Towards a Process Reference Model for Research Management: An Action Design Research Effort at an Australian University

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Abstract. Increasing emphasis in the Higher Education sector for high impact research has generated a proliferation of activities aimed at supporting university research processes, commonly referred to as 'research management'. While there has been considerable growth in this new field, it remains an elusive area, with a lacuna on what comprises good 'research management'. A lack of common terminology and definition of the activities comprised within research management limits the capacity to provide efficient services, properly share learnings and consistently assess the effectiveness of this work.

This paper discusses the development of a research management reference model, through an Action Design Research (ADR) project conducted at a leading Australian university. The model defines 10 core domains (with areas of activities and processes within each) that constitutes the end-to-end research management process. The model was derived and validated across four ADR cycles of a detailed case study – which proved its potential value. Future research is planned to further validate the model in other universities, both within Australia and internationally.

Keywords: Research management · Reference model · Action Design Research · Case study

1 Introduction and Background

Research outcomes has become a core indicator of university performance, with its emphasis growing over the last two decades [5]. Many universities across the world have steadily increased their focus on research income and impact [5, 18]. In Australia alone, research income has increased nearly five-fold from 1997 to 2017 [10]. This has initiated an emerging new field of work, designed to support and oversee institutional-wide research activity, commonly referred to as 'research management'. Kirkland et al. [18] defines research management (RM) as institutional activities, separate from the research process itself, that add value to the research activities supporting the relevant stakeholders. Ultimately, research management is about providing services that allow the researchers to do less administration and focus more on research. Research management *does* incur notable cost, which is often built-in to and funded by the research

income generated, hence, it is important that the researchers feel the benefit of these services. Recent studies (i.e. [5]) have found that universities with a higher research management index have higher research productivity, in both publications and competitive grants; indicative of the positive impacts it can bring. But the research management domain, in general is in its genesis yet.

Research management practices cover a wide spread of disciplines, including financial management and accounting, contract development, business-relationship management, training and capability building as well as the research specific fields of ethics oversight and research output management. This broad collection of disciplines is then set against the backdrop of ever-changing government legislations, the multitude of funding body requirements and internal strategy and oversight needs, resulting in complex, interdependent processes. While there are societies dedicated to guide and support research managers[1] and some frameworks that provide diverse guidance to research management at different units of analysis and levels of maturity [5, 27], there is still very little direction on what research management "best-practices" are. To date, no resource provides a holistic view on what research management entails, and null resources exist, on how to design, deliver and continuously manage the core services and underlying processes to support institution-wide research management.

Other sectors (such as Health [6], Manufacturing [2] and Finance [31]) have progressed well by applying process-centric approaches to generate efficient and effective service delivery. A process-based approach attempts to change the focus of stakeholders to a single flow of work, resulting in enhanced performance [14]. As stated by Hammer [15] (p. 7), "*Through process management, an enterprise can create high-performance processes, which operate with much lower costs, faster speeds, greater accuracy, reduced assets, and enhanced flexibility.*"

For the research management (RM) field, a first crucial (yet missing) step in this journey is to identify and define the involved 'processes', and this is not a trivial task, especially in complex and previously under-examined domains (like RM). While there are many learnings that can be taken from the field of project management, the domain requirements of research management (such as the funding models, legislative and ethical oversight and the segmentation between academic and professional staff) warrant a specific definition of processes. *Reference process model*s have been created in diverse domains (e.g. [1, 17, 33]) as a means to address this gap. A reference model presents a synthesis of the most essential/best-practice processes of a domain, ordered in a systematic manner (in logical hierarchies, with standardized sets of actions along with their interdependencies) [7, 16, 24, 25]. A well-developed reference model can be used as a point of reference for diverse process centric purposes; it plays a vital role in the initial 'process discovery' [12] phase, and can be used as a source of guidance for process improvement [13].

Aiming to develop a reference model for research management of a university, this paper addresses the research question: **what are the processes fundamental for research management of a university?** An Action Design Research (ADR) is

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[1] Two examples are the Society of Research Administrators International (https://www.srainternational.org/) and the Australasian Research Management Society (https://researchmanagement.org.au/).

conducted to identify and synthesize research management processes within a multi-tiered hierarchy, forming an evidence-based research management reference model.

2   Methodology

An Action Design Research (ADR) approach is adopted and deployed here, where the aim was to develop an empirically supported research management reference model which would be developed/re-specified and validated through multiple stages. Peterson and Lundberg [22] describe ADR as a means *"to generate prescriptive design knowledge through learning from the intervention of building and evaluating an artefact in an organizational setting to address a problem"*. ADR typically takes place within multiple cycles – each of which follows three-steps [28]: (1) problem formulation; (2) building, intervention and evaluation; and (3) reflection and learning; after which the final step is (4) formalization of learning. The stages are iterated through and built upon over the course of the work. This paper reports on the outcomes resulting after 4 ADR cycles (see Fig. 1), as applied within a single case study at the Queensland University of Technology (QUT), Brisbane, Australia.

2.1   Introducing the Case Study Context

QUT, the selected case study for this work, had undergone rapid growth as a research-intensive university in recent years. It has grown from just under Au $15 million in research income in the year 2000 to over Au $100 million in 2017 [10]. This rapid growth has seen a reciprocated increase in provisioning research support. Through this expansion, processes and systems around research management have proliferated and evolved to various degrees. Overlaps of some services are observed and legacy systems and underlying processes have continued to exist well after their expiry date.

A 'Research Transformation' project was kicked off in 2018, to evaluate the organizational model that would best support QUT's research activity into the future. At the same time the Research Management Systems Upgrade Project, or RMSUP, was underway to replace QUT's core research management system(s), which had been in place for over 20 years. Early phases of these projects raised the lack of a consistent way to speak about the different activities of research management and their inter-connected nature. Some of the terminology used was very specific to certain areas and was creating issues and hindering process redesign[2]. It was soon clear that a more holistic frame of reference was needed.

This described context made QUT a very suitable case study candidate for this research. Additionally, the researcher team had ready access to the case with the required support to run an ADR study.

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[2] One example was between the Research Grants and the Commercial Research team. For the former the term 'project' reflected the entire lifecycle from the development of a grant application, whereas for the latter a 'project' was only considered to exist once a contract had been signed. This simple terminology difference had caused a large deviation between the two in both processes and how systems were used.

2.2 Developing the Research Management Reference Model: ADR Cycles Within the Case Study

Four ADR cycles were conducted, following the guidelines of Sein et al. [28], over a period of 6 months (see Fig. 1). The evolutionary model building efforts are presented here with the final model outlined in Sect. 3. The cycles began first within the ADR team (i.e. the research team members and others from the RMSUP team), where the knowledge of the team's 3 domain experts was drawn on, to obtain the first exploratory model. The next cycles were designed to engage other university-wide stakeholders to further build and evaluate the model. Over the course of these cycles, 15 experts from a variety of domains were engaged (see Table 1), with 5 other experts engaged informally. The primary means of engagement was through detailed structured walkthroughs, as this allowed for both direct feedback from the experts and observation of the effectiveness of the model as a standardized communication tool, a method used effectively in other ADR projects [22, 23]. All up, 10 such walkthroughs were conducted, involving the 15 participants, which were run by the RMSUP team, with researcher observations. They were designed to see how easily understood the reference model was, as well the completeness of the activities it detailed. Some initial framing of the model was delivered in the walkthroughs, but space was allowed to see what the experts' interpretations of terms were, to see if terminology needed to be changed. Each of these cycles are outlined further below.

Table 1. Detailed walkthrough summary

| #	Attendees	Domain/Department of origin
1	Director, Office of Research Director, Office of Commercial Services	Strategic Management/Grants & Commercial Research
2	Manager, Research Development Unit	Research Grants
3	Manager, Research Partnerships	Commercial Research
4	Business Manager, Office of Commercial Services	Commercial Research
5	Director of the Office of Research Ethics and Integrity	Ethics & Governance
6	Research Governance and Compliance Coordinator	Ethics & Governance
7	Associate Director, Office of Commercial Services Project Officer, Office of Commercial Services	Commercial Research
8	Manager, Research Finance Unit	Research Finance
9	Research Quality Coordinator Research Information and Systems Support (3 members)	Reporting & Systems Support
10	Senior Research Fellow, School of Psychology	End User Academic
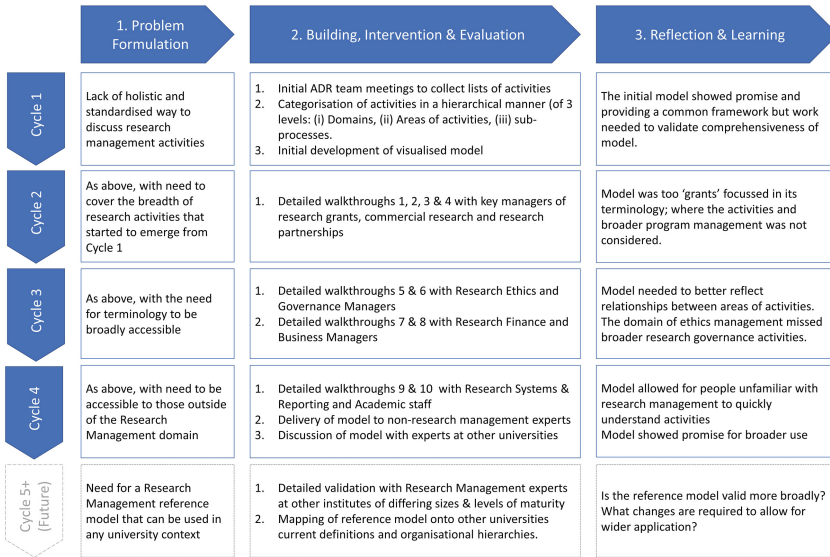
Fig. 1. Overview of ADR cycles

2.2.1 Cycle 1

The first cycle aimed to address the problem of the lack of a holistic framework to discuss research management activities. Initial discovery was synthesized from a variety of QUT corporate documentation, including service catalogues for the Division of Research and Commercialisation, organizational hierarchies as well as artefacts generated by RMSUP, such as business requirements, use cases and business process documentation. The RMSUP, through its market scan process, had been exposed to a wide variety of research management systems and was able to draw on the processes these systems supported and map this to the QUT context. Following this a series of brainstorming sessions were held with the RMSUP team to collate a list of activities that are part of research management. The RMSUP team consisted of 3 process-oriented business analysts, who had all been focused on the research management domain for the prior year and 3 subject matter experts who had worked in a series of roles across the gamut of research management for a decade each. The combination of knowledge and process-oriented thinking provided a solid basis for this initial work.

From this, a categorization of groups of activities and an overall flow (of research management activities) was recognized. This was split into a three-tier hierarchy of *domains*, *areas of activity* and *processes*[3]. Following this session, work was done to create a visual presentation of this hierarchy. This was conducted over the course of two weeks with the research team being embedded within the RMSUP team to allow for immediate feedback and iteration of the model. At the conclusion of this process 9[4]

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[3] Domains are high level groupings, ordered in a loose logical flow, each consisting of several areas of activity, with their own list of processes.

[4] The final domains are presented in detail in Sect. 3.

key high-level domains were identified, each containing a collection of areas of activity and 153 different processes divided between those areas. At this stage, the model was deemed ready for initial engagement with members outside the research team.

2.2.2   Cycle 2

This engagement was focused on the area of managing research projects[5], as this was the area at QUT with the greatest diversity of processes and terminology, and hence of key importance for validating the model.

The model showed promise in facilitating discussions around processes related to research project-management, but the language was considered by some to be too "research grants" focused. This prompted a rewrite of the activities to better address this. Additionally, the linear presentation of the model caused some people to assume it meant that all research projects must follow this path. To address this, the model was framed as not being prescriptive for every project, but more indicative of the norm.

One major discovery from these walkthroughs was the need for a 10th domain that was all-encapsulating, *program management*. This related to broader activities that the university would undertake to support research more generally. These didn't fit well into the project-oriented process of the model, but instead helped to create a healthy ecosystem for new research projects to emerge.

2.2.3   Cycle 3

In the third cycle, the implementation of the model was expanded to new domains, looking at the areas of research ethics and finance, considering their significance to research management. At this point, the model had a domain entitled *Ethics Approval* but in discussions with the research ethics experts it became clear that there was far more involved that just ethics management. These more broadly went to activities of risk identification, mitigation and incident management. There was a common pattern of governance and compliance processes, of which ethics was just a subset. This domain underwent a name change, to *Governance & Compliance*, and a significant rewrite to accommodate these changes.

2.2.4   Cycle 4

By this cycle the model was becoming more robust and so engagement began to branch broader than active managers of research. Detailed walkthroughs were held with people working in the research system support and research reporting spaces as well as informal discussions with research managers from other institutions. Changes at this point were very minor, limited to process renaming and the addition of more connection points between domains. The model began to be used as a communication tool for people unfamiliar with research management and proved to be very effective in providing an initial grounding. This evidenced the completeness and relevance of the model within this case context, ending the cycles within the case. By the end, the total number of processes in the model had grown from 153 to 218.

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[5] Management of research projects covers activities to support funding application and the subsequent oversight of funding and project obligations. It forms part of most of the domains identified with the exception of research outputs, performance and HDR management.

3   The Research Management Reference Model

The resulting research management reference model was captured and presented across 4 levels of abstraction (following the example of other reference models, such as [4, 21]). It provides a model overview (see Fig. 2), which consists of 10 domains (see Sects. 3.1–3.10) which are ordered as a flow within the model, indicative of common practice, but not necessarily dictating a chronological flow. Each domain captures the core areas of activities that forms the domain, and there are relevant processes underlying each area[6]. While there already exists accepted language and notation to document process hierarchies (such as [8]), the end users of this model are administrators with little to no business process experience, hence a customized approach was needed to be easily comprehensible. For similar reasons the model uses icons and colors to avoid end-users disengaging with the model at first due to cognitive overload [26].

The model overview essentially presents a first high-level overview of the "life-cycle" of research management, reflecting the life of a research project, from initial conception through proposal development and approval, into conducting the project, including financial, ethical and contractual management, then into the outcomes of the project, in research outputs and the reporting around these. Note how the HDR (Higher Degree Research student) Management (domain 9, see Sect. 3.9 below) is kept separate from this, to reflect its individual processes, but a research student's journey bares many similarities to a research project, so color-coding is used to indicate the points of overlap. Each of the domains are outlined briefly below, and the full reference model and descriptions of the areas of activity can be found at https://doi.org/10.6084/m9.figshare.7819424.

Fig. 2. Research management reference model overview (Color figure online)

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[6] For example, Domain (1) – **'Project Conception',** consists of 6 areas (*Project Idea Initiation, Funding Sources Identification … Review and Revision* - see Sect. 3.1) and each area has a list of clearly identified processes (see Fig. 3).

Fig. 3. Project conception

3.1   Project Conception

Project Conception refers to the initial stages of any research, where ideas are spawned, teams are formed, and proposals are developed. This work is often nebulous and difficult to define; hence it will often lack well defined processes or oversight. Within the research management field, this is often described as "pre-award", followed by "post-award" management once the application is successful. Some universities have distinct teams to manage pre and post, with others having the same team follow the project throughout its lifecycle [29].
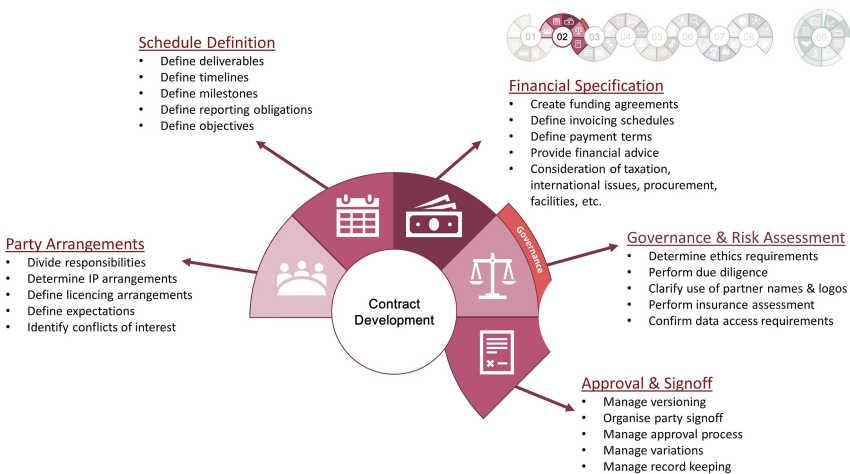

Fig. 4. Contract development

3.2   Contract Development

Contract Development (Fig. 4) covers the development of arrangements between parties and funding bodies. In some cases, such as research grants, this may occur after funding has been approved, while for commercial research the contract signing may signify the funding approval. Furthermore, there often will be multiple stages of contract development throughout the life of a project as variations are required. The domains, while placed in an order, should not be seen as stages to check-off and progress to the next, there will be overlap between them, and often multiple iterations.
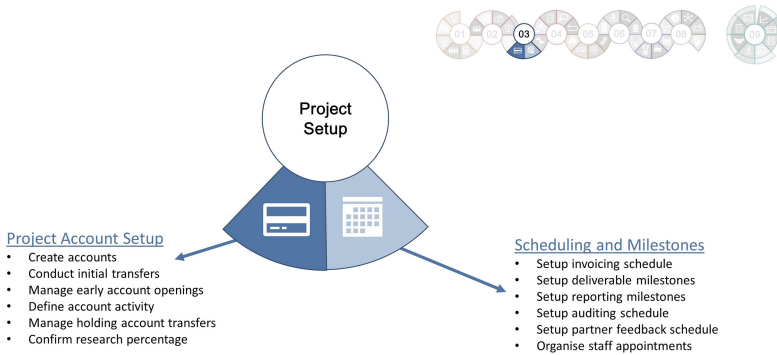

Project Account Setup
• Create accounts
• Conduct initial transfers
• Manage early account openings
• Define account activity
• Manage holding account transfers
• Confirm research percentage

Scheduling and Milestones
• Setup invoicing schedule
• Setup deliverable milestones
• Setup reporting milestones
• Setup auditing schedule
• Setup partner feedback schedule
• Organise staff appointments

Fig. 5. Project setup

3.3   Project Setup

Project Setup (Fig. 5) refers to the administrative work that supports the project commencement. There are a number of financial administrative tasks as well as scheduling of milestones to ensure that obligations are met by all parties.
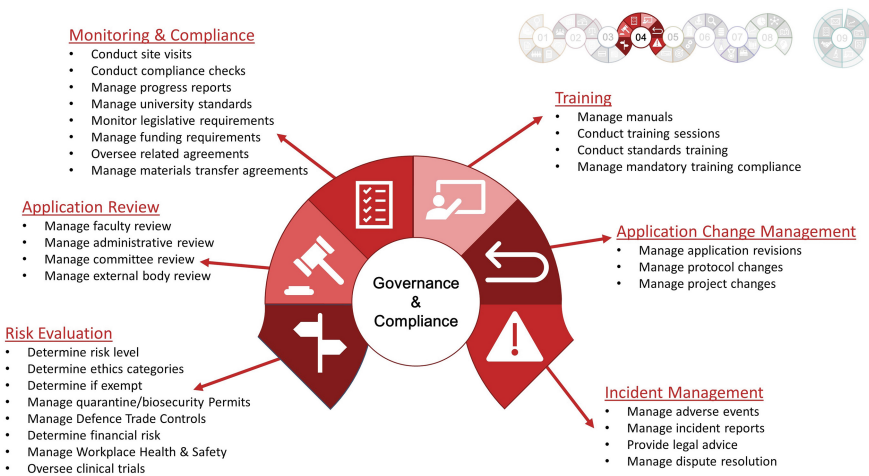

Monitoring & Compliance
• Conduct site visits
• Conduct compliance checks
• Manage progress reports
• Manage university standards
• Monitor legislative requirements
• Manage funding requirements
• Oversee related agreements
• Manage materials transfer agreements

Training
• Manage manuals
• Conduct training sessions
• Conduct standards training
• Manage mandatory training compliance

Application Review
• Manage faculty review
• Manage administrative review
• Manage committee review
• Manage external body review

Application Change Management
• Manage application revisions
• Manage protocol changes
• Manage project changes

Risk Evaluation
• Determine risk level
• Determine ethics categories
• Determine if exempt
• Manage quarantine/biosecurity Permits
• Manage Defence Trade Controls
• Determine financial risk
• Manage Workplace Health & Safety
• Oversee clinical trials

Incident Management
• Manage adverse events
• Manage incident reports
• Provide legal advice
• Manage dispute resolution

Fig. 6. Governance & compliance

3.4 Governance & Compliance

As mentioned previously, *Governance & Compliance* (Fig. 6) first began as looking at ethical management of the project but there are many other areas of project governance that follow a similar process of risk identification, mitigation strategy development, ongoing monitoring and incident reporting and management. Some of these may be managed by an ethics unit, others by different areas of the research institute and some may be managed by the researchers themselves. Due to the overlapping regulations between universities, governments and other organizations there can often be significant administrative overheads in this space, resulting in slow responsiveness [20].

Fig. 7. Project management

3.5 Project Management

Project Management (Fig. 7) outlines the administrative activities that occur during the life of the project. This domain will often cover the longest period, but the degree of administrative engagement may be minimal. However, some universities are starting to provide centralized resources to support the day-to-day management of projects [30]. This domain ensures compliance with the obligations and strategies identified in previously areas, as well as managing any changes to the project that may occur.

3.6 Research Outputs

Research Outputs (Fig. 8) covers the creation and dissemination of all outputs from the research activity. What was previously referred to as publications is increasingly being called research outputs in an effort to broaden the scope beyond standard publishing avenues. In this domain all of the outcomes of research, both tangible and intangible are considered as outputs. This includes traditional publications but also research data, commercial outputs (such as IP, patents or business relationship), media engagements

and real-world research impact. All of these items have value to a research institute and can feed into future research, but the standard reporting models of journal articles will fail to consider these.
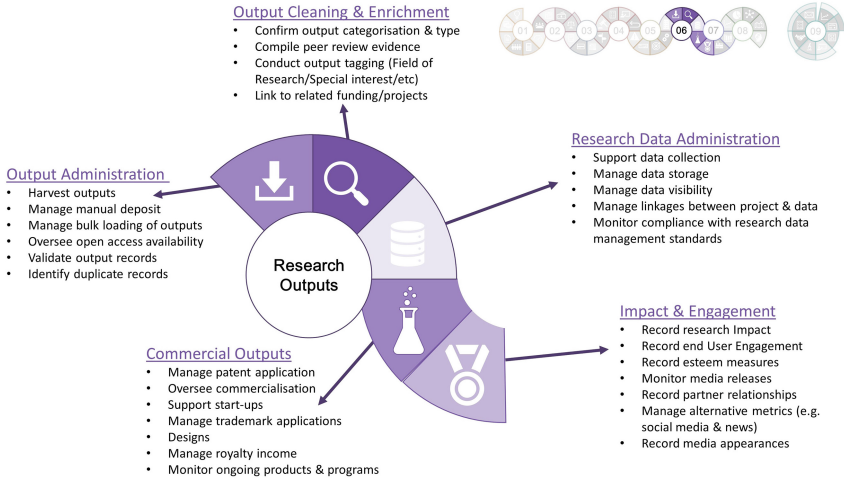

Fig. 8. Research outputs

3.7 Project Finalization

Project Finalization (Fig. 9) covers the stages of "clean-up" that need to occur once a project is completed. This can often be difficult as while certain projects may have a nominal date of completion, the various stages of final delivery and client acceptance, as well as final expenditure of funds, can continue long past this initial date as project timelines slip. Additionally, contracts may be extended or renewed, meaning that what was initially meant to be a 6-month project can continue for many years.
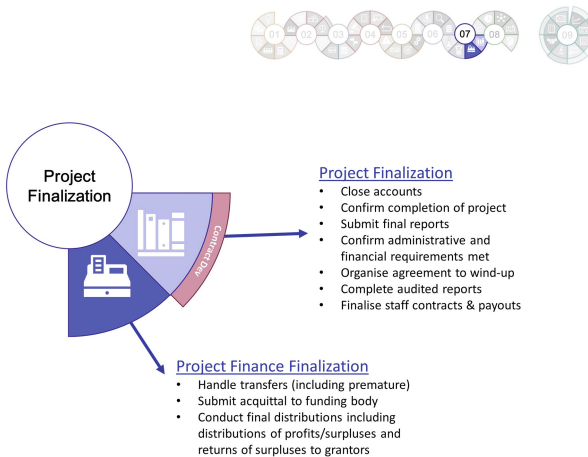

Fig. 9. Project finalization

Fig. 10. Research performance

3.8   Research Performance

Research Performance (Fig. 10) details the reporting and analysis applied to research activity. The fruits of the previous stages are collated and presented to give a clear picture of how a research institute is performing. To properly be able to demonstrate performance at this stage, data collection and aggregation needs to underpin all of the previous domains. Also benchmarks and KPI's are used here to indicate expected levels of performance. External metrics, such as journal rankings or citation counts are used to give an indication of the quality of the research activity.
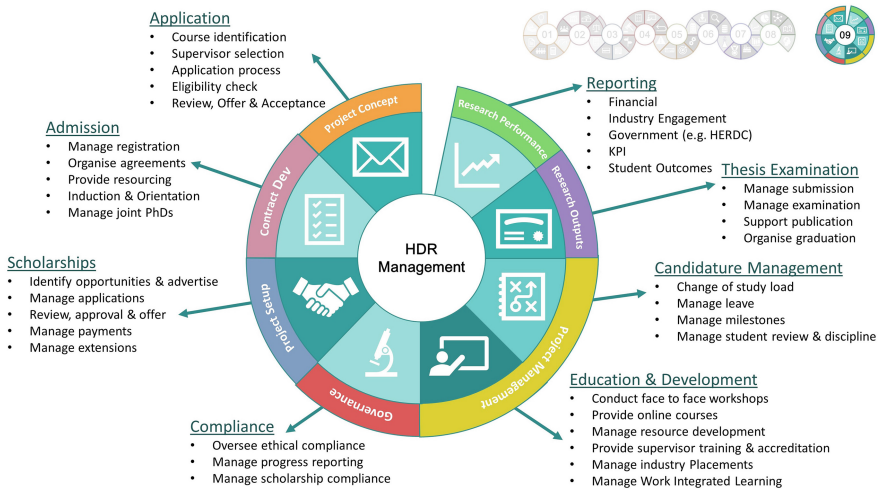

Fig. 11. HDR management

3.9 HDR Management

HDR Management (Fig. 11) refers to the management activities to support higher degree research students. A Higher Degree Research Student follows a similar path to a research project and so there is a large amount of overlap with existing areas already outlined. The color-coded bands surrounding the pie indicate these relationships, but the pie itself focuses on the activities specific to HDR management, which cover the full lifecycle of a student. It should be noted that while research management can be a consideration for undergraduate students, a study by [11] found that less than a quarter of universities have a specific strategy towards this, and of those more than 80% were handled separately from the Deputy Vice Chancellor of Research (or similar role).

Fig. 12. Program management (Color figure online)

3.10 Program Management

Finally, *Program Management* reflects the broader ecosystem that supports research activity at an institute. This is a higher level of proactive strategic management that looks beyond individual projects and support transformative research initiatives [9]. These programs support the creation of many new projects or students. As Fig. 12 shows, there will be similar analogues to many of the previous stages, with these programs going through the process of conception, contractual setup and governance. Similarly, they will create outputs, including those of the research projects they contain and will have reporting requirements to show the effectiveness of the program.

4 Discussion

Despite the growth of research within universities and the proliferation of support staff, the lack of a holistic framework that describes the activities of research management limits the capacity to provide efficient services, properly share learnings and consistently assess the effectiveness of research. In an endeavor to address this gap, this paper addressed the research question: *what are the processes fundamental for research*

management of a university? A preliminary reference model for research management was developed through an ADR effort consisting of 4 cycles. The first cycle aimed at identifying high level activities, the second cycle focused on capturing activities related to research project administration, the third cycle addressed the areas of governance, ethics and research finance with the final cycle confirming the reporting, system and end-user academic dependencies. This ADR effort served the goals of the research well by allowing for constant feedback loops with people well experienced in the research management space.

The findings illustrate the primary components of the reference model. The resulting model is a comprehensive and highly detailed model, which can be used as a point of guidance to identify the processes underlying research management at a higher education or research institute. It takes the form of normative guidelines to guide users to approach research management. It is a multi-disciplinary artefact bridging two communities of researchers, namely from the field of BPM and from the higher education sector. Diverse stakeholders (i.e. research managers, researchers and university leaders) can greatly benefit from the clarity and visibility of research management processes that the resulting reference model provides. It is a useful tool for research process management, investigations and communication [19, 32]. For example, on an anecdotal level, the project manager of RMSUP, who was involved in many of the end-user sessions, commented on the effectiveness of the model to elicit requirements from stakeholders who may not have been used to process-oriented thinking, as it provided a frame of reference for them to consider their daily activities. It also was used to introduce people unfamiliar with research management to the concept, in a simple and easily accessible way.

This research management reference model can be used by a research institute to not just assess what they are presently doing, but what sub-processes of the model they may not be currently addressing. Additionally, it can be used to assess what data is captured about different processes, to ensure that work is visible and can be reported upon. Similarly, it can be used to determine the systems used to support these processes and the adequacy of them. Finally, it can be used to assess service delivery, by examining researchers' experiences and satisfaction with each of the sub-processes. These are just examples of the potential applications of the reference model to a specific research institute context.

While this model has varied applications, we do acknowledge limitations. A reference model by its nature is designed in one specific context, but can be applied to other contexts [3], and as yet this model has not been validated beyond one university. Informal engagement has been conducted and shown promising signs of generalizability, but a rigorous evaluation is required to confirm that the reference model is an accurate representation of research management internationally. Additionally, engagement with research manager's specifically focusing on Higher Degree Research (HDR) was minimal in the current ADR cycles. Hence, more work is needed to confirm the completeness (with the appropriate inclusion of all processes like HDR) of the resulting reference model.

We suggest that the model be tested; re-specified as needed and validated with insights from other universities to consider both its generalizability and its completeness. Future studies should be extended to include other stakeholders (such as research

academics, funding bodies and HDR students) to enable the inclusion of diverse viewpoints. Mechanisms to adapt the model (for different institutional contexts and to address dynamic needs) and to allow the model to evolve with changing industry demands also needs to be investigated. As the model matures, work should be done to develop measures that can be used to assess a research institutes maturity in these different domains. Future research in this field can deliver real benefits for research institutes to provide effective services for research management.

References

1. APQC: APQC Process Classification Framework (PCF). APQC (2018)
2. Barber, K.D., et al.: Business-process modelling and simulation for manufacturing management. Bus. Process Manag. J. **9**(4), 527–542 (2003). https://doi.org/10.1108/14637150310 484544
3. Becker, J., Delfmann, P., Knackstedt, R.: Adaptive reference modeling: integrating configurative and generic adaptation techniques for information models. In: Becker, J., Delfmann, P. (eds.) Reference Modeling, pp. 27–58. Physica-Verlag HD, Heidelberg (2007). https://doi.org/10.1007/978-3-7908-1966-3_2
4. Becker, J., Schutte, R.: A reference model for retail enterprise. In: Reference Modeling for Business Systems Analysis, pp. 182–205. IGI Global (1)AD. https://doi.org/10.4018/978-1-59904-054-7.ch009
5. Beerkens, M.: Facts and fads in academic research management: the effect of management practices on research productivity in Australia. Res. Policy **42**(9), 1679–1693 (2013). https://doi.org/10.1016/j.respol.2013.07.014
6. Bertolini, M., et al.: Business process re-engineering in healthcare management: a case study. Bus. Process Manag. J. **17**(1), 42–66 (2011). https://doi.org/10.1108/14637151111105571
7. Carpinetti, L.C.R., et al.: Quality management and improvement: a framework and a business-process reference model. Bus. Process Manag. J. **9**(4), 543–554 (2003). https://doi.org/10.1108/14637150310484553
8. Davis, R.: British telecom - six level process hierarchy. In: Process Days Conference, Sydney, 22–24 August 2006 (2006)
9. Demes, K.W., et al.: Catalyzing clusters of research excellence: an institutional case study. J. Res. Adm. **L**(1), 108–122 (2019)
10. Department of Education and Training: Research Income Data (2004–2017). https://docs.education.gov.au/documents/herdc-research-income-time-series
11. Droegemeier, K.K., et al.: The roles of chief research officers at American research universities: a current profile and challenges for the future. J. Res. Adm. **XLVIII**(1), 26–64 (2017)
12. Dumas, M., La Rosa, M., Mendling, J., Reijers, H.A.: Process discovery. In: Dumas, M., La Rosa, M., Mendling, J., Reijers, H.A. (eds.) Fundamentals of Business Process Management, pp. 155–184. Springer, Heidelberg (2013). https://doi.org/10.1007/978-3-642-33143-5_5
13. Fettke, P., Loos, P.: Perspectives on reference modeling. In: Reference Modeling for Business Systems Analysis, pp. 1–21. IGI Global (1)AD. https://doi.org/10.4018/978-1-59904-054-7.ch001
14. Greasley, A.: Using process mapping and business process simulation to support a process-based approach to change in a public sector organisation. Technovation **26**(1), 95–103 (2006). https://doi.org/10.1016/J.TECHNOVATION.2004.07.008

15. Hammer, M.: What is business process management? In: Brocke, J., Rosemann, M. (eds.) Handbook on Business Process Management 1, pp. 3–16. Springer, Heidelberg (2014). https://doi.org/10.1007/978-3-642-00416-2_1

16. Hollingsworth, D.: The Workflow Reference Model. The Workflow Management Coalition Specification, Hampshire, UK (1995)

17. IBM: Align IT with business goals using the IBM Process Reference Model for IT. IBM Corporation (2007)

18. Kirkland, J., et al.: International research management: benchmarking programme. Association of Commonwealth Universities (2006)

19. Lawrence, R.J., Després, C.: Futures of transdisciplinarity. Futures **36**(4), 397–405 (2004). https://doi.org/10.1016/J.FUTURES.2003.10.005

20. Liberale, A.P., Kovach, J.V.: Reducing the time for IRB reviews: a case study. J. Res. Adm. **XLVIII**(2), 37–51 (2018)

21. Mauser, A.: A reference model for savings bank. In: Advances in Banking Technology and Management, pp. 232–242. IGI Global (2008). https://doi.org/10.4018/978-1-59904-675-4.ch014

22. Petersson, A.M., Lundberg, J.: Applying action design research (ADR) to develop concept generation and selection methods. Procedia CIRP **50**, 222–227 (2016). https://doi.org/10.1016/J.PROCIR.2016.05.024

23. Du Preez, J.L., et al.: Developing a methodology for online service failure prevention: reporting on an action design research project-in-progress. In: Australasian Conference on Information Systems (ACIS 2015), Adelaide (2015)

24. Rosemann, M.: Using reference models within the enterprise resource planning lifecycle. Aust. Account. Rev. **10**(22), 19–30 (2000). https://doi.org/10.1111/j.1835-2561.2000.tb00067.x

25. Rosemann, M., van der Aalst, W.M.P.: A configurable reference modelling language. Inf. Syst. **32**(1), 1–23 (2007). https://doi.org/10.1016/J.IS.2005.05.003

26. Saadé, R.G., Otrakji, C.A.: First impressions last a lifetime: effect of interface type on disorientation and cognitive load. Comput. Hum. Behav. **23**(1), 525–535 (2007). https://doi.org/10.1016/j.chb.2004.10.035

27. Schützenmeister, F.: University Research Management: An Exploratory Literature Review. Institute of European Studies, UC Berkeley (2010)

28. Sein, M.K., et al.: Action design research. MIS Q. **35**(1), 37–56 (2011). https://doi.org/10.2307/23043488

29. Squilla, B., et al.: Research shared services: a case study in implementation. J. Res. Adm. **XLVIII**(1), 86–99 (2017)

30. Wedekind, G.K., Philbin, S.P.: Research and grant management: the role of the project management office (PMO) in a European research consortium context. J. Res. Adm. **XLIX**(1), 43–62 (2018)

31. Wei Khong, K., Richardson, S.: Business process re-engineering in Malaysian banks and finance companies. Manag. Serv. Qual. Int. J. **13**(1), 54–71 (2003). https://doi.org/10.1108/09604520310456717

32. Wickson, F., et al.: Transdisciplinary research: characteristics, quandaries and quality. Futures **38**(9), 1046–1059 (2006). https://doi.org/10.1016/J.FUTURES.2006.02.011

33. Zimmermann, H.: OSI reference model-the ISO model of architecture for open systems interconnection. IEEE Trans. Commun. **28**(4), 425–432 (1980). https://doi.org/10.1109/TCOM.1980.1094702