Research and Grant Management: The Role of the Project Management Office (PMO) in a European Research Consortium Context

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Abstract: *This paper illustrates how a university-based project management office (PMO) can provide focused support across the entire grant project lifecycle within a European research context. In recent years, EU (European Union) research and innovation grant programs have increasingly shifted to support multidisciplinary consortia composed of industry, academia and end-users, which collaborate to achieve tangible and sustainable socio-economic impact. This scope change, from traditional academic research projects to research and innovation projects, has created the need for professional project management and has provided a fertile environment for PMOs to flourish. The paper includes discussion of an illustrative case study based on the EDEN2020 project - an ongoing, international, multidisciplinary consortium project in robotic neurosurgery that is coordinated by Imperial College London and supported by a grant from the EU's Horizon 2020 research and innovation program. Imperial College's PMO provides project management and dedicated support to the academic team to enable delivery of the overall consortium project. In so doing, the PMO involved in EDEN2020 clearly adheres to the PMO roles identified by the PMBOK® standard, i.e. supportive, controlling and directive, albeit at different levels depending on the grant lifecycle stage. In EDEN2020, the PMO was predominantly confined to a supportive (advisory) role in the project's ideation and grant negotiation stages, a controlling (supporting delivery through standardization, templates) role in the proposal preparation stage, and a more directive (leading) role in project implementation. The paper concludes with a recommendation to increase the number of cases under investigation and expand the scope beyond Europe.*

Keywords: *Project Management Office (PMO); European Research Grant Management; Consortium Management; Horizon 2020; Collaborative Projects.*

Introduction

In order to facilitate successful research outcomes, universities and public research institutions are increasingly focused on providing adequate capacity in research administration and management. (Nguyen and Meek, 2015). In this context, faculty members and their research teams work with support and administration colleagues to enable the delivery of research projects that may be supported by a range of different funding sources, such as governmental agencies, industrial

companies and charitable foundations. Indeed, the process of managing the research grant itself may involve a number of professional service teams and departments at a university or research organization, such as a central research office, sponsored programs office as well as administration teams that reside at the departmental or divisional level. Moreover, faculty members increasing face pressure to secure research funding and especially where tenure is being sought (Reiser et al., 2015). Therefore, faculty members are required to work alongside research administrators, maintaining communication channels and a two-way flow of information if they are to successfully navigate the world of research grant management. This is required from the initial ideation stage through to proposal development and possible award of the grant followed by the eventual delivery of the project.

This process can run smoothly due to the joint working adopted by research administrators and faculty members, and especially in the case of more straightforward research grants, e.g. a research project based on the work of a single graduate student (i.e. at PhD level) or post-doctoral researcher. However, in the case of more complex projects, such as those involving large scale consortia with several research partners, there may be a number of challenges encountered (see the work of Philbin and Mallo, 2016). Such challenges include a lack of planning of how to engage all the partners, the need for financial and commercial work to be undertaken rapidly and in parallel with the development of the technical (academic or scientific) case, as well as the difficulties in estimating the true costs for complex research projects.

In the case of large scale projects that include a funded work package for project management, when the project has been awarded the principal investigator may need to recruit a new project manager to the research group in order to manage the project. Such a project manager may or may not also be a researcher on the project. While this approach has some merit, there can also be a number of obstacles encountered. There is the need for the new project manager to rapidly move up the 'learning curve' in terms of knowledge of the project and the university infrastructure (including processes and systems), and establish working relations with all the partners. Indeed, there may even be a hiatus in project delivery at the beginning of the project, while the new project manager is recruited, which can sometimes take several months to conclude, potentially delaying the start of the project. A further challenge is that the project manager may well be working without the support or guidance of any peer project managers plus there may be a lack of standardized tools and templates available to support the project management process. Dedicated project management resource is also an essential part of managing large scale research consortium projects, such as those funded in Europe by the European Commission as part of the Horizon 2020 program. In other work, recent studies (Rolland, Lee, and Potter, 2017) have highlighted how coordinating centers can provide four types of facilitation work to enable consortium initiatives to be delivered and these are as follows: (a) structural work; (b) collaboration-development work; (c) operational work; and (d) data work.

The traditional approach of resourcing the project management function in the academic department presents a number of challenges as described above and these issues can in some cases impede the progress of the project and have a negative impact on the project's performance. A potential organizational solution to address such challenges is to establish a so called project management office (PMO) in order to provide a dedicated resource as part of a focused strategy

to support the research administration and management of large scale research consortium projects. The PMO is an organizational structure that is established to nurture strong project performance through adopting supporting process models and a standardized approach to the delivery of projects (Dai and Wells, 2004). Moreover, the PMO approach can help ensure knowledge is shared across projects through the PMO essentially acting as a knowledge broker (Pemsel and Wiewiora, 2013) and is therefore ideally suited to the academic world and research projects where knowledge generation and dissemination is of paramount importance. In terms of the nature of a PMO, and although there can be a variance in the actual structure and resourcing adopted, it is likely to be based on a team of project managers that are supported by a back-office or administrative unit. The PMO adopts standardized processes and tools so that it can deliver a portfolio of projects across an organization or part of the organization, such as division or department.

Consequently, this paper will explore how a PMO can be configured and deployed at universities and public research institutions to support research grant management and this will be considered in the context of the European research funding landscape. An illustrative case study involving a European research consortium project will be described in order to identify the structure, processes and supporting strategies needed for a PMO to be successful, which will be helpful to practitioners and organizations looking to establish a new PMO.

Background on the Project Management Office (PMO)

The project management office (PMO) is an organizational unit that is established to improve the performance of projects through the provision of standards and methodologies, thereby leveraging knowledge on project management practices and also benefiting from lessons learnt through the delivery of multiple projects across the organization (Desouza and Evaristo, 2006). These benefits can also be viewed in terms of 'economies of repetition' through adopting best practice for routines and learning processes so that a growing portfolio of projects (and bids) can be delivered more efficiently and effectively (Davies and Brady, 2000). With foundations in the information technology (IT) and engineering sectors (Martin et al., 2007), PMOs are now becoming more popular in other sectors and in governmental organizations. The PMO approach has been implemented to support the operational delivery of projects and also as part of the development of strategic projects, where a PMO can help provide alignment of such projects with corporate strategy. More generally, a PMO can help organizations to maintain the delivery of projects according to the schedule, avoid cost overruns and generate the required project specification according to the defined quality levels, i.e. delivery according to the project's 'iron triangle'.

Previous research has identified various potential benefits for the PMO and this has been articulated in terms of corporate efficiency, client satisfaction as well as staff effectiveness, although such benefits would need to outweigh the costs of resourcing and operating a PMO (Desmond, 2015). The PMO has been found to support more accurate control of project information, for example, as reported by Bettin et al. (2010) in the case of a PMO established at a research institute. Further research has identified how a PMO can help ensure quality assurance

for projects (Andersen et al., 2007) and other work has shown how the PMO can help maintain alignment of projects with organizational strategy (Chen & Mo, 2008). The former of these two benefits can be regarded as an operational benefit and the latter may be regarded as a strategic benefit. This approach of considering a PMO from strategic and operational viewpoints has been extended further according to work by Philbin (2016), which identified both strategic and operational benefits for engineering projects managed by a PMO (as depicted in Figure 1).

While implementation of a PMO may provide scope for such benefits to be realized, there should however be caution. For instance, excessive levels of standardization may even hinder flexibility and creativity, which are essential components for research projects. Establishing a new PMO should also take account of the specific organizational context so that a PMO structure and processes are designed to accommodate the needs of the organization and relevant stakeholders. In regard

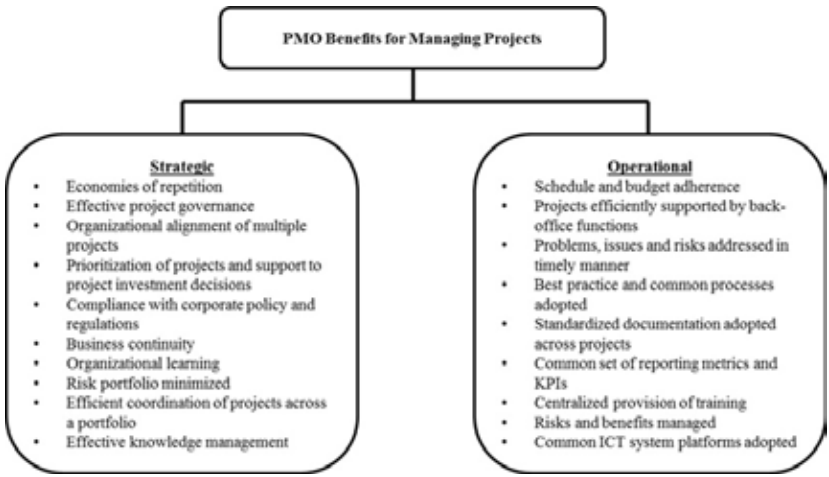

Figure 1. Benefits of the PMO approach for managing projects (adapted from Philbin, 2016).

to the classification of the PMO, the Project Management Body of Knowledge (PMBOK®) has identified three types of PMOs, which are supportive, controlling and directive (PMI, 2013). Table 1 provides a summary of the characteristics for these three types.

As can be observed from Table 1, all three types of PMO support adoption of a standardized approach to managing projects that will likely include provision of standard project documentation, templates and tools (i.e. management products), which enable delivery of the project outputs (i.e. technical products). The PMO effectively provides a portfolio (or program)

Table 1. Summary of the characteristics for PMO types identified by the PMBOK® (PMI, 2013).

PMO Type	Main Characteristics
Supportive	• Providing a consultative role for projects as part of the provision of documentation, templates, project management best practice, training, access to project information in addition to lessons learnt from other projects. • Acting as a knowledge repository for organizational project management. • The degree of control exercised by the PMO is low.
Controlling	• Supporting and crucially ensuring compliance of projects according to a range of control levers, namely through the adoption of appropriate project management standards, using specific templates, documents, forms or via conformance to required governance arrangements implemented by the organization. • Acting as a control mechanism to ensure standardization of projects. • The degree of control exercised by the PMO is moderate.
Drective	• Providing direct control of projects through provision of project management services to enable delivery of projects. This is accompanied by systems and processes to ensure compliance with project management standards and organizational protocols. • Acting as a central project management resource for the organization. • The degree of control exercised by the PMO is high.

level oversight of projects to maintain the performance of projects and quality levels according to defined key performance indicators (KPIs). Therefore, adopting a PMO approach to managing projects at universities and independent research organizations that are engaged in the delivery of research projects offers significant potential.

Exploring the PMO role in EU-funded research and innovation grants

European grant programs for research and innovation provide ample opportunity for PMOs based at academic institutions to add value. Acknowledging the need to foster intra-European collaboration and integration as well as leveraging economies of scale, the European Commission has supported collaborative research projects since 1987 - when the first Framework Programme for Research and Development was launched. Since then, the related European budgetary

envelope has grown steadily - surpassing €70 billion for Horizon 2020, the EU's main funding program for research and innovation for 2014-2020 (European Commission, 2013). Alongside Horizon 2020, a range of other funding programs currently exists, which exclusively or partially provide grant-based funding for research projects, e.g. Interreg Europe, the European Regional Development Fund (ERDF), EUREKA or the European Commission's Joint Programming Initiatives.

Despite differences in thematic outlook and eligibility rules, European grant programs in this field almost unequivocally fund collaborative projects in which a consortium of project partners work together on a shared (research and innovation) challenge. Funding is generally allocated competitively, with the most excellent proposals being retained for funding. Traditionally, European grant programs have focused on facilitating joint research and co-publication between European academic institutions and research performers. Due to this emphasis on research, project management was often taken-up by the (team of the) principal investigator coordinating the project. More recently however, the scope of European research grant programs has widened beyond their traditional academic realms. Programs such as Horizon 2020 increasingly aim at bolstering the innovation capacity of Europe by funding impact-oriented research and innovation projects. Such projects are required to have clear outputs and provide tangible benefits for the economies and societies of European states. In these projects, partners from industry, (local) authorities and end-users collaborate alongside universities and research performers on developing or refining innovative products, solutions, services or processes. As such projects span larger areas of the innovation chain, involve different stakeholders and in effect have become more complex; the need for standardized and professionalized project management has therefore increased.

At European level, grant programs for research and innovation are generally over-subscribed and only the very best proposals are retained for funding. Cuts in the research and development (R&D) budgets of many EU Member States, coupled with a broadened scope of European research programs have resulted in significant levels of competition. For instance, the average success rate for a Horizon 2020 application currently stands at 10.7% (European Commission, 2016). Consequently, being excellent in this regard is not confined to research only: proposals are evaluated on a wide range of non-research related aspects, such as the socio-economic impact and visibility of the envisaged project as well as the project and risk management processes and competencies. This concretely means that more than ever - and already at the application stage - a European research and innovation project entails the involvement of a wide range of non-related research roles. Such requirements add further weight on the shoulders of the researcher (principal investigator) coordinating the grant proposal (and later, project). Projects have become more complex and the skills and knowledge requirements to successfully complete a European grant application and project often exceed thematic scientific knowledge. Whereas coordinating researchers can be expected to be masters of their academic domain, requirements for them to be an equally competent project manager, innovation manager, business developer, stakeholder manager or dissemination manager would be challenging and undesirable as it could entail a deviation from their core capability, namely conducting academic research alongside their teaching responsibilities. This supports the need for dedicated project managers to be employed by universities engaged on such consortium projects, who can provide close support to academic

teams as part of a professional and focused project management service.

The collaborative yet competitive nature of European-funded research and innovation projects, combined with a change in programmatic outlook and broadened skills requirements provides a fertile ground for university-based PMOs to flourish. As Figure 2 shows, PMOs can act as the linchpin between the grant-making authority (i.e. the European Commission), project partners (including academic and non-academic entities) and academic support such as faculty administrations or central research offices. In this regard, the PMO can interpret and convey needs and expectations of different project parties while ensuring that the coordinating academic institution delivers the project according to the aforementioned iron triangle of project needs.

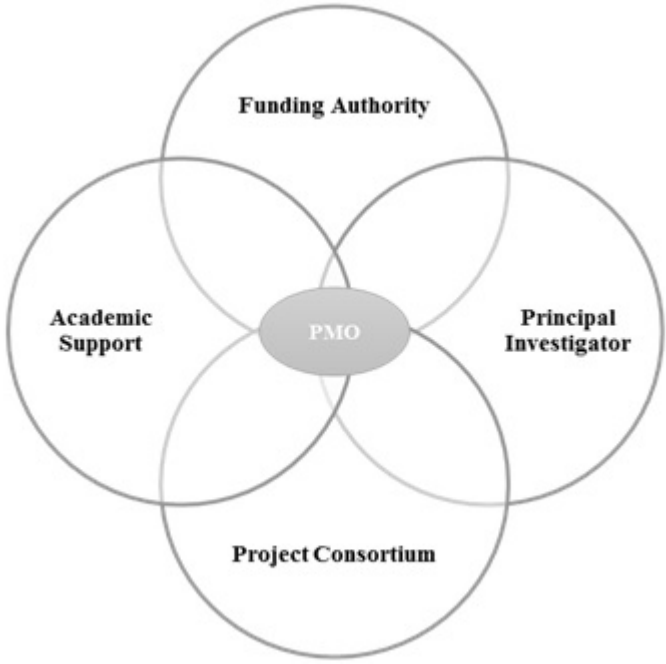

Figure 2. Positioning of university-based Project Management Office (PMO) among stakeholders involved in European grant applications.

Within a European research and innovation grant context, PMOs can deliver meaningful support across all five phases of the grant cycle (see Figure 3). In accordance with PRINCE2® definitions (Office of Government Commerce, 2009), which is a United Kingdom (UK) standard for project management, all such phases can be regarded as distinct projects as they are unique, have a (more or less) defined start and end date, aim to introduce changes into the organization and bring together people with different skills and backgrounds. Adopting a process-driven approach for supporting research projects provides various advantages, such as ensuring project tasks are properly costed and scheduled as well as ensuring all the project deliverables are specified and risks are managed.

Figure 3. Phases of the grant lifecycle (Authors).

In a European academic context, PMOs can fulfil the three roles as identified in the PMBOK® (Table 2). Logically, a supportive PMO has the most confined role. This PMO type generally relates to the pre-submission, ideation stage of a grant - when a researcher is scoping the possibilities to submit a proposal and actual proposal submission is not yet certain. The main value-add for PMOs in this capacity is to act as an advisor or trainer, advising researchers aspiring to coordinate a project on grant requirements and the feasibility of the project idea. A supportive PMO often shares its experience without the ambition to partake in the actual project should it be retained for funding. In an academic context, the role of a supportive PMO might even be comparable to other academic support bodies such as research grant offices or technology transfer offices (TTOs) as it acts largely in an advisory capacity and retains relative proximity to the actual project or proposal. A supportive PMO might often work together with the aforementioned bodies to ensure an optimal relay of expert advice. Although a supportive PMO's natural focus is the ideation phase, it can also assist during the other stages of the grant lifecycle.

Table 2. Summary of the characteristics for a university-based PMO in a European research and innovation grant funding context, according to PMBOK® definitions (PMI, 2013).

PMO Type	Main Characteristics
Supportive	• Advising on calls for proposals and grant requirements. • Sharing project management best practices. • Facilitating set-up of the research team and networking with potential consortium partners. • Providing training on consortium management where required.
Controlling	• Helping to prepare and submit grant applications to the funding body. • Ensuring adoption of project management best practices. • Ensuring usage of standardization tools (e.g. costing spreadsheets) and templates (e.g. risk registers). • Providing input in project resourcing decisions.

Drective	• PLeading the preparation and submission of grant applications. • Managing the research project according to defined project management standards. • Ensuring the project is implemented according to budget, schedule and specification criteria as specified in the proposal. • Conducting risk management and associated mitigation throughout the project. • Engaging in non-research related project tasks, such as consortium management, communication & dissemination activities, innovation management, research commercialization and stakeholder management. • Leading on reporting to the grant authority. • Managing project closure and ensuring the necessary documentation is completed according to the grant authority's requirements.

A controlling type of PMO is more actively involved. This PMO type is often prevalent during the preparation phase of a grant proposal - when a project idea has been positively assessed and the decision has been taken to pursue the project. During this phase, a controlling PMO provides the coordinating researcher with feedback on the ongoing grant application. PMO staff may proof-read, pre-evaluate proposals and actively ensure that project management best practices or expertise on budget or staff allocation are integrated in the grant proposal. Furthermore, the PMO may facilitate proposal submission by providing the coordinating researcher with standardized templates. A controlling type PMO however does not drive bid submission and is not necessarily engaged in the eventual execution of the project.

A directive type PMO actively takes charge of a grant application. Although the coordinating researcher retains overall responsibility for the grant submission process, the PMO acts as a bid manager, which drives the delivery of elements required for a complete, high quality bid submission. The PMO coordinates the bid team and ensures inclusion of its knowledge on project management, funding requirements (and possibly other elements related to the bid such as innovation management or communication and dissemination) in the submission. The PMO also uses its experience of funding programs and bid/project management, coupled with standardized templates and processes in order to support the academic team. A major task for a directive type PMO during the proposal phase is to shield the technical writing team from outside influences, ensuring that the writers can solely focus on achieving technical excellence. This is comparable to the role of a project manager in the agile project management approach (DSDM, 2014). As such, a major level of engagement entails a significant allocation of resources, a directive type PMO often partakes in proposal preparation with the intention of providing the project manager resource once the proposal has been awarded grant funding. It does so alongside the coordinating researcher

(i.e. principal investigator), who retains the scientific lead role and is the overall coordinator of the project.

A directive type PMO supports the coordinating researcher during all phases of the project lifecycle from ideation to project closure (as depicted in Figure 3). Once a bid has been submitted, the PMO can assist in grant preparation. The grant preparation and negotiation phase commonly involves the completion of administrative details and negotiations between the funding authority and the project consortium and internal negotiations amongst project partners on for instance intellectual property (IP) or payment provisions. A directive type PMO can drive the grant preparation process, ensuring to liaise with the administrative teams from participating project partners in order to submit the required documentation (e.g. bank and contact details) to the funding authority.

Once the project has commenced, a directive type PMO takes responsibility for project management, ensuring delivery according to specification, time and budget. It acts alongside the coordinating researcher who is responsible for the project and the overall quality of the technical and scientific project work packages. Depending on arrangements with the coordinating researcher and in-house expertise, the directive type PMO might lead on work packages in addition to project management, e.g. communication and dissemination, innovation management or managing stakeholder relations. Similar to the preparation phase, a distinct value-add of the PMO is that enables focus within the technical team by ensuring to take on-board tasks such as project management, administration and reporting, contact with the funding authorities, quality assurance, risk management and auxiliary tasks (e.g. project communication, stakeholder management or innovation management). Also in the final phase of a project, the closure phase, a directive type PMO can have a meaningful role as it may help with preparing the final reports and reviews and paving the way for project audits. These activities are administrative in nature and as such project researchers are keen for project management support from the PMO to help in regard to the coordination and production of the required documentation. Conversely and in the case of technical publications (e.g. journal and conference papers), the researchers would take the lead on drafting and submission of the manuscripts to the relevant publication or conference. This differentiation in work is consistent with the PMO leading on management and administrative tasks, thereby allowing researchers to focus on the scientific aspects of the project.

PMOs in a European grant management context add value in multiple ways, helping the coordinating academic institution to attain numerous operational and strategic advantages. At a strategic level, PMOs foster economies of repetition, ensure compliance and alignment with the institution's mission and vision and facilitate organizational learning. Bid and project management is not pursued in relative isolation at faculty or research group level, but rather at the higher, central level. Given a larger pool of bids and projects, more opportunities exist to gather and share expertise and knowledge. Strategic advantages of PMOs are particularly relevant for European grants for research and innovation: sunk costs for preparing such proposals are often significant, with relatively modest chances of being retained for funding. It is therefore paramount to pursue those opportunities that align clearly with the institution's goals in a focused and professional manner. These strategic advantages are ultimately supported by more practical operational advantages. Despite thematic differences or funding rules, European grant programs for research

and innovation operate in largely similar ways, thus enabling standardization of work through the use of templates, facilitating common reporting metrics as well as the build-up of efficient and effective European project management expertise.

Case Study: The EDEN2020 project

The Enhanced Delivery Ecosystem for Neurosurgery in 2020 (EDEN2020) project serves as an interesting case for assessing the operation and strategy of a university-based PMO in a European context. As the project is still ongoing, the EDEN2020 case study is assessed from early 2015 until late 2016. This period covers the inception of the proposal idea, the proposal submission, grant preparation and first six months of project implementation.

EDEN2020 is a four-year project that started in April 2016 and is coordinated by Imperial College London in the United Kingdom. The project has received funding under Horizon 2020, the EU's Research and Innovation Programme under grant agreement no. 688279. As such, it was one of the thirteen proposals retained for funding out of 194 submissions under the Horizon 2020 ICT-24-2015 call for proposals (European Commission, 2015).

In EDEN2020, eight partners from academia and industry collaborate to progress the scientific and technological state-of-the-art in the area of minimally invasive neurosurgical treatment, with an initial focus on brain cancer. In EDEN2020 a robotically-steered system for neurosurgical interventions is developed which will feature enhanced autonomy, surgeon cooperation, targeting proficiency and fault tolerance. This system will be supported by a range of steerable and flexible catheters which can be deployed robotically alongside research into new drug diffusion models and real-time imaging techniques. In doing so, the consortium aims to provide a step-change into today's approach to brain disease management and contribute positively to the quality of life of cancer patients, by ensuring increased efficacy and accuracy of drug diffusion and neurosurgical interventions (EDEN2020, 2017). In addition to Imperial College London, the EDEN2020-consortium consists of the University Medical Center Groningen (UMCG), Politecnico di Milano (POLIMI), Renishaw PLC, Technische Universität München (TUM), the University of Milan (UMIL), The San Raffaele Hospital (OSR) of Universitá Vita-Salute San Raffaele (UniSR) and Xograph Healthcare.

Imperial College's Programme Management Office (the PMO) provides management and administrative support for collaborative research programs and commercial projects coordinated by academics from its institution. The PMO team at Imperial was established in 2014 and includes both staff previously employed by the university as well as new staff. The team is part of Imperial's Enterprise Division, which provides management support for the development of partnerships with industry, delivery of business ventures, entrepreneurship initiatives as well as project management services for major research projects. Delivering support for EU-funded consortium projects led by Imperial College is one of the Office's main activities, which acts as PMO in a large number of bids and projects. As mentioned the PMO is an integral part of Imperial College's Enterprise Division and, as such, is one of the professional services departments that works with academic teams across the university. The PMO provides a range of professional services to project teams engaged on EC funded consortium projects led by Imperial College, including consortium management,

project support, dissemination and communication, and support to the evaluation of exploitation opportunities. Imperial College's PMO has been closely involved with the EDEN2020 project since its inception and has been instrumental in preparing and delivering the project. Table 3 summarizes the involvement of the Imperial College PMO in EDEN2020 for each phase of the grant lifecycle according to PMO typology developed in the PMBOK®.

Table 3. Involvement of Imperial College London's Programme Management Office (PMO) in each of the grant phases of EDEN2020 according to the PMBOK® PMO typology.

Project Lifecycle Stage	**PMO Type**		
	Supportive	**Controlling**	**Directive**
Ideation	x		
Proposal preparation & submission	x	x	
Grant preparation & negotiation	x		
Project implementation	x	x	x
Closure	N.A. (The project is ongoing)		

Ideation

Imperial College's PMO was involved in the ideation stage, although it predominantly played a supportive role. Involvement of the PMO in this phase was largely advisory. The initial ambition to work towards a Horizon 2020 grant application came from the Principal Investigator (PI) of the Mechatronics in Medicine Laboratory in the Department of Mechanical Engineering at Imperial College. The PI had already a track record in successfully applying for European research grants and participating in consortium projects.

Thus, when the PI approached the PMO for potential support in early 2015, it was with an already well-defined project idea and thorough knowledge of EU grant requirements and consortium management practices. Based on his experience in previous EU projects, the PI already had a strong consortium in place that could carry forward his project idea successfully. Therefore, the PMO's project management staff predominantly advised the PI on call requirements, procedures and intricacies of the Horizon 2020 program - for instance on the requirement to showcase clear and tangible socio-economic impact.

Proposal preparation and submission

The decision to kick-off grant submission was taken by the PI after having received approval to do so from Departmental and Faculty administrations. The PI formally approached the PMO for bid management in February 2015, given the complexity of the project and the need to proceed quickly. The respective call deadline was very nearby, i.e. on 15th April 2015. The PMO then

assessed the suitability of supporting the proposal. Since Horizon 2020 is highly competitive a thorough risk assessment was made in order for the PMO's operating model to remain sustainable.

A Horizon 2020 grant application is complex. It requires thorough knowledge about the scientific/ technical state-of-the-art as well as insight in project management, resourcing, the envisaged tangible socio-economic benefits and pathways to exploitation of the various project outputs. Moreover, as a Horizon 2020 grant application commonly includes multiple partners, there is a need to ensure that a complete and competitive grant application is submitted on time by managing the bid process in an efficient and effective manner.

After positive assessment, Imperial College's PMO decided to deliver bid management support The PMO delivered project management for the bid with a view of delivering consortium management, exploitation and communication management in case the proposal was selected for funding. During the proposal preparation stage, the PMO project manager and support team worked closely with the PI's team. The academic team at the Mechatronics in Medicine Laboratory led the write-up of most parts of the proposal, except for parts related to consortium management and exploitation, dissemination and communication.

In this stage, the PMO predominantly played a controlling type role, although supporting the PI's academic team throughout the process as well. With the exception of the funding authority, the PMO reached out to all the parties depicted in Figure 2. It advised the PI's team on the format, requirements and layout of the grant application - providing a thorough review and revision of draft versions. Simultaneously, the PMO ensured to gather consortium members for a one-day proposal writing workshop in early March 2015, in which it outlined the rules and requirements as well as the 'do's and don'ts' of a robust Horizon 2020 grant proposal and project.

While the PI's team focused on the technical and scientific write-up, the PMO liaised with consortium partners to gather administrative details such as institutional information or researchers' biographical details as well as information on resourcing - using standardized templates wherever possible (in order to ensure efficient data gathering and processing). The PMO maintained a shared, online working space - ensuring that all partners involved in the write-up delivered their sections efficiently while using the same document formats. The PMO also supported the PI by informing him about bid progress and flagging-up potential issues or inconsistencies. It maintained a detailed progress chart. In doing so, it enabled the PI to retain an accurate and updated overview of the status of the bid and take informed decisions. results are to be reported.

Although the PMO mainly supported the PI, it worked with the entire consortium: informing partners on budgets and resourcing, flagging-up possible inconsistencies and working with the partners' research administration departments in order to obtain the required administrative and financial details. The PMO did the same internally, working with Imperial College's Research Office (to secure sign-off for the draft proposal) and the Faculty of Engineering (to ensure budget and costing details were agreed and in place).

The proposal was finalized well in time for the deadline. The PI ensured to retain strict version control, with himself taking the lead in various iterations. Based on prior partners' input, PMO

prepared the administrative and financial sections of the proposal (which needed to be completed online). Eventually, the PI - as the coordinator retaining full responsibility for the proposal - submitted the proposal.

Grant preparation & negotiation

In mid-August 2015, the PI and consortium were informed by the European Commission that EDEN2020 had been evaluated favorably and was in principle retained for funding. A pre-condition for actually being able to start EDEN2020 was the signature of the so called Grant Agreement. This is an agreement between the European Commission and the project consortium, the latter being represented by the coordinating institution. The Grant Agreement spells out the modalities, rules and obligations that the project partners are required to take into account. The set timeframe for completing the Grant Agreement was approximately three months.

Imperial College's Research Office led this phase of the grant cycle, as it is tasked to sign project agreements on behalf of Imperial College. The PMO supported the Research Office for instance by liaising with partners and ensuring that submission deadlines were met. In parallel, the PMO worked with the PI to (marginally) update the submitted project proposal as it was to be annexed to the Grant Agreement and provided the blueprint for upcoming project work. The Research Office also led on establishing a Consortium Agreement. This agreement governs the relations between project partners. Among others, it contains provisions on project structure, decision-making procedures and intellectual property (IP) arrangements. The PMO team supported the Research Office by providing input in the proposed project governance and management processes and by sending out hard copies of the agreement to partners for final approval and signature.

Other support activities by the PMO during this phase included entering project information (such as deliverables, milestones and work packages) into SyGMA, the European Commission's online grant management system and supporting Imperial College's Faculty of Engineering in preparing the grant disbursement arrangements. It did this work by collecting partner bank details and liaising with the Faculty on pre-financing arrangements.

Project implementation

This phase of the grant cycle covers the first six months of the project, until November 2016, during which the first deliverables where submitted and the project's implementation phase was well underway. EDEN2020 commenced on 1st April 2016. Since then, the PMO has been responsible for the project management work package. The PMO delivers administrative and logistical support, as well as consortium management.

From a logistical and administrative point of view, the PMO team is responsible for consortium-level meeting organization (e.g. project kick-off and review meetings) and maintains the project's online file repository and work space. In regards to project management, PMO monitors project progress by maintaining frequent contacts with other work package leaders and liaising with the PI. Following the PRINCE2® project management standard, it retains oversight of project progress by gathering periodic technical and financial progress reports, at quarterly and six-

monthly intervals respectively. In order to do so, it liaises with work package leaders. Such reports are template-based and serve to inform the PI about project progress - an important activity as the project consortium is dispersed across Europe. As these templates mimic the templates of the funding authority, it is ensured that obligatory periodic reporting (which is linked to further grant payments) can be undertaken efficiently and effectively. Furthermore, it maintains a risk log for EDEN2020 on a quarterly basis, which helps to identify potential bottlenecks in project delivery from technical, logistical, commercial and managerial perspectives.

Imperial College's PMO is also responsible for delivering the dissemination, exploitation and communication work package of EDEN2020. To this end, it has set the exploitation framework of the project by leading on EDEN2020's exploitation and communication strategy. It has appointed a dedicated exploitation manager, which has been liaising with project partners to scout (future) commercial opportunities of the technologies developed under EDEN2020. The exploitation manager's function is to kick-start preliminary discussions within the consortium on how to arrange exploitation of developed project outputs, with a view to facilitate the future commercialization of leading technologies with industrial partners. In addition, the PMO acts as the management structure for the project. It has been responsible for branding, social media outlets and the website and ensures that outreach moments and publications are properly recorded and are in accordance with the non-disclosure provisions of the exploitation strategy.

In this phase of EDEN2020, the PI retained overall leadership of the project by coordinating its scientific and technical delivery. Yet, by having recurring catch-ups, the PMO has effectively acted as an advisor to the PI; thereby sharing insights and experiences on how scientific and technical project work could be addressed efficiently and effectively. Furthermore, the PMO was also able to facilitate a smooth handover when the project manager left the organization and an alternative project manager was recruited. The PMO was able to ensure that there was an effective handover of background knowledge on the project along with information relating to the performance of the project (e.g. according to achievement of project milestones) from the departing project manager to the new project manager.

The value added by the PMO in this phase of EDEN2020 is clear. It has occupied multiple project roles, from advisor to work package leader and consortium manager. Following the PMBOK® typology on PMO's, the Imperial College PMO is playing supportive, controlling and directive roles simultaneously - working with, for and alongside the PI. It is important to mention in this regard that multiple staff from the PMO team have been engaged in the project and that these roles do not fall only on one person, but rather on a focused team, where the consortium management and work package roles are shared by the project manager and other dedicated staff engaged for support and exploitation management as well as overall team supervision and direction. Moreover, this highlights a key benefit for faculty members to engage with PMOs, which is the continuity of service that is provided. For instance, in the case where a project manager is absent or unexpectedly leaves the organization, the PMO has adequate resource to ensure continued project management support is provided to the academic team thereby minimizing disruption to the project and management of the deliverables.

Although, the PMO approach offers a number of potential benefits, it is worth noting that the

project management of major consortium projects can also be undertaken via other resource models, such as through recruitment of the project manager in the academic department, or via outsourcing to an external business consultant. Each resource model will have its own pros and cons and while we have illustrated the merits of the PMO model, we do recognize that there may be instances where the other models may be more suited. Furthermore, the PMO approach is predicated on there being a sufficient need for project management services and a corresponding number of projects. This approach potentially works well for large research-intensive organizations but may be less suited to much smaller research organizations—although even in this latter case, there would still be scope for a supportive or controlling type of PMO.

Conclusions and Future Work

The competitive and collaborative nature of grants-based research and innovation projects provide a fertile ground for university-based PMO's to flourish. This is further enhanced by the need for such projects to generate results that show clear socioeconomic value in addition to excellent scientific outputs in an efficient manner. Moreover, this means that projects increasingly consist of diverse (and international) consortia along with there being a need to demonstrate value-for-money towards public authorities and ultimately, the taxpayer. A clear-cut case therefore exists for professional project management teams to support and ensure delivery of grant-based consortium projects according to the 'iron triangle' of delivery, i.e. budget, time and specification. Furthermore, complex research projects increasingly require the involvement of multiple partners working in a collaborative manner and as part of a research consortium.

The case of the European Commission funded EDEN2020 project highlights how a PMO team can add value in a European research context through providing close support and working as part of the academic team that is driving forward project delivery; an effective PMO therefore works both jointly and integrally with the academic team on project development and subsequent execution. Its experience in project management, knowledge of funding rules (in this case of the EC's Horizon 2020 program) and capacity to implement tasks such as bid management, consortium management as well as project dissemination, exploitation and communication helped the principal investigator of EDEN2020 to successfully deliver a multi-partner grant proposal and project. In doing so, the roles that the university-based PMO at Imperial College has taken up so far, clearly adhere to the PMBOK® typology on PMO's through spanning all three types at varying levels. In the case of EDEN2020, the supporting PMO played multiple roles, with differences between the various stages of the grant submission process. At the ideation and grant negotiation stages of EDEN2020, the PMO predominantly played a supporting role. At the proposal submission stage, PMO was predominantly acting as a controlling type of PMO, whereas it has taken-up supportive, controlling and directive type roles during the implementation stage.

There are a number of benefits that can be secured through supporting complex research projects, such as those that involve the work of multiple partners, with a PMO management structure. There is continuity of service that is available to the academic team, e.g. if a project manager is not available or suddenly leaves, then the PMO team has resource available to maintain project management support until a replacement or alternative project manager is appointed. There is the

access to management best practice that is acquired by the PMO team from supporting multiple complex research projects, which enables insights and knowledge to be incrementally built up as further projects are delivered. This knowledge base can help faculty members to reduce the management risk when engaging on research consortium proposals and during the delivery stage of such projects. Along with the best practice that is generated, there can also be management processes, systems and tools that are available within the PMO, thereby allowing projects and faculty members to benefit from the learnings and experience of the team and from the delivery of previous projects. Access to a PMO management structure also provides faculty members with access to complementary resources and this includes back-off administrative staff, senior manager and director level staff, as well as other functional specialists, such as contracts managers and commercial exploitation focused staff. These complementary resources can be deployed flexibly at different stages of the project lifecycle, i.e. as and when needed, providing flexibility but without interrupting the core support provided by the project manager. Consequently, there are a range of different benefits that can be realized when supporting complex multidisciplinary research projects with a PMO management structure.

This work constitutes a first attempt to kick-start further analysis in this area. Further study will address the gaps and needs inherently identified in this paper. For instance, the EDEN2020 project is still ongoing and further analysis might be required to see how the role of the PMO evolves over the course of the project, including its role in the closure phase of the project. Moreover, future work can also focus on a further expansion and diversification of cases. Focusing on different grant programs, different sectors and examples from different countries (not necessarily confined to Europe) may provide an improved insight into the workings and merits of university-based PMOs. As such, this research is not only of relevance to those interested in the design and operations of PMO's, but also to individual researchers and project managers involved with research grants as well as academic policy makers that aspire to improve their institution's grant management processes and performance therein.

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