THE IRISH ACADEMY OF ENGINEERING

ENGINEERING & TECHNOLOGY

THOUGHT LEADERSHIP IN A TIME OF GREAT CHANGE

Delivering Major Capital Projects

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THE IRISH ACADEMY OF ENGINEERING

The Irish Academy of Engineering is an all-island body, concerned with long-term issues where the engineering profession can make a unique contribution to economic, social and technological development.

Its members are Irish Engineers of distinction, drawn from a wide range of disciplines, and membership currently stands at 145.

Drawing on the experience and knowledge of its distinguished members, the Academy works to facilitate communication and dialogue on engineering-related matters. It regularly publishes reports and analyses, some jointly with other learned and professional bodies.

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1. DELIVERY OF MAJOR CAPITAL PROJECTS

1.1 Introduction

A very significant programme of capital investment in public infrastructure is planned under the NDP following decades of underinvestment.

Following the economic shock visited on the country by the Covid19 crisis there is a need to stimulate the economy with increased investment, to re-start and promote its growth and to ensure that it returns to growth as early as possible. It is recognised across all developed economies, that investment in public infrastructure is a proven and economically effective way of providing stimulus to the economy.

It is recognised too, in Ireland and internationally, that infrastructure delivery is fraught with risk and that programmes and major projects frequently fail to meet their initially approved budget or timescales.

There has been much public comment and criticism of the delivery of public infrastructure particularly the variance between initial cost and time estimates, developed at the outset of a project and the final costs that are incurred on the completion of the facility[1].

The Irish Academy of Engineering (the Academy) has undertaken a high-level review of a number of major capital projects. The aim of the study is:

- To identify and examine a number of major capital projects in terms of the time, budget, and scope of the outcome versus the aims set at the outset of the project.
- To identify the reasons why the selected major capital projects were perceived as increasing in scope and or cost and why they may have varied from their planned outputs.
- To set out some lessons for future project delivery in the context of the challenges of meeting the NDP targets.

The National Development Plan 2018 – 2027, (currently under review), has proposed a National Plan to address the identified infrastructure deficits and has assigned a rolling 10-year capital investment plan to support the approach. The scale of this Plan and its ambition challenges the capacity of both the client bodies and the supply chain companies to deliver efficiently.

Many of the priority projects will be delivered through programme-specific bodies/organisations (e.g. Irish Water, Transport Infrastructure Ireland). However, there are also many projects involving significant expenditure to be delivered through bodies that do not have the experience and focus required for successful major capital project delivery. It is these bodies that will require the greatest support and direction.

It is intended that the lessons learned and set out in this report, from both successful and less than successful projects, will help identify measures that can be adopted and adapted to ensure that future projects benefit from a more efficient and effective delivery.

The Covid Crisis and Brexit

In common with many sectors of the economy, the construction sector has experienced severe impacts because of Covid 19 and associated restrictions. Even as work resumes, ongoing impacts arise through the introduction of new health and safety, social distancing and hygiene measures. There can be little doubt that such measures coupled with the staggering of work hours and reduced workforce availability will all result in reduced productivity, programme delays and substantial additional costs.

Similarly, it is as yet unclear how the final Brexit agreement will impact on the delivery of infrastructure and on the construction sector, bearing in mind the global dimension of supply chains and on the availability of labour and engineering expertise. Ireland is dependent on imported trades and professionals to meet the needs of many major capital projects underway and planned.

The contraction in construction sector activity is likely to continue for some time and will undoubtedly impact on the financial viability of many companies. The identification of efficiencies in the infrastructure delivery process is therefore all the more pressing.

1 For example see Colm McCarthy: 'We must make sure what the Government builds is proved to be worth public money' https://www.independent.ie/opinion/comment/colm-mccarthy-we-must-make-sure-what-the-government-builds-is-proved-to-be-worth-public-money-38433897.html; accessed 5th Dec 2020.

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The projects in this study, were designed went through planning and on to construction prior to the onset of the Covid19 crisis and Brexit, so will not reflect delays or impact of these events on the construction processes, costs or timelines.

1.2 Management of Risk

Major capital projects are generally complex, usually extend over many years, have a wide range of stakeholders and represent a considerable investment for the client, sponsoring agency or Government.

Whilst many of the issues that have been identified in this study are systemic, the importance of an experienced and capable client team working collaboratively with a suitably experienced and capable project management and design team cannot be overstated.

The selection of suitably experienced and capable service providers and contractors with the requisite technical skills and financial resources is another critical element.

The achievement a successful outcome requires systematic and skilled programme and project management developed over a period of time by both client and delivery agencies with clear lines of reporting and accountability between them and their services providers and contractors.

The identification, quantification (including costing) and management of a large number and wide range of risks, is an area that requires knowledge and experience to ensure that the impact on the project are both understood and controlled. As a project develops some risks become better defined and new risks will arise. Certain risks can be avoided, and the impacts of some can be reduced or mitigated (albeit at a cost to the project budget).

Some risks are transferred to a service provider or the contractor (at a cost which may be included in the tender price) and some, but not all, of the remaining risks which are retained by the client organisation, will result in an additional cost and/or delay and are not included in the contract price.

Many risks arise from items either excluded from the project and the contract or items added to the project after the preparation of cost estimates. It is clear that the pre-tender discussion stage is far too late to add risk mitigation measures as project appraisal will not have considered them. Risks must be systematically identified, allocated, costed and managed from commencement of the project cycle.

Risks may arise at all stages of a project and it is most important that the client organisation is very clear about

what risks it is transferring and those it is retaining. It is important too that individual risks are retained or transferred to the project participant who is best placed to manage or mitigate the cost and time ramifications of the risk impacts.

It is important to note that it is at the early stage of any project that 70% - 80% of the opportunities for cost savings arise and cost savings can be made. Once the tender stage is reached opportunities for cost savings are very limited.

As to how risks will be evaluated, effectively managed and communicated will depend greatly on the knowledge and experience of the project team.

A final point is to restate the importance of communicating the nature and level of risk when advising on budget estimates and time forecasts for delivery of the project. The issue of risk management will be discussed further under a number of the following sections of this study.

1.3 Methodology of this study

The Academy has selected a number of major projects for this examination drawing on its members experience of projects and programme management and using publicly available material matched to the experience of the Academy members.

A list of the projects selected is set out in Appendix 1.

A total of 16 major projects in both the public and private sectors were reviewed, and the assessment is presented here by the category of project as described below.

Categories of Project examined

The projects selected may be broadly grouped into 3 categories as follows:

Category 1:	Projects that were successfully completed substantially on time, within the approved budget estimate and delivered as planned;
Category 2:	Projects that have been completed but which had cost overruns, time delays or major changes, which were required to meet a client demand or to address an emerging unavoidable risk.
Category 3:	Projects that are currently stalled or have been cancelled.

The Academy's working group was asked to set out (i) the challenges and the best approach to managing them; and (ii) the reasons for the difficulties that arose during the various stages of the projects. All of the members of the working group have extensive personal knowledge and experience of managing programmes and projects

Stages of a Project

It is informative to consider projects from the perspective of the stages of the decision-making that each project goes through. Here four generic major stages are considered.

These represent points or gates at which the Client Organisation (the Sanctioning Authority or Sponsoring Agency) might be expected to make decisions to proceed or not based on such considerations as:

- the defined scope of the project and the basis of that scope;
- how the project meets the aims of the organisation;
- the cost estimates and timeline;
- an assessment of the risks identified and associated mitigation measures.

Successful projects by definition complete all four stages as planned and problematic projects encounter major difficulties in one or more of the four stages.

It is recognised that these stages may not align with the Public Spending Code (December 2019 edition) in their present form - they were identified by experienced Academy members as reflective of the areas where difficulties most often arise. They thus offer a proven and robust model to help identify corrective measures and suggestions.

Stage 1 Appraisal and preliminary approval of the project

The Appraisal and Preliminary Approval stage is where the need and the benefits are identified.

At this stage, a project scope and aims are designed to meet the need as determined, a high-level budget cost estimate and timeline are outlined that demonstrate compliance with cost/benefit and value for money criteria.

The potential risks are identified and an outline plan to mitigate the risks is developed.

The additional expertise and capacities needed by the client organisation are identified and procured to support its in-house capability and capacity, together with clear lines of reporting and accountability.

Procurement and delivery strategies are considered. This may include examining PPP vs traditional procurement; conditions of Contract for services and construction.

Stage 2 Comprehensive planning process & tender documentation

The design is advanced to meet the identified scope from Stage 1. This is done in such a way as to avoid adverse risk impacts where possible or if not possible, then to mitigate the possible effects of such risks. The aim is to reduce the uncertainty in both budget and time elements.

The preparation of the necessary documentation is commenced at this stage. Discussions are opened with the relevant planning authorities and other relevant bodies preparatory to applying for the for the necessary statutory consents including planning permission and environmental licences.

An outline procurement strategy for delivering the project is considered and decided. The preparation of tender documents commences and when finalised these are issued to tenderers.

More detailed budget and timeline are developed, together with the costs of addressing the risk mitigation measures identified, giving the client a tighter budget cost range than at stage 1.

Stage 3 Assessment of tenders and awarding of Construction Contract

Valid tenders are examined and assessed at stage 3, and a preferred tenderer identified in accordance with the process set out in the tender documentation.

The risks that are to be transferred to the preferred tenderer should be clarified, noted and agreed, prior to signing of the contract.

The previously approved budget and timeline are either confirmed or changes to the details sought to address additional costs that have arisen in the tender and post-tender discussions.

A final project budget and timeline are presented to the client for sanction to award the contract.

Stage 4 Construction stage, handover commissioning of project

Following the sanction of the client and the award of contract, the work of stage 4 is to manage the on-site construction, variations and unanticipated issues that may arise during the that process.

The authority delegated to the project manager must be clearly set out. It is vital that there is clarity as to who decides if there are changes needed to the approved budget or timeline as well as how any such changes are agreed and at what level approval of the Board or other supervisory body is required.

This Stage also comprises the commissioning of the completed facility and handover to the client and the completion of the final account for the project.

1.4 Findings of the Study

For those projects in category 1, i.e. those found to be delivered substantially on time and within the budget parameters set at their approval stage, a number of factors were identified that contributed to the successful outcomes of these projects.

There was one primary stakeholder/promoter with deep knowledge of the business across the organisation up to the board level. That client organisation had developed programme & project delivery capability which included multi-disciplinary in-house experience stretching to over 15 years in many cases, with well established procedures and systems for the identification and management of risk and changes that inevitably will emerge during complex project delivery.

In this category the client capability and expertise available was more than adequate to identify, quantify and manage risks and to manage project scope changes. There was a strong focus on the management of costs and adherence to budgets and timescales. A system of delegated responsibility and authority was also a feature of successful projects in this Category.

The teams managing these projects had well-established external relations with planners, regulators, community leaders, contractors and consultant service providers.

The adverse issues that caused time or cost variation from the planned estimates occurred during stages 1 & 2. About 75% of the issues arose in these two stages. The remaining 25% occurring during stages 3 and 4.

As noted above, it is at this early stage that the opportunities for cost savings arise and are identified. Once the tender stage is reached opportunities for further cost savings are very limited.

Where projects were stalled for a prolonged period of time or postponed by the client organisation on account of cost increases or delay, all of the issues are seen to have arisen early in the project timeline, at stages 1 or 2.

The following pages look in some further detail into the major issues identified in this brief overview and offers some recommendations.

Ballymore Eustace

2. SCOPE OF THE PROJECT:

It is recognised, particularly for public projects, that there is a tendency for the initial project scope to increase and to be enhanced during the early stages of its development. This may occur during consultations with stakeholders, end users of the infrastructure or facility. This is referred to as "scope creep" and is seen as challenging in project management (PM) literature[2]. Scope growth can sometimes arise from inadequate consideration at early stages of the project, sometimes from the addition of stakeholder wish-lists, from changing statutory requirements, and may be imposed by a statutory authority such as An Bord Pleannála (ABP) or other approving authority. Project sponsors should obtain independent assessment of their project scope at the preliminary stage, draw on lessons learned from peer organisations elsewhere, and be realistic in anticipating likely developments through the planning phase. Once the scope is approved, scope change that negatively impacts the cost or the timeline should be subject to approval by the client or the sanctioning authority.

2.1 Managing stakeholders' and end user requirements and expectations:

Consultation with end-user groups and with wider public stakeholder groups are an essential part of the scope definition. It is important to realise that there are frequently conflicting demands from disparate stakeholders and such conflicts need to be addressed as early as possible in the development process. Projects can suffer major delay or even rejection, without a reasonable measure of public support.

Stakeholders are rarely responsible for the additional costs that may arise from accommodating their demands. The management of such demands and expectations generally is vital to keeping the project within the approved budget. This is a skillset developed by experienced agencies. It can include where necessary, the moderation of the protect scope in order to ensure the core outputs required are protected.

Changes of scope arising from the demands of end-user groups and citizens will need to be informed by fact-based cost and benefit estimates as well as an overall assessment of affordability in the context of other demands on the public purse.

Public engagement is a necessary part of the process and can often result in more robust and better-defined projects by the early identification of issues to be addressed. This emphasises the criticality of timely and adequate consultation which makes heavy demands on promoting bodies, many of whom do not adequately resource this critical task.

On the basis of our examination, the projects that are successfully managed begin with a very significant effort to identify the need in a broad sense, to identify and put in place an appropriately qualified PM structure, with the range of skills needed to develop the project in all its aspects, overseen by a robust review and approval process.

Client organisation experience and capacity

In those projects that are seen to be successfully delivered, a common element is the knowledge, capability and experience of the client to act in an intelligent informed manner in the market for services such as engineering design, environmental studies and related work.

Very often these clients are dedicated to a particular area of development (e.g. water, roads etc.) and consequently have extensive knowledge and experience of the industry area in question. They also generally have sufficient in-house expertise to assess the risks on the basis of previous projects and on a data base of cost from those works. These are very significant advantages and their benefits are evident for areas such as the roads programme (TII), flooding projects (OPW), electricity supply networks (ESB Networks, EirGrid), and water/ wastewater asset improvement programme (Irish Water).

The State agencies behind these successes have developed considerable expertise in identifying and managing risks. Such bodies will have defined project development handbooks and documented governance processes with defined authority limits.

The final decision-making authority for many of these bodies is an informed and focused Board. This is the

2 McKinsey & Company: Taming scope creep to keep public-sector projects on track https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/taming-scope-creep-to-keep-public-sector-projects-on-track. Accessed on 28th October 2020.

final step in a tiered management governance process. That process has its own experience and understanding of risks, budget development process and procurement of external service providers to supplement its in-house capacity. Such governance steps maintain focus on budget and timelines and employ corrective actions at the various stages as required.

Differences of approach becomes most evident between private sector entities and the public sector when addressing the conflicting requirements of citizen groups both opposed to and in favour of the intended project.

In both sectors the single most persuasive variable in project assessment is return on investment (ROI). In both the private sector and in commercial semi-State bodies the board, acting with fiduciary responsibility to shareholders (private citizens or the State) may be forced to abandon a project if costs escalate beyond an acceptable benefit or the ROI is reduced to an unacceptably low level.

On the other hand, infrastructure projects that are the State's direct responsibility are frequently difficult if not impossible to stop in such circumstances.

Public consultation and support:

The commercial semi-State bodies mentioned above, have in general, earned and gained an important degree of public trust and confidence in their ability to deliver a project in a professional manner and to interact with stakeholders during the planning design and delivery stages of the programme or project.

Guidance is needed for those bodies that have not previously needed to deliver major infrastructure projects or have done so infrequently, to support them with selecting and building an appropriately skilled and experienced project team.

In concluding this section on scope, the importance of the initial scope during the project development phase in managing the risks cost & timeline cannot be overemphasised.

Recommendation 1

- Define the scope of the project in consultation with the stakeholders and end-users, ensuring that there is clarity of the aim and of what is to be achieved by the delivery of the project.
- Clarify who 'owns' the scope, who has authority to approve scope changes and how the revised scope is approved.
- Set out the responsibility matrix and the duties and limits of authority of the project manager (PM), as the person responsible to the client, for enacting changes that may emerge during the delivery process, in particular when the PM needs to revert to the client for additional authority to enact change.

3. BUDGET DEVELOPMENT:

In deciding to bring forward a programme or project of infrastructure an accurate understanding of the costs involved is a critical consideration. It is evident that there will be significant pressure to provide an estimate of cost at a very early stage in the life of a potential project. It is not possible to prepare a single-figure estimate at a point where the scope is still being developed, and stakeholder and end-user requirements have not been collated. An examination of the 'must-haves' as against 'nice-to-have' criteria must be weighed against affordability for the project.

Preliminary estimates for large projects regularly underestimate the time and cost of bringing the project to and through the statutory approval process. Delivery programmes should be based on realistic assessment of the impacts of risk rather than best-case or optimistic assumptions. In particular, public consultations, legislative measures, and consideration of less-preferred options regularly take longer than allowed for. Realistic time and cost estimates should also be included for tendering, contract supervision, and claims management. An appropriate contingency should be included in the programme budget to allow better estimates of inflation impacts, time-based support costs, and the like.

It is important in the context of the budgetary planning for submission to the funding authority and ultimately to the D/Finance, that cost estimates of risks and possible mitigation measures are included.

There are significant difficulties in doing so, which include:

- Probability of a risk event occurring;
- Practicalities of proposed mitigation measures;
- Uncertainties related to the costs of disruption which can be time-dependent;
- Modifications demanded by planning or licencing conditions.

Whilst there are techniques for evaluating overall risk, those techniques have limitations, particularly where there are features that are unique to a project, which is generally the case for major projects.

3.1 Non-Construction elements of a budget:

Estimates, even at a preliminary stage, should include a provision for all associated costs, including items that are difficult to estimate. A cost forecast that excludes known but hard to assess "known unknown" costs will invariably be exceeded as excluded items come to pass, and the niceties of the estimate caveats are generally lost in public discourse. A cost range is a more appropriate approach rather than a point estimate, particularly at an early stage of a project.

It is important to include in the development of a comprehensive project budget elements other than the direct construction costs. These will include in a typical project the following items:

- Property and site purchase costs;
- Planning and legal costs;
- Compensation for disruption to third parties affected by the construction works,
- Environmental mitigation measures to comply with anticipated or actual planning and licence conditions and environmental regulations,
- Archaeological works undertaken prior to construction and oversight during the execution of the works,
- Survey and site investigation costs
- Realistic construction contingency ideally based on previous experience of similar projects;
- Professional design fees;
- Client organisation own costs of staffing, funding & interest costs;
- VAT on construction and fees
- Fitout & commissioning, equipment & training,
- Cost inflation over the period of the design, approvals planning & construction.

Considerations relating to Budget Forecasting

The above points illustrate the difficulty of determining a 'fixed' single point cost estimate for a major project several years in advance of its scope definition – at least if the project is to meet its required objectives determined at the outset. The one-off nature of major projects presents challenges to benchmarking of cost estimates and needs to be factored into any consideration of cost certainty. This emphasises the point made above regarding the requirement to set a budget range and more broadly the importance of how information regarding costs is conveyed to the client organisation, the political system and to the public at large in a properly framed context.

It is important to stress the need to update the project budget at the various decision gates, to include updated figures for these non-construction elements and for the impact of any changes to the timeline for the project construction.

Timeline

The timescale for delivery of major projects from concept to construction and commissioning is significant with most exceeding 10 years and some significantly longer. "Time is money" is a well-worn phrase and the time taken to obtain statutory consents and client body approvals are generally not within the control of the project management team or manager. Nonetheless, in an economy where construction price inflation is has been running at some 7% to 8% annually, a time lapse of 1 – 2 years adds a significant cost to the construction costs, and thus to the project cost.

Delays in bringing benefits of a planned infrastructure project on-stream are seldom included in a cost/benefit examination in the public sector but would impact, sometimes significantly, on the Rate of Internal Return in a financial or economic examination. In an extreme case this could undermine the feasibility of the project.

The cost figures that go into the public domain should, from the beginning, be the projected total spend. That does not preclude using different figures to comply with prevailing internal management requirements, such as the public spending code.

This point is of particularly applicable for those projects in the National Development Plan (NDP). The publication of precise but inaccurate cost estimates for projects in the NDP before they have been fully scoped and all project costs included, is inadvisable.

Recommendation 2

- Review the process of project budget-making, risk assessment mitigation & costing.
- The approved budget should include not only the construction cost of the facility but also the non-construction elements including capitalised maintenance and risk mitigation measures.
- Develop a cost range at the early stage of project life. Such a range will reduce throughout the design process, as risk measures are quantified and included in the budget.
- The PM to ensure that any scope changes under consideration during the project, are within the approved budget or within the authority for change limit set by the client, where commensurate savings to balance the extra cost are not identified. The approved budget is updated at each key milestone of the project.

4. STATUTORY CONSENTS

Compliance with statutory consents is an essential element in the process of delivering major projects. Consents are a key part of public governance and ensure proper planning and sustainable development as well as the protection of our environment.

There may also be requirements for compliance with conditions set out by the Commission for Regulation of Utilities for commercial State organisations.

Such statutory consents are obtained from a number of State authorities or agencies. Each is a separate application procedure often accompanied by a significant requirement for highly specialised and detailed documentation and reports.

Extensive details are required to allow the regulatory agencies to assess the proposed project and, if they are minded to grant approval, to design appropriate conditions on the consent issued.

The planning process has become increasingly complex in recent years with a growing number of key legislative instruments – both domestic and of EU origin. In addition, and perhaps a greater source of complexity, is the rapidly developing and expanding jurisprudence based on this legislation and comprising case law from the Irish courts and the European Court of Justice (ECJ).

Irish planning law is unusual in permitting third party appeals against decisions. This has been a feature of system since the first statute was passed in the area in 1963.

In addition to this access international conventions, to which Ireland is a signatory, such as the Aarhus Convention, require that stakeholders and the general public have ready access to environmental justice and environmental information.

Grants of development consent can contain conditions that have profound implications for the project – in terms of cost and otherwise. Yet the consent process itself can often appear, from the developer's or promoter's perspective, to be frustratingly vague and uncertain as to outcome and apparently open-ended as to timeline.

4.1 Statutory planning policies

National spatial planning policy is set out in the *National Planning Framework (NPF): Project Ireland 2040*. This is transposed at regional level through three *Regional Spatial and Economic Strategies*, and at city and county level through local authority development plans. *The National Development Plan 2018 - 2027* (NDP) sets out the investment priorities that will underpin the implementation of the NPF, through a total investment of approximately €116 billion. The NDP is currently being updated in the light of the Programme for Government 2020.

The planning system facilitates the provision of strategic infrastructure[3] through statutory planning policies and through the development consent process.

Since 2006, proposals for strategic infrastructure developments (SID) are submitted directly to An Bord Pleanála for consent. The scale and nature of such projects frequently entail environmental impact assessment and / or appropriate assessment (under the EU Habitats and Birds Directives - see following section).

While the SID process has reduced the time periods for decision-making, further delays have occurred arising from legal challenges to Board decisions, often related to the EU Directives. Those Directives provide for access to justice in environmental matters, by ensuring that environmental NGOs are able to put forward claims to protect the environment and that the costs of going to court are not prohibitive.

There is a wide-ranging definition of those who may raise an objection or appeal to the development and who may subsequently take a Judicial Review where they consider that due process has not been followed by the deciding authority. The complexity of law both domestic and European, transposed into Irish law has proven fertile ground for such reviews, which on occasion has also been referred to the ECJ either by the complainant or indeed by the Courts seeking clarification of the compliance of domestic law with the underpinning EU Directives that are transposed into Irish law.

3 As defined in the 7th Schedule, Planning and Development Acts 2000-2020. They include major energy, transport, waste disposal, health, and data developments which exceed specified thresholds.

In 2019, judicial review proceedings in relation to Board decisions and procedures were instituted in 55 cases, (an increase from 41 in 2018). There were 17 substantive court judgements given in 2019. Nine judgements upheld the legality of the relevant Board decision and eight found against the Board. Proceedings were discontinued, dismissed or withdrawn in 11 cases.

From February 2018, all applications for leave to apply for judicial review in respect of permissions or decisions concerning strategic infrastructure developments must be made to a designated High Court judge. Should leave be granted to the applicant to apply for judicial review, the judge will give all necessary ancillary directions with a view to ensuring a fair, just and expeditious hearing of the matter. This represents a significant move forward in helping to expedite such cases through the courts.

Since 2017, planning applications for strategic housing developments of more than 100 residential units and 200+ student bed-spaces can be made directly to An Bord Pleanála. Around 40,000 housing units have been permitted by the end of 2020. However, the time-limited legislation is due to expire at the end of 2021.

The challenge of determining and then managing issues arising from planning and other regulatory requirements, particularly given uncertainties around how regulations will apply to a project, is well understood and covered elsewhere.

From time to time one state agency will consider it necessary to object to projects being developed by other state agencies. For example, National Parks and Wildlife may need to do so to ensure compliance with environmental legislation. Many such issues are dealt with at pre-planning consultation stage. Ideally, a mechanism should be put in place to resolve any disputes that might arise between within public sector actors as soon as they arise, quickly and clearly.

4.2 Environmental Impact Assessment & Habitats Directive:

The Habitats Directive (Council Directive 92/43/EEC of 21 May 1992) contributes to ensuring biodiversity in the European Union by conserving natural habitats and wild fauna and flora species. It sets up the '*Natura 2000*' network, the largest ecological network in the world. Natura 2000 comprises *special areas of conservation* designated by EU countries under this directive and *special protection areas* classified under the Birds Directive (Directive Directive 2009/147/EC).

Any plan or project that is likely to have a significant effect on a Natura 2000 site must be subject to appropriate assessment under Article 6(3) of the Habitats Directive. Competent authorities may only agree to a plan or project after having ascertained that it will not have a significant impact on the integrity of a Natura 2000 site.

The manner in which Ireland has transposed and complies with EU environmental regulation is recognised as being legally problematic, with unpredictable outcomes. The Chief Justice in his address to the Law Reform Commission Annual Conference in 2017 stated "…in certain areas we have also created very unwieldy structures for deciding many things; we have questions, part of which go to local authorities, part to An Bord Pleanála and part to the Environmental Protection Agency, and that in turn creates legal difficulties".[4]

Article 6.4, imperative reasons of overriding public interest (*IROPI*), of the Habitats Directive in Ireland has seldom been used to the extent possible. Irish Water used the process successfully in seeking to balance conservation concerns (Lough Talt) and public health (13,000 people exposed to cryptosporidium). This was Ireland's first Art 4.6 "success" and is a useful reminder that the Habitats Directive need not be a barrier to necessary development. Although time-consuming the process is used routinely in Germany, the UK (when a member state) and many other jurisdictions.

4 Address of The Hon. Mr Justice Frank Clarke, Chief Justice of Ireland, to the Law Reform Commission Annual Conference, November 2017. https://www.lawreform.ie/news/annual-conference-speakers-presentations.789.html accessed on 06/02/2021.

It has been noted that the pace of change in environmental legislation is a relatively hectic one – comprising new or amended statutes, regulations and case law emanating from Irish courts and the ECJ. This makes for a particularly challenging context within which to promote major infrastructural developments. Legal action can delay projects such that their consents are overtaken by legislative changes - so-called 'aged consents'. These can then be vulnerable to challenge in the new legal context.

Licences

In addition to planning consent and depending on the nature of the proposed development various licences must be sought and received prior to commencement of construction. These may include a Foreshore Licence (obtained from the State), discharge consent (from local authorities), environmental licences (Environmental Protection Agency) or approval of utilities regulators e.g. connection to the electricity grid.

Sometimes the various applications must be made to the approving authorities sequentially which can add to the overall timeline for regulatory approval. Issues regarding the effect of the length of time taken to obtain such approvals may impact the cost or time estimates of project delivery.

It would be useful to examine if efficiencies might be identified through the co-ordination and/or alignment of various consent and approval procedures – at least for a certain scale of project. A version of this approach applies in the case of EU-backed Projects of Common Interest. However, there are very few projects in this category; they must involve two or more Member States to qualify.

Foreshore Licences are issued under the Foreshore Act 1933 and this is a process particularly fraught with delay. Applications are made to the Department of Housing, Local Government and Heritage under recent changes. Applications are not trivial undertakings – an application for one major infrastructural project consisted of 9 pages of the official application form accompanied by over one thousand pages of supporting information.

As will be seen in the next section overdue reform is coming soon to the whole area of marine development.

Current Legislative Programme

There are a number of key pieces of legislation that are required to facilitate more efficient development while complying with proper governance arrangements and environmental protection.

The current legislative programme includes a proposed Planning & Development Bill. This aims to bring changes in the planning & development appeals process, and the access to JR with a view to making the application/ permission process more efficient while also meeting the need for public governance.

A Marine Planning and Development Management Bill was published on 22 December 2019 and is currently before the Dáil. Once enacted this measure will supersede the 1933 act. It is a critical step towards the much-needed reform and modernisation of the existing regime for controlling and licensing foreshore and offshore development and is welcomed by the Academy.

In conjunction with the Bill a statutory *National Marine Planning Framework (NMPF)* is being drafted. It will set out, over a 20- year horizon, how we want to use, protect and enjoy our seas. The NMPF will sit at the top of the hierarchy of plans and sectoral policies for the marine area. It will become a decision-making tool for regulatory authorities and policy makers into the future in a number of ways including, decisions on individual consent applications which will have to have regard to the provisions of the plan in the same way that terrestrial plans form part of the decision making tool-kit in the on-land planning process.

Notwithstanding these reforms there is, in our view, a need to look also at how various licences and statutory permissions/consents might be better aligned to make the process more efficient especially for public infrastructure. Pending such reform, the potential for significant delay and additional cost to projects will remain.

The recommendation proposing an 'efficient and coordinated approvals system' would, if it proves possible, bring huge benefits.

The proposed changes would in our view, give more certainty regarding the timeline for all developers with knock on benefits for value for money and cost/benefit assessments and for public confidence in the ability of the client or sponsoring organisations to deliver on commitments.

Luas Bridges

Recommendation 3

- Review and streamline processes across public bodies, to make the approvals processes more cost efficient and timely to deliver while meeting public control and democratic accountability requirements.
- Examine the planning processes, including the permissions & objections criteria, access to judicial review process, and recourse to Irish and European Courts, in the light of the proposed amendments in the Legislative Programme.
- Examine the Environmental Directives and their transposition, ensuring that the appropriate level of flexibility allowed by the Directive are included without compromising its fundamental aims of environmental protection, in the light of the experience of other EU jurisdictions and in Ireland to date.

5. PROCUREMENT

5.1 Overview

A procurement and delivery strategy is broadly set out at the initial stage of a project. This will require decisions to be made as to the type of contract to be used, i.e. some form of public-private partnership (PPP) or a more traditional approach; also the most appropriate conditions of contract for both services and construction will need to be determined.

The purpose of the contract is to achieve the construction of the proposed development and in the process to assign risk to each contract party that is in the best position to manage and control them so that negative impacts on the cost, time or quality are minimised.

It is important that the client understand what risks are best transferred to service providers and what ones are best retained in-house.

Major projects are likely to require some involvement of international contractors and suppliers. Attracting and then retaining international interest through a lengthy period of project development and procurement to then achieve competitive pricing is particularly challenging, especially when the project is a one-off.

Important issues under this general heading include the procurement processes, contract models and how risks are allocated. Predicting market conditions which will pertain at the time of tender with any certainty is obviously difficult, especially so when complicated by the involvement of international players.

Some of the biggest risks to predictable project delivery are overheated markets, with the concomitant skills shortages, and a stretched contractor base. A significant increase in public investment is anticipated, across Europe in a Post-Covid stimulus to restart the EU economy. The levels of investment anticipated could trigger inflation in construction inputs and competition for resources and specialist companies and skills can only increase.

This is particular issue for Ireland as we currently import many of the trades and engineering professionals engaged in most of our major ongoing projects. As it will take time to increase the numbers of Irish nationals available to the domestic construction market this factor should be a criterion when prioritising projects.

Risk Transfer

When transferring risk to a contractor some of the assumptions made are that the contract provisions are robust, and that the contractor will meet his obligations.

There are other, secondary, risks that often are not provided for sufficiently or at all, and that can give rise to additional costs and/or reduced output. These include:

- the contractor cannot meet his obligations because they have not fully evaluated the risk or made sufficient provision for it in his tender, and/or has insufficient reserves to deal with the consequences,
- the contract provisions have undetected weaknesses, which are likely to lead to claims for additional work beyond the contracted price.
- even if neither of the above apply, the contractor, for whatever reason, cannot absorb the additional costs that have arisen.

The contracting strategy for any major project should give consideration to standard state forms of contract and their risk allocation models. Due consideration should also be afforded to other approaches including partnership or collaboration type contracts, and to performance-based incentive payments.

5.2 Form of Contract

There is little doubt that the level of contract management expertise residing in construction companies and needed for the for cost effective delivery of projects has significantly increased over recent years.

Ireland has a reputation for its adversarial contractual models and that can prove a barrier to increased interest from foreign contractors and thus place a limit on competitive forces.

There is strong evidence of a lack of overseas supply chain interest in Irish public contracts in many sectors because of the preferred risk model in the contracts employed. This hesitation is also applicable to many Irish contractors who are favouring private sector work, where strong relationships are increasingly delivering challenging projects on time and within budget.

The commercial sector increasingly uses the 'Tier 1' contractor model, with scope agreed within a defined budget and scope management used to deal with uncertainties within an overall budget.

Cash flow during the period of the contract, is a key concern for contracting organisations. Contractors in a growing market find it difficult to sustain the cash flow impacts of extended payment terms. Therefore, there is merit in considering new contract models where shared risks and incentives are a central part of the process. There are examples of the successful use of such methods Ireland on a limited number of projects (Haulbowline Island, Shannon Airport Runway) and in the UK over a number of years and it is worth examining how their introduction may be facilitated in Ireland and what processes would need to be put in place to ensure value for public money and increased efficiency of delivery.

The Public Spending Code requires that tender prices, once received, should form the basis of budgets from that point. While that is not unreasonable, we believe that an alternative such as a mid-range or average tender price is worth examining and that may prove more appropriate than to use rather than the lowest price.

Invariably issues will arise in the period of time between the submission of tenders, formal approval to proceed and throughout the construction on site. An appropriate contingency sum, included in the project budget, is still needed that recognises the challenges that will lie ahead in the later stages of the project.

Recommendation 4

Drawing on the experiences of established public sector bodies who have developed their capability in this area:

- Establish methodologies for risk assignment and retention, with pre-tender discussions to ensure contracting parties are clear about the risk assignment before committing to the contract.
- Explore other Forms of Contract including examining the potential for collaborative contracts in the light of the current complexity of the delivery of public infrastructure.
- Revise the Public Works suite of Contracts to ensure that risk is identified, allocated and managed by the appropriate party.

6. CONCLUDING COMMENTS

Projects, even large and complex ones, should not present undue difficulties in budgeting and delivery, if they are of a type within an organisation's prior experience. It is when something is being done that is new to the organisation that problems arise.

Thus, former National Road Authority's (NRA) estimates of the likely capital cost of the motorway programme were well off target when originally produced in the late 1990's, simply because the organisation at that time had no experience on which to draw. A decade later the NRA had considerable experience of major project implementation. They were closely networked with their opposite numbers across Europe with regard to technical standards, project execution challenges and solutions, and with shared cost data. Consequently, large, complex projects in the roads sector were being routinely delivered in a timely and cost-effective manner.

The lesson to be learned from that experience is that sponsors of projects of a type new to Ireland such as Metro North for example, should engage at an early date with the sponsors of similar projects in other countries so as to gain as much as possible from skills and information transfers. Active, confidential engagement with EU or UK peer organisations is invaluable as publicly available data can lack transparency or completeness. For example, not all costs may be captured and planning timelines may be much longer than indicated, and so on.

As has been, it is hoped, demonstrated in this paper, the processes involved in bringing public infrastructure to completion is complex and challenging. These processes will require continual review and revising to ensure that the demands for value and compliance across a range of areas are met. Efficient and effective delivery methodologies are improved through a continual learning from experience of completed projects.

It is the Irish Academy of Engineering's fervent hope that this paper will represent a useful contribution to this learning.

M17 – M18 Motorway Interchange

7. APPENDICES

7.1 Appendix 1: Projects initially reviewed by the IAE

1. **Projects that were successfully completed on time, within budget and as planned.**
   - Moneypoint Power Plant
   - Gas Networks Extensions
   - National Roads Phase 2 (TII)
   - ESB Network upgrading
   - Remedial Flooding Alleviation Projects

2. **Projects that were completed but had significant cost overruns, time delays or major changes**
   - Corrib Gas Terminal
   - Dublin Port Tunnel
   - Phase 1 of the National Roads Programme
   - Waste Disposal Plants
   - Intel Plants[5]

3. **Projects that are stalled or abandoned**
   - North/South electricity interconnector
   - Athenry Data Centre
   - LNG plant in Shannon Estuary
   - Metro North
   - Galway By-pass

5 Intel major capital projects all start with the expectation of change, as the process development is running in parallel with construction. The major commitment is to meeting a market entry date, while controlling the cost of change, and without compromising standards.

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