

Basis of Estimate (BoE) Novel and Comprehensive Proposal

(We gotta get to higher ground... J Cash 1959)

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Introduction

This paper and associated presentation have arisen because of a gap in guidance to the Estimating Community in relation to very complex estimating tasks and their documentation.

BoE guidance exists and is taught in some training sessions but it normally covers a specific Project or Programme of work requirement that involves a Customer within a Government Department or in potential Suppliers/ Contractors. The lack of guidance is more serious if we consider that some costing exercises seek to cover a 'portfolio' of projects and programmes that cover a capability involving, in Defence system terms, Air, Land, Sea and Space sectors – such costing work is usually undertaken by public servants or specialist Consultancies. Over the last four years (2020-24) I had correspondence with and posed questions to my Member of Parliament, the answers received were useful but offered no explanation as to how certain aspects of guidance could be improved.

Other estimation work by the Public Service (UK) has caused me to question the content of formal costing guidance issued. During research into one particular issue, I found a scientific report from researchers at Delft University¹ in the Netherlands. This report attempted to quantify the impact of one aspect of European climate change – sea level rises. The quantification was in Nation costs based upon their GDP. After reading this it was obvious that the BoE problem was more serious and widespread than I had previously thought.

My concern is that the guidance subject matter covered was incomplete and dealt solely with a 'project/ programme' and omitted evaluation of the need to document and respond to the additional challenges posed both politically, legislatively and industrial capability/ capacity to successful project delivery. Climate change, of course, was acknowledged and judged to occur slowly (the next 100+ years) so complacency and necessary government attention regarding early planning and policies was not focused where ought to be. The current and next generation will see increasing impact but it is the third generation where the impacts become a challenge if no preparatory work is in place.

The Attention Getter(s)

Sea level rise is a topical subject and is one extremely serious aspect of Earth's changing climate; the sheer volume of water makes it uncontrollable. Most of our planet's fresh water is locked up in the Antarctic ice sheet with other smaller contributions being the mountain glaciers, Arctic ice shelf and the Greenland ice sheet. Experts have calculated that an ice-free Earth would have sea levels more than 30 metres above their current levels – most of this rise is from melting Antarctic ice sheets. Such a situation has previously existed over 200 Million years ago but since then the Earth has had several ice ages the last one clearing around 12,000 years ago into the land-forms we recognise today. Nothing happens quickly in geologic terms and at the current rate of ice melt the increase in sea level is predicted by 2100 AD to be around 1.5 metres on average² which does not seem much **but** averages are deceptive and no-one should plan sea defences on such an average because other weather impacts like storm surges and local tidal variations may cause high tides to be many metres higher than this 'average'. The Great Storm of 1953 on the East coast of England that caused much devastation and loss of life had a storm surge of almost 6 metres (18 feet) above the

¹ S41598-023-48136-y "Distribution of economic damages due to climate driven sea level rise across European sectors and regions"

² UK Meteorological Office website

Spring high tide; such events may no longer be classed as a '1 in 150' Storm. Obviously, it is not feasible or financially viable to construct a 'coffer dam' around the UK as protection and piecemeal coastal defence will fail as sea levels rise.

Planning for such future events and defending against the continued steady increase in sea level requires a full understanding of societal impacts and planned future mandatory government edicts (legal ones) to enable forced population relocation from impacted lands to safety on a permanent basis and necessary financial remedies for loss of property value to private, business and agricultural sectors; the insurance³ sector will be in need of regulation as mortgages require insurance and flood risk increase premiums rendering some areas liable to becoming 'no go' for landlords and private mortgagees. The loss of food producing areas will be a challenge as the UK will not be the only country to lose productive lands. There are also other areas of the world (Asia, Pacific Islands, North America) where the impact will be far more serious should the sea levels rise more than currently predicted. Australia has recognised this and has a Treaty to take in Pacific islanders so affected as sea levels rise.

Many areas inland, around existing watercourses, will be impacted by increased flooding due to water not draining due to the increased sea level. The existing infrastructure is already vulnerable to flood damage.

The defences required to maintain safety and continued productivity of the UK cannot be built quickly (lack of government money, skilled resources, materials, comprehensive and cohesive planning). In short, the next 70 years are likely to become increasingly fractious and will inevitably contain pockets of civil unrest as enforced coastal and low lying area populations are displaced.

The 'Climate Change Committee' is a part of the UK House of Commons cross party work to review the impact of climate change and the current focus is primarily on achieving net zero targets for Carbon. Somewhat short sighted in my view as improvements in reduction of carbon will take hundreds of years to have a serious impact on climate change and those carbon effects will not stop the ice melt problem or replace the lost ice this side of 3,000 AD (my analysis given the volume of replacement required and achieve needs to be a catastrophic reduction in temperature like a nuclear winter).

In the case of the Delft paper subject on sea level rise impacts does not fully recognise challenges beyond the submerged lands on a nation's population and impacts are costed as a GDP percentage; the other impacts on populations (including increased migration), employment, education, changes to housing or damage to infrastructure which was not designed to be underwater or partially submerged during adverse weather events. There are of course more difficult areas to estimate relating to food shortages and basic needs of a displaced population.

As I wrote this paper a new Report emerged by world leading Danish scientists Peter & Susanne Ditlevsen "How soon might the Atlantic Ocean break?" published against analysis of over more than 200 years of collected ocean data, the predicted results indicated a timescale for a catastrophic change (tipping point) in the Atlantic Meridional Ocean Current (AMOC) for the Western European areas would occur around 2057 and greatly impact the climate experienced. This is startling and has caused some backlash in the scientific community and it may however be the closest crocodile to the canoe. If true, then certainly by 2100 the combined effects of sea level rise and AMOC induced climate change will have serious consequences for humanity.

The proposed BoE is able to cater for both scenarios and any linkages between them to aid reduction of nugatory work. My powerpoint presentation deals with the costing aspects and schedule

³ In the UK AXA2024 Insurance Company futures paper includes the need to change insurance to meet the climate change

needs to aid estimators working on the future needs of public service budgets and other requirements.

In the long-term government(s), need to plan for movement of population, re-siting of national treasures and historic items, official building, educational buildings and industrial facilities. Some of these will require unfavourable forced movement and relevant legislation to enable such movements.

Because of all the interlinked and dependent areas of society any cost estimate has not been complete due to the lack of inclusion and consideration of all government, public and private sector elements nor has it considered the timescales for legislation and planning to achieve a defensive line across the low-lying impact areas of the UK or its Dominions. In the case of the UK the timescale for delivery may be measured in government tenures (5years each) and to the year 2100 this equates to 15 parliaments to get the work done!

Such a holistic estimation requires a method to achieve a logical and comprehensive foundation for the costing requirements for use by Estimators possessing all the specialisms that need to contribute to prediction of the likely cost impact of the current Met Office predicted 'bad' case rise⁴ and a far worse case if the Antarctic icesheet does collapse. Given that cost of defences (as yet unknown) and the impact on the UK GDP the ability to raise funds for the UK sea defence programme will decrease as time progresses so budgetary estimate are required sooner rather than later.

BoE Proposal

Previous experience of process development guided me to use a 'Mind Mapping' application to create an outline diagram of all the aspects of Government (National & Local) – For US readers this equates to 'Federal & State' responsibilities. The national government is responsible for all top-level Policy, Legislation, Defence, Education, Health and Taxation decisions and co-ordination of Government Agencies and Emergency services. In the UK, the second unelected House (Lords), also includes the Faith Leaders. Much of central Government is devolved to individual UK countries (Northern Ireland, Scotland and Wales) who have their own administration and sometimes Legal systems and these are controlled by overall UK Government regulation.

This complex arrangement is quite difficult to replicate and the individual services that are supplied at Country, County and local level make for a complicated and inter-related (correlated) structure. However, over a period of several months a 4-level map was created using terminology that is easily understood. This mapping and other graphic information are the subject of my presentation offered to the London based ICEAA/SCAF meeting.

The map uses a simple numbering system to identify each part of the 'family tree'. The map element descriptors indicate where **any** Estimator needs to place resource to identify both cost and schedule impacts for almost any Public Service Infrastructure type, project or portfolio of work and take into account the intra-mural and extra-mural resources (contracted) required to plan and deliver the project. This mapping process is similar to the creation of a Whole Life Cost estimate for a military project but is much wider in scope because it includes all of the necessary national/ regional government actions to introduce new laws and/ or make changes to existing laws thus allowing for that decision time to be included in the 'project' plan.

Also, the due legal process for any changes impacting infrastructure must include the ability of the UK public to force an inquiry or legal challenge and thus delay the plans, particularly where the project(s) impacts local communities or heritage areas. These aforementioned issues and the

⁴ British Antarctic Survey Report 2024 indicates that their research using underwater remotely controlled vehicles, has found that the rate of bottom ice melt is faster than previously measured. This places more uncertainty in the Met Office figures.

resulting GDP impacts, I believe, were not fully addressed in the Delft University paper and were the cause of my creation of the mind map.

The mapping is contained in a separate report style MS Word Document and formatted into a draft report style that may be used as a direct guide or amended to suit different Country organisations and legislative arrangements. This document may be obtained on request to the author.

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