

2020

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Recommended Citation

Abu-Rumman, Ayman (2020) "Project Management: a help or hindrance a collaborative research," *Al-Balqa Journal for Research and Studies* **البلقاء للبحوث والدراسات**: Vol. 23 : Iss. 1 , Article 9.

Available at: <https://digitalcommons.aaru.edu.jo/albalqa/vol23/iss1/9>

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Project Management: a help or a hindrance in collaborative research

إدارة المشروع: نحو تسهيل أو إعاقة البحوث التعاونية

Abstract

This small-scale mixed method study explored perceptions of how different project management approaches and tools are used by those working in industry and within academia, and how this may impact on collaborative research projects given their distinct and unique nature. The study also aimed to generate suggestions for how collaboration between industry and academia could be strengthened in the future.

Underpinned by a phenomenological perspective, a survey and interviews were conducted with a sample of Jordanian professionals from different industry and academic organisations who had previous experience of working on collaborative research projects. The study identified, consistent with other studies, that the stages of research and project management are aligned, whilst the unique nature of research projects and their greater propensity to change during the project lifespan was emphasised.

The findings also indicated that formal project management approaches were much more embedded within industry than within the case example universities. It appeared that more traditional tools associated with project initiation and closure were used in the universities, whereas in industry a much wider range of tools and techniques spanning all of the different stages of a project were used. In addition, respondents from the industry organisations were generally more positive about their experiences of collaborative working on research projects than those from the universities, but there was a consensus about the partial compatibility of the project management tools and approaches used by the two.

Suggestions for improving collaboration on such projects in the future included: making better use of technology to overcome communication barriers associated with collaborative working; agreeing to the use of common project management methodologies and language between all partners; acknowledging the unique nature of research projects and building in greater flexibility into project plans; and delivering joint project management and research training.

Keywords:

Project Management Research Project Management Academic Research Collaborative Research Industry and Academic Collaboration.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Received: 30/10/2018

Accepted: 5/3/2019

المخلص

تهدفت هذه الدراسة إلى استكشاف الكيفية التي تؤثر بها الطرق المختلفة لإدارة المشاريع التي يستخدمها أولئك العاملون في الصناعة وأولئك الذين يعملون داخل الأوساط الأكاديمية على مشاريع البحوث التعاونية، وإلى أي مدى تحديداً يمكن تطبيق أدوات وتقنيات إدارة المشاريع على المشاريع البحثية نظراً لتمييزاتها الفريدة. كما تهدف إلى تقديم اقتراحات لكيفية تعزيز التعاون بين الصناعة والأوساط الأكاديمية في المستقبل، حيث اتبعت هذه الدراسة منهجية مختلطة صغيرة النطاق للوصول إلى مدى تأثير المناهج المختلفة لإدارة المشاريع على مشاريع البحوث التعاونية بين الصناعة والمنظمات الأكاديمية، حيث استندت إلى الدراسة الظاهرية باستخدام المسح والمقابلات، وكذلك إلى تصورات عينة من المهنيين الأردنيين من ذوي الخبرة في العمل التعاوني على مشاريع بحثية تمثل منظمات قائمة في "الصناعة" وكذلك على تجارب الأكاديميين العاملين في واحدة من أكبر الجامعات..

وأظهرت الدراسة أن المنظمات القائمة على الصناعة تتركز ممارسات إدارة المشاريع لديها بشكل أكبر وذلك على مراحل المراقبة والتحكم في المشروع، والأدوات والتقنيات المرتبطة بها، بينما في الجامعات كمثل كان هناك تركيز أكبر على مرحلة التخطيط ومشاريع البحوث، وأظهرت الدراسة أيضاً دعم لرؤية الصناعة والعمل الأكاديمي والتي تميل إلى العمل معاً بشكل جيد على مشاريع البحوث التعاونية لإدارة المشروع. شملت اقتراحات الدراسة تحسين التعاون لمثل هذه المشاريع في المستقبل ووجود آليات اتصال قوية بين المنظمات في تخطيط المشروع، وان يتم تخصيص الدعم الإداري الكافي بشكل مناسب من قبل المنظمات الشريكة؛ وزيادة المرونة داخل نُهج إدارة المشاريع المتفق عليها بصورة مشتركة؛ وأيضا المشاريع البحثية الفريدة ان يتم الاعتراف بها بشكل كامل من قبل جميع الأطراف.

الكلمات المفتاحية

إدارة المشاريع، إدارة مشروع البحث، البحث الأكاديمي، البحوث التعاونية، التعاون الأكاديمي والصناعي.

Introduction

Over recent years, public and private organisations have become increasingly involved in collaborative research projects with academic institutions and partners. This is in contrast to the more traditional approach of the past whereby research was mainly conducted within the confines of universities and research institutes where only the results were transferred into industry (Perkmann et al., 2013). This increase has been attributed to rapid technological advancement, increased global competition, and reduced product lifecycles for those organisations operating within industry (Abu-Rumman, 2018b). For academic institutions, pressure to collaborate more with industry has stemmed from rising costs, reduced funding and the rapid growth in new knowledge (Ankrah and Al-Tabbaa, 2015).

Both industry and academia have been promoting the development of a stronger partnership approach to generate mutual scientific and economic benefit and to tackle the challenges that arise from conducting research that neither can resolve in isolation (Oesterle and Otto, 2010). It has been argued that collaborative working of this type can enhance national competitiveness and wealth creation (Perkmann et al., 2013; Abu-Rumman, 2019), as well as delivering individual benefits for industry; such as greater invention and profitability, and for universities; enhanced academic results and funding opportunities (Philbin, 2008). In support of this view, Wohlin et al. (2012), argue that collaboration helps to support quality improvement in industry whilst helping to ensure that there is industrial relevance within academic research. Furthermore, in relation to strategic theory, university-industry cooperation is viewed as a key functionality of industrial clusters and is recognised as a significant innovation strategy (Nomakuchia and Takahashib, 2015).

Although the volume of research into industry and academic collaboration is starting to increase, there are still significant gaps in understanding about how best to manage joint research projects and the body of evidence is somewhat fragmented in this respect (Ankrah and Al-Tabbaa, 2015). Furthermore, much of the research on university-industry collaboration has focussed mainly on traditional market-economy countries rather

than the experience within developing countries such as Jordan (Vadi and Haldman, 2010). Therefore, this study makes a valuable contribution towards the strategic debate on university-industry collaboration and adds to the body of evidence in this field which may be of interest to those working within industry and academia, as well as policy makers.

Challenges of Collaborative Research Projects

In essence, project management is the skill of planning and the application of organisational effort with the intention to achieve a specific goal. It is commonly seen as being one of the main ways of assuring the quality of a project and is critical when working in collaborative environments which are often more difficult to manage and control (Van der Merwe, Gerber and De Vries, 2015), and where conflicts of interest are more likely to exist (Nomakuchi and Takahashib, 2015).

According to Oesterle and Otto (2010), the aim of collaborative research project is to solve a research problem as opposed to following a pre-defined service or product description. From their qualitative study of the use of project management within the academic context, Rioli and Thuillier (2015) identify that classic project management methodologies do not always adequately address the human factors and uncertainties that are inherent in collaborative research projects.

The scientific research cycle is said to comprise of five key phases including: idea conception; research plan; execution of plan; the dissemination of research findings; and project closure (Rioli and Thuillier, 2015). According to Mustaro and Rossi (2013) these phases are aligned to the key stages of a project which the Project Management Institute (2017) identifies as: initiation; planning, execution; monitoring and controlling; and closing. A summary of this alignment between the steps taken in research and in project management is illustrated in Figure 1:

However, with research projects it is not always clear from the outset what the research outcomes will be and projects can frequently change direction; a view that is supported by Huljenić, Dešić, and Matijašević,

ment with draws on organisational contingency theory. In this way the approach taken to project management is considered to be the structural variable that needs to be adapted based on different internal and contextual contingencies in order to ensure the effectiveness of the management of the research project.

From their study of project management methodology used in collaborative industry and university projects, Chin, Yap and Spwage (2011) aimed to develop an adapted version of traditional project management that was suited specifically to the unique nature of the industry-university environment. Their model included an emphasis on the planning phase of research projects, and on communication throughout the implementation phase. This is a view supported by Ankrah and Al-Tabbaa (2015) who also argue that the planning phase in the project management of collaborative research projects is crucial. They propose that a common organisational structure for the project is established and that the project is conducted under the direction of an overall Project Manager who is appointed by the different partners. They also emphasise the importance of equal participation by members of the project team representing the different partners and identify the project plan as being key to the successful delivery of collaborative projects with final deliverables clearly defined and measures of success specified to avoid any conflict between partners during the course of the project.

According to Brocke and Lippe (2015), other drivers for success in the management of collaborative research projects include: careful management of the project vision to ensure all stakeholder views are aligned; ensuring compatibility amongst partners involved in the project and early discussion of expectations around ways of working; getting the balance between flexibility and firmness in the planning and monitoring of the project; and having a skilled project manager in post to oversee the project who is able to demonstrate the competencies of diplomacy, technical excellence, delegation and a participative leadership style.

(2005), who argue that research projects require constant adjustment and adaptation which is something that traditional project management planning and scheduling tools used often in industry find problematic. Furthermore, Singer (2010) argues that research projects are very different to other types of project by their very definition; stating that if the outcome of a research study was predictable, there would be likely to be no need to conduct the study. She further asserts that in research projects there is often no predictable start or end, funding can be conditional or unstable, and proposes that the levels of uncertainty at each different stage of the research project would constitute an unacceptable risk in most other project settings making industry partners wary.

Collaborative research projects are therefore faced with many challenges in relation to the implementation of effective project management given that the problem-solving focus is frequently associated with high levels of risk (vom Brocke and Lippe, 2015). Furthermore, they comprise of heterogeneous project partners who are not co-located and who tend to be more individually than group oriented, and experience pressure in terms of delivering creativity and innovation (Calamel et al., 2012; Abu-Rumman, 2018a).

With such projects the need to maintain flexibility within a controlled environment is key to success to enable the 'learning by doing' principle so commonly associated with research (König et al., 2013). In addition, the wide diversity of partners involved in collaborative research projects inevitably leads to differences in relation to project goals, their approaches to project management, and their perceptions of project success (Lippe and Brocke, 2016).

According to Fernandes et al. (2016), the applied style and approach of project management is heavily dependent upon the context of an organisation such as its structure or industry sector, its size and the external environment in which it operates. Therefore, collaborative projects spanning both industry and academia where very different organisational cultures, motivations and contexts exist can prove problematic (Cooke-Davies, Crawford and Lechler, 2009; Casey, 2004). With such projects, Lippe and Brocke (2016) recommend a situational approach to project manage-



Figure 1
Alignment of Key Research Study Activities against Project Management Dimensions

Source: PMBOK (2013)

Context to the study

The focus of this study was industry and academic organisations based in Jordan. This middle-income country, located in the Middle-East, is relatively small with an estimated population of around 6.5 million people (Al-Hamdan, Manojlovich and Tanim, 2017, Al-Abbadi et al., 2019). Around 30 public and private universities exist serving an estimated quarter of a million students (Ministry of Higher Education and Scientific Research, 2017). In recent years, the Jordanian government has implemented a significant reform agenda to promote growth and innovation in the country with a view to expanding foreign trade and increasing competitiveness (Alhajahmad and Lockhart, 2017). Industry and academic collaboration is key to achieving this aim (Jordan Chamber of Industry, 2018).

Aims

This study aimed to explore how different approaches to project management utilised by those working in industry and those working within academia impact on collaborative research projects, and to identify to what extent project management tools and techniques can be applied to research projects given their distinct and unique nature. It also aimed to generate suggestions for how collaboration between industry and academia could be strengthened in the future.

Methodology

This study adopted a phenomenological theoretical approach to explore the experiences of using project management in collaborative research. Phenomenology focuses retrospectively on lived experiences (Conklin, 2007), and according to Finlay (2009), provides an inductive methodology to allow for the systematic exploration of what individuals are really feeling and experiencing and therefore it was considered appropriate for this study. A mixed methodology using a survey and follow-up interviews was used to gather the required data. Although critics such as Lincoln (2009) argue that quantitative and qualitative methods are not compatible, others such as Creswell (2014) and Doyle (2009) propose that a mixed methodology can increase validity and result in a more robust analysis that could otherwise not be achieved and so was therefore felt to be relevant for this study. Furthermore, whilst phenomenology usually lends itself to solely qualitative research methods, Mayoh and Onwuegbuzie (2013) argue that phenomenological research methods can also work well as a component of mixed methods approaches.

The participants were selected from two large universities based in Jordan and from three 'industry' organisations who had previously participated in collaborative research projects with the identified universities. Two of the three selected 'industry' organisations represented medical care, and one represented the financial banking sector. In total, 60 individuals were invited to participate in the study (10 from each industry organisation and 15 from each of the university organisations).

Following agreement with the respective organisations to conduct the study, a purposive sampling approach was adopted and professionals who had been previously involved in the collaborative projects were contacted and invited to take part in an anonymous online survey to share their views.

The questions for the survey were derived from reviewing the current literature and identified the most commonly cited project management tools and techniques that are used. It also asked for views about the enablers and inhibitors to effective project management in collaborative research studies.

Those who completed the survey were also invited to participate in a short semi-structured interview to explore their experiences in more depth. Such participants identified their interest via the online survey. Assurances of confidentiality were given.

The interview questions were developed in response to the survey findings to explore the specific issues raised in greater depth. The interviews themselves were conducted face-to-face using a semi-structured interview schedule and lasted around 45 minutes each, with transcripts being produced post interview and shared with participants to confirm accuracy. The data collection period spanned 6 months due the limited availability of participants for interview. A summary of the methodology is provided in Figure 2:

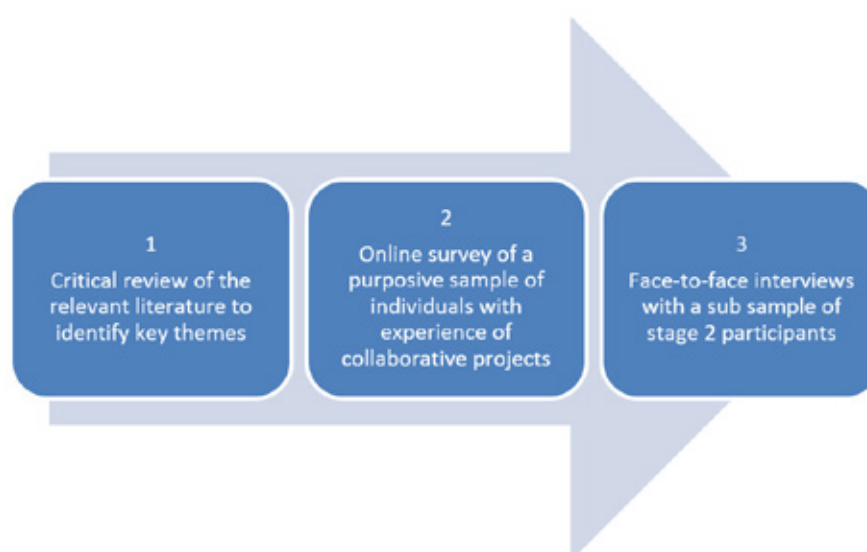


Figure 2
Methodological Approach

Key Findings

Online Survey

Response Rate

Overall, there were 51 respondents to the survey giving a response rate of 85%. 49% (25) of respondents came from industry and the remaining 51% (26) came from a university background.

Background of Respondents

All of the respondents had previous experience of being involved in collaborative research projects involving the university either as a team member, a project manager or as a project sponsor.

Use of different formal project management techniques

Respondents were asked to rate to what extent they currently use different formal project management techniques in practice including different planning, analytical, estimating, monitoring, controlling and evaluation tools.

The scale used was as follows:

- 1 = Not Used
- 2 = Very Limited Use
- 3 = Limited Use
- 4 = Extensive Use
- 5 = Very Extensive Use

The scores were then aggregated and a mean score calculated in order to enable a comparison between industry and university respondents to be made. The findings are listed in Table 1:

Table 1
Comparison of Mean Scores between Industry and University Respondents against the usage of different Project Management Tools

Project Management Tools	Industry (mean score)	University (mean score)
Project Initiation:		
Assigned project sponsor	4.04	3.96
Bid documents	4.64	4.19
Business case	4.36	4.15
Business opportunity/problem definition	4.36	4.12
Needs analysis	4.20	4.00
Organizational capacity analysis	3.32	2.04
Project charter	2.48	2.77
Project mission statement	3.44	3.38
Project priority ranking	3.56	2.35
Requirements analysis	3.72	3.04
Scope statement	3.76	2.96
Stakeholder analysis	4.04	4.00
TOTAL:	3.83	3.41
Project Planning:		
Assignment of risk ownership	3.16	1.77
Bottom-up estimating	2.52	1.58
Communication plan	3.96	3.58

Contingency plans	3.80	3.27
Cost/benefit analysis	3.92	2.88
Critical chain method & analysis	2.96	1.46
Critical path method & analysis	3.32	1.85
Database for cost estimating	3.16	1.92
Database of risks	3.00	1.58
Gantt chart	4.48	4.00
Graphic presentation of risk information	2.60	1.58
Graphic representation of portfolio	2.72	1.50
Kick-off meeting	4.28	3.85
Milestone planning	4.16	3.92
PM software for cost estimating	3.00	1.38
PM software for multi-project scheduling	3.36	2.58
PM software for resource scheduling	3.36	1.85
PM software for task scheduling	3.84	2.77
Quality plan	4.28	3.62
Ranking of risks	3.20	1.77
Responsibility assignment matrix	3.84	3.54
Risk management documents	3.84	2.58
Team development plan	2.84	1.69
Top-down estimating	2.56	1.62
Work breakdown structure	4.00	3.54
TOTAL:	3.45	2.47
Project Execution:		
Monitoring critical success factors	3.68	3.19
PM community of practice	2.56	1.50
PM software for issue management	3.44	1.92
PM software for monitoring of cost	3.32	1.69
PM software for monitoring of schedule	3.80	2.42
PM software for multi-project resource management	3.36	1.77
Progress report	4.40	4.00
Project procedures manual	2.80	1.38

Project scorecard/dashboard	3.40	2.19
Project Website	2.20	1.50
Self-directed work teams	4.32	4.15
Team building event	3.12	1.81
Timesheets linked to project activities	3.28	1.73
Updated business case at gates	3.80	3.46
Value analysis	2.92	1.46
TOTAL:	3.36	2.28
Project Control:		
Change control board	3.00	1.38
Change request	3.28	1.62
Client acceptance form	3.16	1.65
Contract penalties	3.60	2.35
Contractual commitment data	3.72	2.38
Financial business benefits metrics	4.12	3.35
Non-financial business benefits metrics	3.44	3.42
Stage gate reviews	3.80	2.88
Trend report	3.60	2.35
Work authorization	3.32	1.69
TOTAL:	3.50	2.31
Project Closure:		
Customer satisfaction surveys	3.20	1.77
Database of lessons learned	2.80	1.58
Lesson learned/post-mortem	3.56	2.69
Medium-term post evaluation of success	3.80	3.46
Project closure documents	3.84	3.00
TOTAL:	3.44	2.50
Overall Mean:	3.50	2.57

Table 2
T-Test (paired two sample for means)

	Industry	University
Mean	3.503283582	2.572835821
Variance	0.314431479	0.883072139
Observations	67	67
Pearson Correlation	0.874033751	
Hypothesized Mean Difference	0	
Df	66	
t Stat	14.48699776	
P(T<=t) one-tail	1.77184E-22	
t Critical one-tail	1.668270514	
P(T<=t) two-tail	3.54367E-22	
t Critical two-tail	1.996564419	

The application of a t-test (paired two sample for means) shows that the difference between the ratings of industry and university respondents is significant at $P < 0.05$ (as shown in Table 2). It implies that formal project techniques are used much more in the industry organisations than the universities.

Project Management Compatibility

Respondents were then asked to indicate to what extent they felt that industry and universities work well together on collaborative research projects based on their previous experience.

The results suggested that those who work in industry are more positive about the working relationship on collaborative research projects than those working in the university; although a third felt that the two did not work well together. This situation is illustrated in Figure 3 below:

Respondents were then asked for their views on the compatibility of project management approaches between the university and industry-based organisations. The majority of respondents agreed that the different approaches were compatible to 'some extent', with university respondents tending to be more positive than their industry counterparts (as shown in Figure 4).

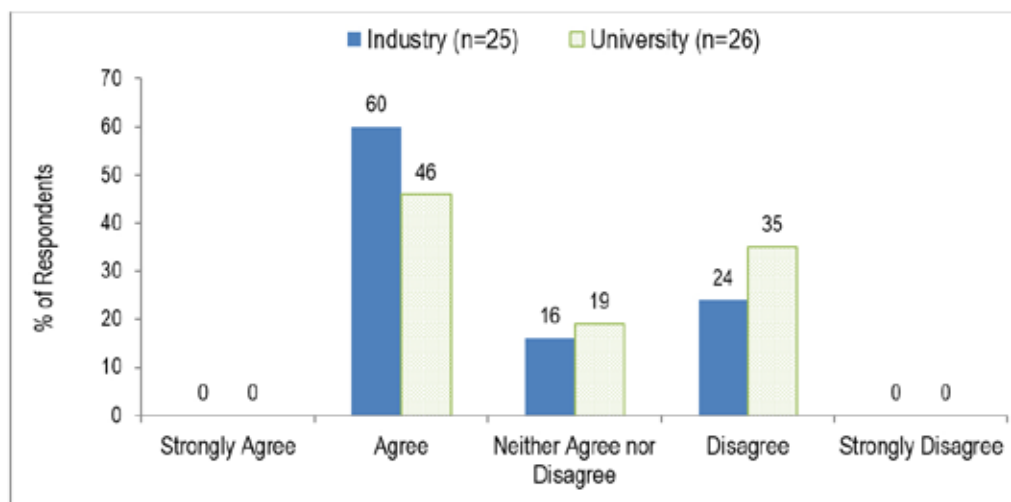


Figure 3

Based on your experience, to what extent do you agree that industry and universities work well together on collaborative research projects?

Improving Collaboration

When asked what would make the most difference to improving the way industry and universities work together on collaborative research projects, agreed project management methodologies, better communication, and more administrative support came out the highest as shown in Table 3:

Interviews

In total, nine participants agreed to be interviewed as part of the study; three represented each of the 'industry-based' organisations and six were from the universities (3 from each institution).

The role of project management in collaborative research

All of the participants confirmed that they felt that project management had an important role to play in successfully delivering collaborative research projects. For the university participants, all stressed the increasing expectation from the university and from external funders that formal project management approaches are clearly demonstrated and felt that this was an expectation of industry also.

"There is definitely a much greater level of expectation from the university about using project management in research studies, and there is a greater emphasis on encouraging our students to do this also..." (Uni-

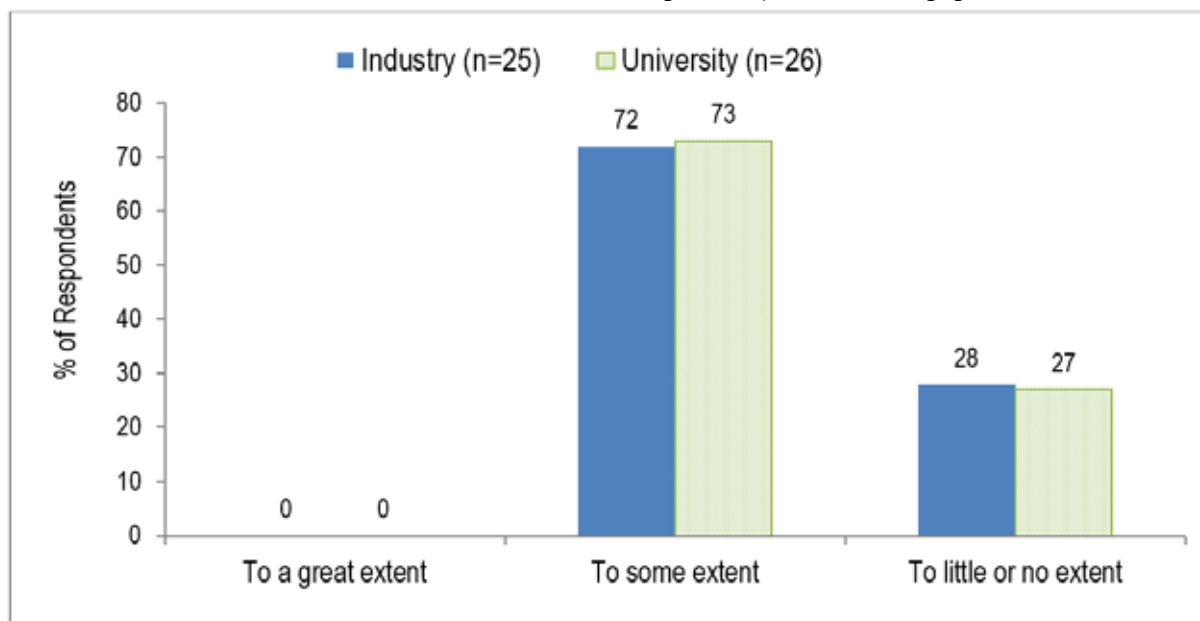


Figure 4

Based on your experience, to what extent do you think approaches to research project management between industry and universities are compatible?

Table 3

What would make the most different to improving the way industry and universities work together on collaborative research projects?

Factors	Industry (% Agree) n=25	University (% Agree) n=26	Overall (% Agree) n=51
Agreed project management methodologies	80%	65%	73%
Better communication	76%	62%	69%
Greater proximity to each other	56%	50%	53%
More administrative support	40%	58%	49%
Joint training	52%	42%	47%
Less bureaucracy	16%	46%	31%
More clearly defined roles within each organisation	48%	4%	25%
Greater senior buy in	36%	4%	20%

versity Interviewee)

"There is definitely a lot of support for increasing the amount of collaborative work we do with businesses." (University Interviewee)

However, some interviewees representing Industry indicated that whilst there was a drive to increase the number of collaborative research projects with universities, there was a lack of senior buy in from some.

"Some members of senior management are really keen for us to proactively seek opportunities to work with the universities on projects to deliver new innovations but others are less keen and can hinder the process." (Industry Participant)

And some expressed concern about the amount of time spent on project management:

"...the pressure to demonstrate adherence to plans, timelines and budgets is definitely taking away time from focusing on the research itself. Governance within research projects is important but it's not the main purpose..." (University Interviewee)

From an industry perspective, all participants indicated that project management was a well-established methodology for delivering projects, and suggested it was of even greater importance in research projects spanning different organisations:

"...we have a robust corporate approach to project management and I think this is particularly important when you are working across organisations, especially when it involves organisations like universities where protocols for managing projects are sometimes different..." (Industry Participants)

However, most of the university interviewees indicated that formal project management was much less well established in the university setting, and that in order to improve collaborative working on projects with industry, there needed to be a focus on using agreed project management methods and a common language around project management.

"I think we talk a different language when it comes to project management – we're probably using similar approaches but in industry it's packaged up as something else..." (University Interviewee)

"It would be useful if we all used the same methodology and had a common approach to project management of research studies." (University Interviewee)

"A common and clearly defined project management approach would help collaboration between us and university partners." (Industry Interviewee)

The distinct nature of research projects

Whilst all participants felt project management had a role in the management of research projects, three indicated that they had taken part in research studies that did not lend themselves to a formal project management approach. One participant explained how they had been involved in an action research project where the ongoing feedback had changed the direction of the project considerably making it difficult to adhere to fixed

timelines and schedules. Another described how undertaking exploratory research meant that greater flexibility in plans and schedules was needed.

"One project I was involved in began by investigating one particular phenomena but then on the basis of what we were learning, moved into focussing on something different all together. That's just the nature of some research projects and so any approaches to project management need to be able to cope with this level of uncertainty... I don't think my industry counterparts quite got that..." (University Interviewee)

"It's been an eye opener to me... research projects are very different to other types of project I've been involved in." (Industry Interviewee)

These participants all emphasised how the purpose of research projects differed to other types of project with the focus on knowledge creation rather than the delivery of a more tangible 'product'. They also indicated that the way in which success is measured for research projects (taken account of factors such as reliability, validity and replicability) differs from that of other types of project.

Most of the participants could identify with the project stages outlined by PMBOK (2013) and could identify how the different key research phases could be aligned to this.

"I think the traditional approach to undertaking research is very much aligned to the steps outlined in modern project management from the initiation of a study through to its completion." (University Interviewee)

"Although the nature of research projects is different, I still think the key steps of project management apply." (Industry Interviewee)

However, industry participants expressed some frustration at the lack of formal processes used by the university in each of the project stages.

"...we have standard proformas and processes for monitoring and signing off different stages of a project but some of the university staff I've worked with seem to struggle with that..." (Industry Interviewee)

"I'm not sure that the universities share the same sense of urgency in relation to ensuring targets are met on time and within budget. There was often a lot of requests for changing the project plan..." (Industry Interviewee)

Strengthening Collaboration

All participants stated that they felt that industry-university collaboration was important and the way forward in terms of delivering robust research which can drive quality improvement and innovation.

It was recognised by all those taking part that research projects and collaborative projects have their own unique challenges, but it was felt that a shared approach to project management, which adopted some of the formality of project management systems within industry, whilst acknowledging the need for greater flexibility and adaptability in project plans required by the university, would work best.

"...I think if we could reach some common ground where we are all using the same language in relation to project management, but where we appreciate the changing nature of research studies and build in some flex-

ibility; that would be good." (Industry Interviewee)

"Things change often in research, as you gain new insights and knowledge, but it's unrealistic to think that this does not need some sort of structure and framework to ensure it delivers credible and quality results." (University Interviewee)

Joint training prior to embarking on collaborative projects was proposed as one option for overcoming differences in approach, and the need for identified administrative support was also raised.

"Some initial joint training between those who are going to be involved from my organisation and those from the university could be beneficial so we're all on the same track." (Industry Interviewee)

"Some additional admin support would make a huge difference in terms of ensuring the communication trail is kept going effectively." (University Interviewee)

Communication was also identified as a key factor involved in improving collaboration. Interview participants suggested that better use of technology could assist with facilitating better communication.

"Communication is key but is sometimes difficult to get everyone together or to plan meetings. I think we could make better use of technology to help with this such as video and telephone conferencing." (University Interviewee)

"As with all projects, good communication is essential. I think this is something we could improve with technology. Transferring and sharing data electronically due to information security issues is always a problem and there must be a way of addressing this." (Industry Interviewee)

Discussion

It is clear from the findings that there was general support from both industry and university professionals for the use of formal project management techniques in the delivery of collaborative research projects, and that there is an increasing expectation from both academic institutions and external funders that a formal project management approach should be used.

Similar to the findings in other studies (Riol and Thuillier, 2015; Mustaro and Rossi, 2013), interview participants in particular were able to identify how the different stages of collaborative research could be aligned to the different stages of formal project management, but there was frustration expressed by some, particularly university participants, about the amount of time the administration aspect of project management takes and how this can detract from the quality of the research itself due to not being able to devote sufficient time to areas such as analysis and interpretation as a result of the administrative demands.

In terms of types of project management approaches and tools used, it was evident that the use formal project management tools and techniques was more embedded within the practices of the industry organisations rather than the universities. The results suggested that for the university respondents, the initiation and closure stages of a project were perceived as areas where formal project management tools are most likely to be used. For the industry respondents, the initiation stage of a project was also highlighted, but the stages of planning, control and execution were also more highly rated for using formal project management techniques.

For the universities, it was apparent, that electronic tools in particular were perceived to be much less used to assist with project management than in industry, along with certain types of project analysis techniques such as critical chain analysis and value analysis. It could be argued that although the universities within this sample were 'forward thinking' and in the process of transitioning towards a more entrepreneurial model or working, some of the systems and process that are used in these institutions, and in academia more generally in developing countries such as Jordan, are still quite traditional in their focus.

The results also indicated that although the majority of industry respondents felt that based on their experience, industry and universities work well together on collaborative research projects, over a third of university respondents disagreed. However, there was a general consensus between the industry and university respondents around the compatibility of the approaches to project management, with around 70% of both industry and university respondents indicating that they were compatible 'to some extent'.

Consistent with the findings from other studies such as that by Chin, Yap and Spwage (2011), and Lippe and Brocke (2016), it was apparent from this study that professionals from both industry and university recognise that the unique nature of research projects needs to be taken into account when applying project management methodology effectively. It was suggested that a higher level of flexibility and adaptability needs to be incorporated into the process, and in terms of strengthening collaboration, communication was identified as being of key importance along with using common project management methodologies and language.

Conclusion

Overall, this study aimed to examine how different approaches and understanding of project management in industry and academia can impact on collaborative research projects in a developing country such as Jordan. With a growing interest and emphasis on the delivery of such collaborations, it is important to understand what aspects of project management both enable and hinder the success of this type of project.

Consistent with other studies it was evident that participants could see how the stages of undertaking research and project management were aligned, however, the unique nature of research projects was emphasised particularly in relation to their greater propensity to change over time as new knowledge is gathered which can steer the future course of the project.

The findings from the study also indicated that formal project management approaches were much more embedded within the industry organisations than within the case example universities. It appeared that more traditional tools associated with project initiation and closure were used in the university organisations, where the respondents from the industry organisations identified the use of a much wider range of tools and techniques spanning all of the different stages of a project.

Respondents from the industry organisations were generally more positive about their experiences of collaborative working on research projects than those from the universities. However, there was a consensus about the partial compatibility of the project management tools and approaches used by the two.

In conclusion, this study has generated new evidence to contribute towards the strategic debate on collaboration between industry and aca-

demia by providing insights into the perceived use of project management tools and approaches for joint research studies and on the factors that can help or hinder their completion.

Recommendations

Suggestions for improving collaboration on such projects in the future include:

- Make good use of technology to overcome communication barriers associated with geographical distance and issues associated with electronic information exchange between organisations.
- Agree the project management methodologies to be used from the outset and develop a common project management language between all partners.
- Acknowledge the unique nature of research projects and build in greater flexibility into project plans to allow for changes that may result from the acquisition of new knowledge during the data collection phase of the project.
- Consider the provision of joint project management and research training of all partners prior to the execution stage of the project to promote a common understanding for all those involved.

Limitations and areas for future research

Although this study has generated some new and useful information to add to the body of evidence in this field, it was a relatively small-scale study conducted within only two academic institutions and three 'industry' organisations based in Jordan.

There may be some merit in repeating this study over a larger sample incorporating the experiences of researchers from other academic institutions and industry settings.

Acknowledgement

The author would like to thank those who took the time to share their views and experiences of applying project management in collaborative research studies.

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