conducted the ITSM PMF project by applying behavioural science methods with an IS design science framework that integrates 'designerly ways of knowing' in the design step. This fusion of science and design is achieved in three stages and we outline the objective, method, paradigm, parent discipline, philosophy, data analysis, purpose, study phenomena, outcomes and contributions.

Table 2: Fusion of science and design

Research/ Design	▪ Stage 1	▪ Stage 2	▪ Stage 3
Objective	Problem identification and definition of objectives of a solution Determine ITSM benefits and performance metrics	Understand the domain of ITSM performance measurement Design ITSM PMF	Evaluation of prototype PMF
Method	Systematic literature review Survey	Case studies, cross case analysis ISDR (Peffers et al. 2008) and MAPS synthesis and realization (Chow and Jonas 2008; Jonas 2007)	
Paradigm	Behavioural science	Behavioural science	Design science
Parent Discipline	Social science	Social science	IS strand of the Sciences of the Artificial (Gregor and Jones 2007)
Philosophy	Positivist	Positivist/realist	Realist
Data Analysis	Quantitative & qualitative	Qualitative & quantitative	Expert evaluation
Purpose	Exploratory	Explanatory	Application
Phenomena	Organization	Organization	Problem solving artefact
Outcome	Theory building: analysing and describing	Theory building: explaining and predicting	Design and action
Contribution	Empirical ITSM metrics and benefits	A contingency theory of ITSM performance measurement	ITSM performance measurement framework

The macro and micro cycles of MAPS are depicted in Figure 2 and Figure 3 respectively. In the macro cycle, analysis refers to 'the true' how it is today; projection is 'the ideal' how it should be; and synthesis is 'the real' how it is tomorrow (Jonas 2007).
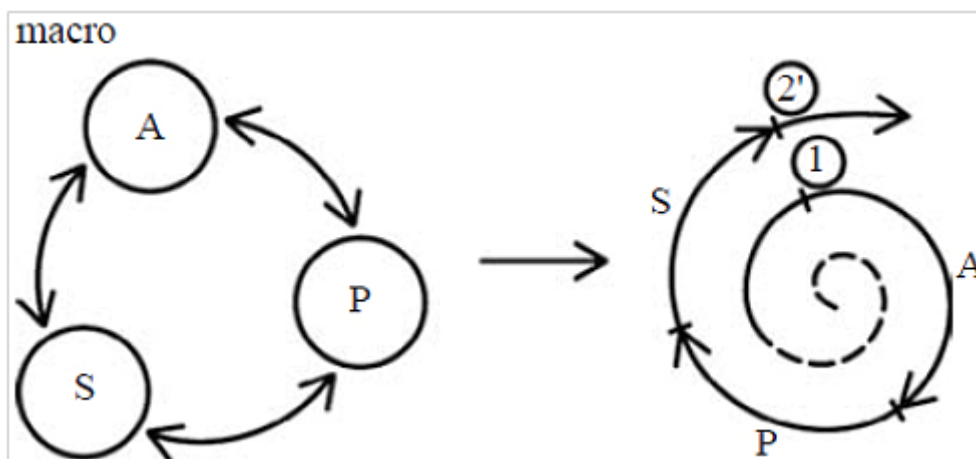
Figure 2: Analysis - projection - synthesis: The macro cycle of the design process (Source: Jonas 2007)
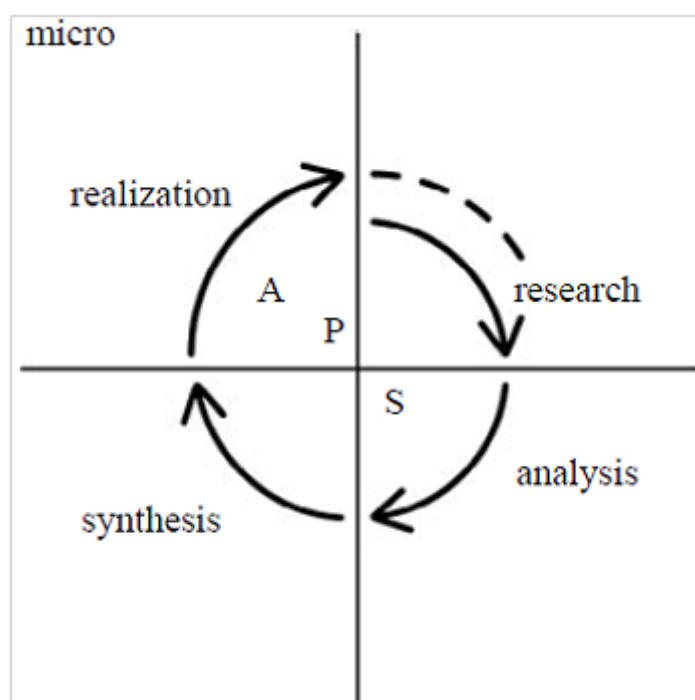
Figure 3: Research-analysis-synthesis-realization: the micro cycle of the design process (Source: Jonas 2007)

Jonas (2007) advises that a hyper cyclic generic design process model results from combining the domains of knowing in the macro model (analysis, projection, synthesis) with the learning phases in the micro model (research, analysis, synthesis, realisation) as depicted in Figure 4.

5.1 Macro cycle of design process

The first step in the macro cycle of the design process, *analysis*, is undertaken using the findings of the initial stages of our project and provides us with information of 'the true', that is, how ITSM performance measurement is currently conducted in industry. Integrating the findings of the literature review, survey and case study we gained empirical knowledge as well as in-depth qualitative knowledge of the state of the art in ITSM performance measurement.

The second step in the macro cycle, *projection*, deals with 'the ideal' and through the literature review and content analysis of the case studies we get an understanding of how performance measurement could be in the ideal. We generate an initial model of the ITSM PMF as it should be, depicted in Figure 5.
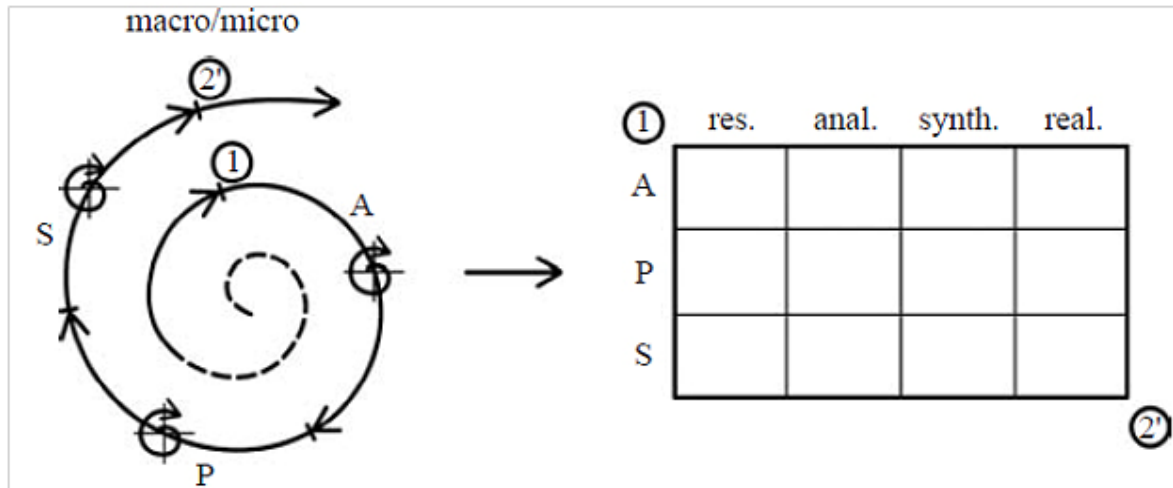
Figure 4: Generic, hyper cyclic model of the design process (Source: Jonas 2007)
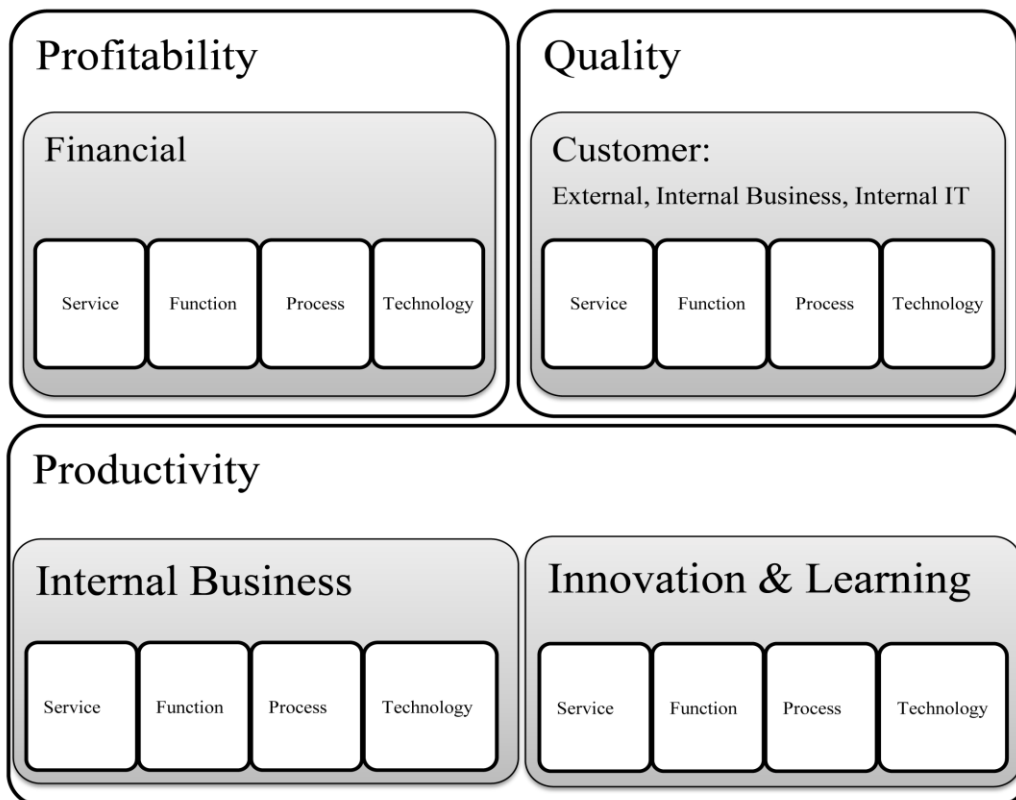

Figure 5: Model to measure the performance of ITSM

The model proposed in Figure 5 can be used by organizations to measure the performance of their ITSM as well as evaluate the metrics they are currently using for completeness in service orientation, financial and non-financial perspectives in broad economic terms. The metrics within each perspective are categorized into service, function, process and technology dimensions. These represent ITSM function, ITSM process and ITSM technology metrics while the service dimension includes metrics to account for end-to-end process outcomes. At the industry level, wide adoption of the performance measurement model would lead to standardization of ITSM performance measurement and enhance the ability of organizations implementing ITSM to benchmark against other organizations using like terms.

Synthesis, the third step in the macro cycle of the design process is achieved in our project by working with a panel of industry and academic experts to identify how to contextualize the ITSM PMF.

In this step the framework is compared against the performance measurement practices currently in place in organizations. The panel of experts contributes to the development of a method to evaluate the ITSM PMF.

5.2 Micro cycle of design process

In the micro cycle of our project, *research* involves the data collection through literature review, survey questionnaires and case studies. *Analysis* entails using the findings of the qualitative and quantitative data analysis from the project stage two. *Synthesis* involves employing the five aspects of 'designerly ways of knowing' described in Section 4:

- The problem was ill-defined as a PMF had not been previously developed and the dimensions of the framework were unknown;

- The focus was to develop a solution to the problem: ITSM practitioners experience challenges in measuring and reporting the performance of ITSM;

- A constructive mode of thinking was adopted to develop, populate and implement the PMF;

- Figure 5 is an example of the visual representation of codes used to translate the abstract requirements of dimensions to arrange metrics for the metrics catalogue;

- This model informed the database design ('object language') of the repository to store the elements of the PMF including metrics, benefits, processes, BSC perspective, challenges, and business sector.

Realization includes the evaluation and communication of the prototype.

For each phase of the macro cycle (analysis, projection and synthesis), four steps in the micro cycle were undertaken (research, analysis, synthesis and realization). Table 3 presents a summary showing the specific design elements for the macro and micro design cycles. We developed a prototype and stopped at proof of concept with further development possible in future projects. Several iterations on the design prototype were undertaken.

Table 3: Summary of hyper cyclic model applied to the ITSM PMF project

| Macro Cycle	Micro Cycle			
	Research	Analysis	Synthesis	Realization
Analysis	Literature review findings	Systematic literature review	Catalogue of metrics	Communication: journal, conference and seminar papers
Projection	Survey and case study data	Quantitative analysis and content analysis	Cross case analysis	Demonstration of prototype
Synthesis	Interactions with panel of experts and ITSM practitioners	Content analysis	Performance measurement framework	Tested prototype, thesis

An ITSM metrics catalogue was developed to populate the ITSM PMF. Proof of concept involved demonstration of the use of the ITSM PMF. The demonstration aimed to solve the problem of measuring the performance of ITSM in the case study organizations. This involved using the ITSM PMF as a guide to selecting relevant and contextualized ITSM performance metrics for the organization and then generating meaningful ITSM performance reports for the business. The revised design science method process model is shown in Figure 6.

6. Evaluation of artefact

Evaluation is an important requirement in design science research (Cleven et al. 2009; Gregor and Jones 2007). To evaluate the ITSM PMF artefact, the study applies the guidance and fitness-utility model for design science research proposed in Gill and Hevner (2011). Evaluation of the developed artefact aims to answer the question "How well does it work?" (March and Smith 1995). In this section, the ITSM PMF artefact is evaluated for its usefulness and fitness, on its capability to assist the organisation to select contextualized metrics, generate relevant reports to the organisation and provide an integrated set of ITSM performance metrics.

Two public sector organisations provided the opportunity to perform the evaluation of the ITSM PMF and the results of the evaluation are used in the synthesis step of the macro cycle of the design process. To maintain confidentiality, these organisations are referred to as Case A and Case B.
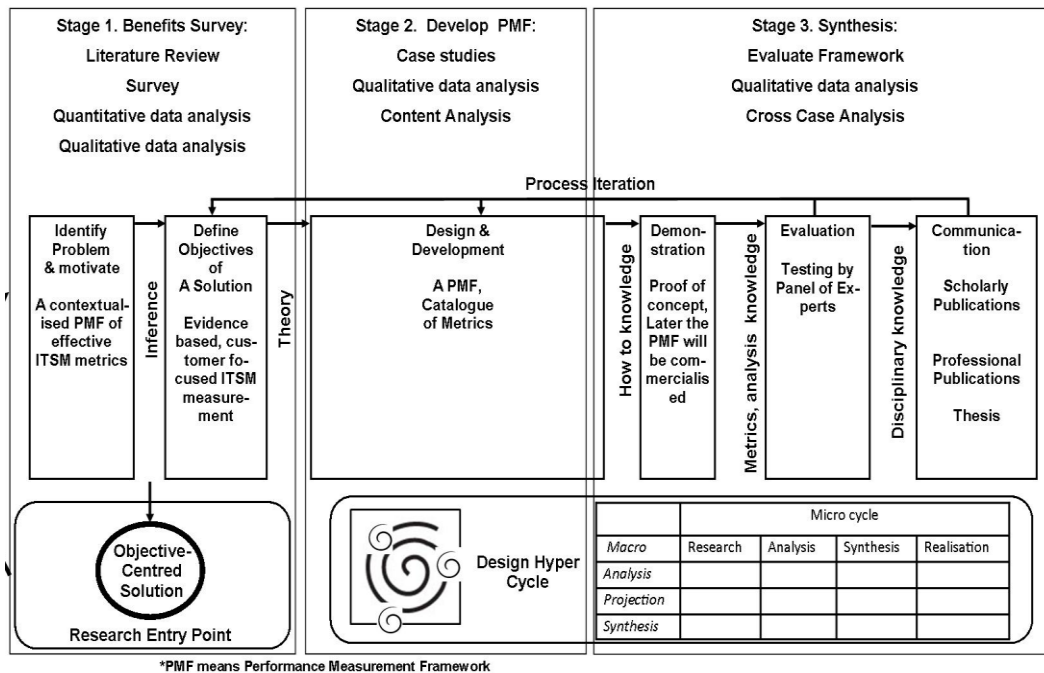
Figure 6: Revised design science method process model

Case A sponsored the project with financial and in-kind contributions. Two meetings were held with the Case A staff. The panel of ITSM practitioners included the Senior Director of Service Management, the Director of Strategy, Governance and Architecture, the Assistant Director of Governance, the Director of Service Planning and Performance, and a Principal Process Improvement Officer. Service performance reporting was a priority for Case A though it had not yet been implemented. Case A collected process metrics that satisfied their operational, and to a lesser extent, tactical level of management. The ITSM dashboard in use tracks correlation between what has changed at the business level and its impact on performance at the operational level. Case A had identified a need for service metrics presentable to the strategic level reporting to the organisation's Chief Executive Officer (CEO). An earlier attempt by managers to present an operational and tactical ITSM report at Case A's strategic level failed. The CEO and strategic level organisation staff rejected the operational report by the IS unit as irrelevant to their needs. The strategic level was not interested in ITSM process metrics. The ITSM managers were of the view that a lot of effort was required internally to generate ITSM reporting. In the past, the BSC had been used for service performance reporting, but that had tapered off over time with a number of personnel changes in the role of CIO. Now Case A's newly appointed CIO has rejuvenated interest in service reporting and has advertised an ITSM service reporting position. Case A is also reinstating an ITSM governance committee that is developing a service improvement road map with a process-maturity monitoring program. The organisation has an extensive list of ITSM process performance metrics with limited reporting. The metrics are mainly tool sourced. The managers sought to find reporting along the BSC perspectives with five to six levels of breakdown to allow reporting to different performance reporting audiences such as strategic, tactical, and operational with the key performance indicators linking into reports. The managers believed they needed a multidimensional framework with a stakeholder's view. The stakeholders are perceived to be the end customer of metrics. Case A had been using internal resources to develop ITSM performance reporting and had not received assistance from external consultants.

Currently the ITSM performance metrics evolve from qualitative metrics, and as maturity is achieved they tend to include quantitative metrics. Case A placed more value on an ITSM PMF and less on an ITSM metrics catalogue. The managers expressed a need for a performance measurement framework that shows how to 'roll up' the metrics across the various organisation levels. Higher value

is placed on aligning the ITSM with the organisational performance and less value in ITSM performance measurement at the operational level. The type of reporting generated and how the reports are used drives the validity of ITSM performance measurement. The level of granularity changes with the needs and priorities at different organisation levels, over time and with senior management's *"appetite"* for ITSM. Case A preferred not to have too many categories for performance reporting in the ITSM performance measurement framework. A recurring need expressed by panel members was the need to show how the ITSM metrics at the operational level roll up to dashboards at the business reporting level. Given that different ITSM report customers are interested in different measures at different levels, varying granularity will be required and the ITSM performance measurement framework would need to be dynamic. Knowledge of IT service issues in the customer domain was increasing and there was recognition of the importance of customers.

An ITSM performance measurement challenge experienced by Case A was the issue of ITSM staff meeting response times but reporting at a later date, thereby skewing the metrics on call response times. Case A sought an ITSM performance measurement model adaptable to the organisation offering an approach to implementing metrics with advice on where to begin. The performance measurement model ideally should provide advice on whether to start at the top level or operational level of the organisation or whether to measure the overall organisation performance or unit level performance. At the operational level the ITSM performance measurement framework needs to be comprehensive to allow "slice and dice". Managers were concerned about demonstrating how the ITSM performance measurement supported the business.

The senior managers at Case A had not reviewed the ITSM performance measurement framework documents emailed to them earlier and made comments and provided feedback on the presentation on the basis of their current organisational needs. Case A was undergoing an overhaul in their performance reporting and had created a new structure for strategy, planning, governance and architecture that subsumed the previous benefits realisation reporting function of the information function of Case A. The information function senior manager advised that ITSM performance measurement represented a small fraction of the Case A's information function needs and direction.

As a consequence of the organisation's focus and needs, Case A declined to commit further resources and time to review the ITSM PMF, to verify its usefulness, or provide further feedback on improvements.

At Case B, the researcher presented the three components of the ITSM performance metrics framework to the Manager (Service Reporting). The feedback from Case B was that the PMF appeared to be valuable and that it addresses areas that would benefit the organisation. The Manager (Service Reporting) confirmed that the organisation already has an ITSM metrics catalogue, and that the effort required to populate the proposed ITSM catalogue with the elements appears to be 'enormous'. The Manager (Service Reporting) is interested in applying current metrics to work through an example based on the PMF.

7. Discussion

Upon reflection, the outcomes of the PMF project were not entirely satisfactory: the prototype PMF has not developed to the point of an actual industry trial. Temporal and financial constraints prevented further iterations through the design-build-evaluate cycle.

Engagement with the project sponsor (Case A) was stymied in part by organisational turbulence. Case A suffered a highly publicised IT system failure that resulted in high levels of uncertainty and staff turnover in the roles of the ITSM PMF project partners as well as the CIO. The evaluation by Case B occurred too late in the project timeframe to action Case B's comments.

We recognise that the effort involved in searching for a suitable design framework was not included in the time allocated for the project. Unfortunately, although the MAPS model satisfied the requirement for concrete and detailed guidance for the design step in this design science project, it may have prevented creativity and flexibility by imposing a too-rigid structure. Drawing from the Information Systems field, a more agile approach (Highsmith and Cockburn 2001) to the design and development of the PMF may have resulted in more frequent prototypes, earlier feedback from the practitioners and the ability to tailor the artefact to the requirements of the sponsor organisation.

8. Conclusions

In summary, the review of the IS design science literature revealed a scarcity of guidance on the design of the artefact, despite a substantial research effort on other aspects of the field, such as the general steps in design science, problem identification, objectives of solutions, evaluation of the artefacts and project management. Our project aimed to develop and evaluate a framework artefact that can be used for the performance measurement of ITSM investments in organizations. The project uses the Information Systems Design Research (ISDR) approach (Peffers et al. 2008). The objective of this paper has been achieved: the silence on design in IS design science has been highlighted and a design approach has been proposed and evaluated in our project.

We approached the fusion of science and design following the advice from the literature. After exploring the design gap in IS design science, we identified the MAPS approach from a discipline outside of IS and used it in our project. Using a design process from the design literature advocating 'designerly ways of knowing' we applied the integrative MAPS approach (Chow and Jonas 2008). We integrated the IS design science research approach with the MAPS model. Based on MAPS, we applied the macro cycle of analysis-projection-synthesis and the micro cycle of research-analysis-synthesis-realization to create an approach to design the prototype of the ITSM PMF.

The approach did not effectively guide the design to a satisfactory outcome. Our experience may shed light on why the design gap in design science is difficult to fill. We sound a warning to researchers that design is a creative endeavour. The design step can be supported, for example by design patterns, exemplars, past experience and approaches such as those from systems analysis. A concrete and rigorous design approach may stifle creativity, reduce agility and prevent flexibility. In our PMF project, a more agile approach with shorter cycles may have enabled more frequent engagement with practitioners and a framework more suited to their needs.

We recognize as a limitation to this work that there may be other design approaches from other disciplines, however, the design process proposed here provides an example and raises issues for other IS researchers faced with the dilemma of how to design the artefact in an IS design science project. This multi-discipline approach improved the rigor of our ITSM project by using a systematic and repeatable approach to guide the design step in developing the framework. This paper contributes to the body of knowledge on design science by proposing and evaluating a design approach to help fill the current gap.

Note: ITIL® is a registered trademark of the UK, Office of Government Commerce.

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