THE GEORGE BOOLE FOUNDATION LIMITED

DAI-Decision Analysis Initiative

2010-2020

Final Report

London

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George Boole
1815-1864

In 1854, George Boole published the book “The Laws of Thought” that explained human deduction and decision-making. He described his mathematical logic, now known as Boolean logic, and a design technique, Boolean reduction. Today these are the foundation of some 99% of the world’s software, decision analysis systems, artificial intelligence, design and operation of computers, logic circuits and communications systems, including the Internet.

George Boole was born in Leicester, England, in 1815 and died in Cork, Ireland, in 1864

The George Boole Foundation Limited was established in 2010 to commemorate George Boole’s immense contribution to the world’s ability to manage data, information and knowledge in analysis and deduction and to foster the development of useful devices based on Boolean Logic to support the achievement of sustainable human wellbeing.

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THE GEORGE BOOLE FOUNDATION

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DAI - THE DECISION ANALYSIS INITIATIVE 2010-2020

FINAL REPORT

INTRODUCTION

This is the final report on the results of the Decision Analysis Initiative 2010-2020 which was launched by the George Boole Foundation in June 2010 and was completed in June 2020. This replaces the interim report published in November 2019 which was limited to a review of some accomplishments related to technical developments.

This report provides information to interested parties on the scope of the activities within the DAI and the results achieved.

Hector McNeill
Director
The George Boole Foundation Limited
London

1^{5th} August, 2020

EXECUTIVE SUMMARY

The George Boole Foundation Limited is a not-for-profit company established in 2010 to commemorate the immense contribution of George Boole to the world's ability to manage data, information and knowledge based on the mathematic logic devised by him and today known as Boolean Logic. The Foundation plans to establish a George Boole Institute to act as a centre of excellence in the development and promotion of advances in beneficial applications of Boolean logic.

Although the Institute is an eventual goal, the Foundation initiated its work into the development and promotion of advances in beneficial applications of Boolean logic through the establishment of the Decision Analysis Initiative (DAI) set up soon after the registration of the Foundation.

The DAI's objective is to address practical questions of how to resolve gaps and needs faced by communities and economic sectors through the development of digital applications. As a foundation to this initiative a considerable amount of this work relied on the know how in practical applications provided by SEEL-Systems Engineering Economics Lab, established in 1983, and a leading decision analysis applications development centre. SEEL's original explorations and development work on decision analysis, starting in 1986, was based on the cumulative output of the Decision Analysis Group at Stanford Research Institute, Menlo Park, California headed by Dr. Ronald Howard.

Based on recommendations arising from SEEL's cumulative experience in applied decision analysis in the field of natural resources and agriculture, a specific unit to deal with project design and investment quality standards was formed as an activity within the DAI. This is the Open Quality Standards Initiative (OQSI). A justification for the OQSI was the high failure rate of agricultural projects pointing to inadequate project design procedures/standards.

OQSI has produced a range of new procedural standards for design of projects largely based on a decision analysis approach. Proof of concepts and online prototype design and testing of each procedure has been conducted by SEEL. As a result, all OQSI recommendations have been established to be relevant, useful and feasible in terms of application.

The DAI and OQSI have gone through two phases. An exploratory phase 2010-2015 to establish operational priorities and an operational phase 2015-2010.

In summary, the results of a ten years effort in reviews, research and standards development has resulted in:

- A new and comprehensive due diligence design procedure for projects
- The development of some 80 analytical tools to support project design procedures
- The development of 4 specific analytical procedures and tools designed to address specific critical failures in the Agenda 2030 project portfolio performance
- The development of 12 analytical procedures and tools to support a new approach to project evaluation criteria, procedures and information management
- The implementation of a cloud-based toolkit that provides support for project design, implementation management, portfolio management and evaluation, based on the recommendations arising from this professional effort

The operational structure adopted by the DAI is shown in Annex 1

In conclusion, the Decision Analysis Initiative, OQSI, SEEL and the new division, SDGToolkit.com, have delivered a comprehensive result for the Foundation. Although there have been delays related to technical factors[1] and early stage lack of funding, the original objectives have been achieved.

PHASE 1, 2010-2015

The Foundation launched its first phase Decision Analysis Initiative (DAI) in 2010 to be completed by 2015. This was based on small workshops, largely concerned with the dissemination of information on decision analysis and the potential contribution of digital logic devices in applying decision analysis to economic and agricultural development and innovation. An attempt was made to guide outcomes so as to produce results of relevance to high, medium and low-income countries.

The outputs from the first phase of the DAI was hampered by lack of funding related to the aftermath of the financial crisis that emerged in 2007/2008.

Detailed reviews, including from data collected by international development organizations, were completed in order to establish priorities for analyses of gaps, needs and constraints in the agricultural and rural development sectors. These studies revealed that 35%-45% of projects funded by international lenders and donors for development projects between 1990 and 2010 were failures. Our tentative assumption was that this failure rate was the result of inadequate design procedures. Projects fail because their designs are not feasible. Therefore, the Open Quality Standards Initiative initiated its work by reviewing project design and cycle management methods with a focus of design relevance and feasibility.

The following represent identified issues for development which were resolved successfully in the second phase:

- Stakeholder involvement is essential in whole project cycles but in practice it is highly variable and often far lower than reported
- Projects need to fit into a national framework where the policies provide adequate incentives or, at least, do not constrain project implementation.

[1] In early 2019,the license fees of the development system/language we were using were raised significantly. This would have made our objective of providing accessible service fees for low income country clients impossible. In April, 2019, all Foundation units switched to open source. This resulted in 8 months additional effort in training, transcribing the original code into the open source formats and conducting testing.

- To reduce failure rates there is a need to invest more time and effort in the decision analysis applied to the details of the design of agricultural, economic development and innovation projects and policies to avoid costly mistakes during implementation
- Project design needs to be based on decision analysis models to improve the understanding of relevant factor interactions and to manage the specific sources of uncertainty facing each project
- Decision analysis models should be used to engage stakeholders effectively to improve model design and the quality of analysis, in terms of relevance and transparency, thereby improving the feasibility of projects entering portfolios
- Gaps and needs must be quantified as deficits in provisions or states of affairs and not as processes. By identifying a gap as a process this presumes the solution is predefined when often it is the existing processes which represent the main problem.
- Processes and solutions should only be identified on the basis of reviewing the state-of-the-art options available to address the specified gaps and needs in the most effective manner; in this way it is easier to accompany and benefit from advancing state-of-the-art technologies and techniques
- Preferably, projects should enter portfolios which contain several projects, with easy to access information and deploying per-project standardized datasets to enable objective comparisons
- Project oversight needs to cover the whole cycle (design, setup, implementation and post-funding sustainability) and be in real time and 24/7 providing access to all per-project information no matter where projects are located
- Besides project management and teams, oversight facilities should be accessible by donors, investors, lenders and stakeholders
- Design operations need to be supported through the application of the most advanced and proven operations research methods (ORM) to cover stochastic uncertainty models, change impact assessments as well as project impacts on results desired involving economic, finance, environment, ecosystems, energy & water economies and social issues
- There needs to be a pragmatic approach to ORM because there are diminishing marginal returns to constantly refining analyses. In the case of some objectives more rough-and-ready but successful techniques are sometimes required (see under Options Benefit Analysis)

During Phase 1 the Foundation published a paper by McNeill & Belko[2] that contained a review of the limitations of conventional project cycle management methods. Their main recommendations were the introduction of Tactical Option Maps (TOMs) and Real Time Audit (RTA). Work within the Foundation units has further advanced the analysis and recommendations of McNeill & Belko but this paper provided the reference foundation and direction of developments leading to several significant improvements in procedures. An additional paper on Data Reference Models (DRM) was also published[3]. DRMs have since been applied in several EU projects to simplify CAP regulatory IT systems design and implementation by relating objectives to required data sets and algorithms.

PHASE 2, 2015-2020

In reviewing the output of the first phase it was decided to continue with the Open Quality Standards Initiative (OQSI) to bring all of the questions of project and policy procedural standards into a single operation during the second DAI phase 2015-2020. Further information on the OQSI can be obtained on the dedicated website.

MAIN OPERATIONAL ACHIEVEMENTS IN PHASE 2

During Phase 2, there were 4 main outputs:

[2] McNeill, H.W., and Belko, F, "*Towards more effective Project Management*", DAI, London, October, 2011, ISBN: 978-0-907833-02-4

[3] McNeill, H.W., "*Improving communications within systems groups*", Decision Analysis Initiative 2010-2015, Portsmouth, August, 2014

1. A set of ***due diligence design procedures*** specified during Phase 1 were extended and completed[4].

2. The advent of Agenda 2030 in 2015 with the Sustainable Development Goals (SDGs) was an important development but by 2019 several important performance gaps appeared in the of the Agenda 2030 project portfolio. Therefore, ***specific procedures/tools addressing the non-performant SDGs*** were developed to address these gaps.

3. Significant changes have been introduced to ***project evaluation criteria*** was well as to the specific management of data/information of relevance to evaluation

4. The analytical procedural cloud-based tool prototypes, used to test and confirm the practical feasibility and operational utility of OQSI recommendations, have been upgraded, re-tested and implemented[5] as ***SDGToolkit - Software as a Service*** system that will be launched via the SDGToolki.com web site.

This SaaS system is due to be launched end of Q3 or beginning of Q4 2020.

1. ANALYTICAL PROCEDURES

By far the weakest link in conventional project cycle guidelines is a lack of practical methods and associated analyses to quantify the greenhouse gas (GHG) emissions associated with project design options. Therefore, considerable effort was made to establish a practical way for project teams to secure, from the initiation of a project implementation, a state of operation that reduces or eliminates some GHG emissions. From that point on, the future reduction in GHG emissions depends upon refinements of processes and additional phases of substitution of inputs with high carbon footprints. This can only be managed if a project design and implementation approach accepts ongoing change to be a necessary practical reality essential for the success of a project. This is quite different from attempting to design and deliver a project that has a fixed productivity target.

MOVING FROM A THEORY OF CHANGE TO AN EVIDENCE-BASED FEASIBLE CHANGE STRATEGY

The analytical procedures generate comparative projections of alternative scenarios based on decision analysis models. Information is built up across three sets of analytical procedures to identify an in-depth assessment of feasible project options. A specific additional set of tools supporting the analysis of the post-funding adjustment to secure long terms sustainability is an important capability. This builds in a corrective procedure that avoids the risks associated with attempts made to deliver projects whose conditions have changed to such an extent as to make original plans unfeasible. As a result, the uncertainty aspects of plans are accommodated through the acceptance, at the outset, that conditions will change. In this way the desired change is moved from a theoretical concept to an applicable and more dynamic and realistic change strategy.

The OQSI analytical procedural recommendations are arranged in three separate but interrelated banks of analytical tools:

- GCA-Global Constraint Analysis

- 3DP-Due Diligence Design Procedures

[4] OQSI analytical procedural recommendations are always work in progress as a result of advances in technology and practice and operate in a framework of constant revision and improvements

[5] All analytical tool modules exist within a regime of constant improvement and are subject to change.

- RTME-Real Time Monitoring & Evaluation

1.1. GCA-GLOBAL CONSTRAINT ANALYSIS

The 2019 Sustainable Development Report revealed that more than 65% of the indicators for SDG 12 (sustainability of production & consumption) and SDG 13 (climate action) have not yet been specified.

Our development teams include individuals with over 45 years strategic analysis and project field experience and have demonstrated that there is no need to await these specifications because there are effective analytical models that can secure a realistic assessment of exposure at the national level. Accordingly, as a result of further research, the OQSI added a Global Constraints Analysis module containing a library of over 20 applied analytical tools that combine various factors to establish national trends and to identify critical gaps and needs and constraints. As a result, project teams gain a better orientation by not only becoming acquainted with their national level gaps, needs and constraints they are better able to identify the numbers and distribution of constituents in need.

As a result, these analytical tools help quantify the dimension of national actions needs and can begin to analyze the detailed constraints facing a project design based on the 3DP procedures. In this way the coherence between national and project level objectives is maximized. This includes the possibility of calculating the contribution of any specific project to the national effort in meeting specific SDGs.

1.2. 3DP-DUE DILIGENCE DESIGN PROCEDURES

One of the first sets of analytical procedures developed by OQSI were submitted as a draft set of recommendations to DAI in 2016. These were structured around a due diligence project design procedure to support decision analysis by ensuring that all relevant factors were identified and given due consideration. The procedure is referred to as 3DP – Due Diligence Design Procedure.

The use of the name “Due Diligence Design Procedure” is meant to convey several important attributes including:

- The creation of an easy to follow, stepwise logical sequence of transparent procedures
- To establish a minimum standard for required professional effort applied to the process of project design.
- The application of standardized and therefore comparable procedures between projects and across portfolios

Any such a process needs to be supported by:

- The issuance of specific guidance for users on each procedure
- The provision of analytical tools to help generate projections of validated evidence for each procedure
- The establishment of a process creating an expectation that projects proposed, or subject to monitoring and evaluation, will record all of the information generated by the due diligence procedures and provide access to this information by authorized personnel such as donors, stakeholders, portfolio managers and evaluators

3DP is a horizontal framework similar to most project cycle management systems although it contains more complete handling of constraints facing projects. The OQSI recommended 3DP procedure are

made up of over 50 procedures[6] whose records are generated in many cases by additional around 25 domain-specific analytical tools.

1.3. RTME-REAL TIME MONITORING & EVALUATION

The Real Time Monitoring and Evaluation (RTME) system holds the design option considered to be the best starting point for a project. This is referred to as a Logical Project Option (LPO).

LOGICAL PROJECT OPTIONS

The OQSI approach accepts that project plans can seldom maintain any design optimality because of changing conditions during implementation phases. Therefore, rather than refer to a single plan the approach is to identify the project option considered to comply with known conditions but accepting that, as conditions change, so will the target benchmarks in a project as the feasible performance adjusts to the changing conditions. Therefore, the presented project plan is referred to as a Logical Project Option (LPO)[7].

The OQSI approach is to maintain all design options on record in a Project Memory, these can be referred to as conditions change as a guide to optimizing decisions taken to response to change, during implementation, so as to maximize the likelihood to achieving original objectives.

PROJECT MEMORY

Project Memory is the record of the accumulated knowledge built up by a team during the course of a project's identification and design and eventual implementation. A key foundation of a sound Project Memory is an adequate investment of time in project design. By having teams share the information on gaps, needs and constraints gathered by the GCA, and exploring the options to address these needs via the 3DP, the teams can develop a detailed knowledge that lays the foundation for a project's design. The exploration of solution options and the optimization of alternative social, technical, economic, financial, environmental and ecosystem impacts, a team can gain a detailed understanding as to why a specific option has been chosen as the project proposal upon which is based the operational plan.

The Project Memory provides a single source of project information that is constantly updated to avoid multiple copies of project documentation containing different content, a common occurrence with paper-based documentation.

Project Memory helps reduce the damage inflicted when a knowledgeable individual leaves a project team which can cause disruption progress and decision making. The Project Memory is a valuable unified source of all of the information on a project helping new team members come up to speed within a short period of time.

The RTME manages the access to the Project Memory and all GCA and 3DP information and complements this information by completing the Project Memory with the LPO data on the project structure, sequence of tasks, task processes, task inputs and output specifications, financial analysis, schedule, Gantt Chart and a Logical Project Option (Log Frame). This data constitutes the project proposal and plan and target performance benchmarks. This information establishes the activity benchmarks against which to monitor performance.

[6] Depending on the SDG objective, occasionally some procedures are not relevant but their presence provides a useful prompt to detecting overlooked issues or they can be passed over.

[7] The LPO is based on the Tactical Options Map (TOM) proposed by McNeill & Belko in 2011. It also replaces the conventional Log Frame which tends to describe a single option plan.

The RTME has the additional function of providing real time on-demand analysis and reporting on any details of project design or implementation status.

A LEARNING SYSTEM

OQSI procedures are designed on the basis of a cognitive ergonomics approach that sequences procedures to maximize the understanding of their function and analytical tools implementations are designed to be easy to apply. Simulation of design options helps advance the understanding of the potential and limitations of a project and build up an in-depth understanding of the accumulating Project Memory content on the part of the team. The reiteration of different options helps in the development of a “discovery” and “retention” model of learning moving the design process from a theoretical exercise towards one that is critically applied. Under this regime mistakes create less recriminations and more an attitude of errors becoming gains in refinement of knowledge as to what works and what does not work.

INTERNAL AND EXTERNAL EVALUATIONS

The OQSI approach to evaluation is distinct. It supports internal monitoring and evaluation by assigned team members and external evaluations. The RTME’s contribution to professional learning support (on the job training through instructional simulation) helps improve the ability of team members to conduct objective performance monitoring and diagnostics. The RTME includes procedures and analytical tools for internal monitoring and evaluation as well as for external evaluations.

Within the overall approach applied, internal evaluations are carried out by team members who as members of the design team are the best qualified to diagnose issues related to performance. This also provides the opportunity for timely informed decisions in response to changing conditions leading to better overall implementation performance. This also helps improve external evaluations because of a far better-informed project team as well as having access to the complete information of the project cycle to date held in the Project Memory and accessed via the RTME.

AGENDA 2030

The initiation of the second phases of OQSI and DAI coincided with the 2015 launch of Agenda 2030 by the United Nations, with 17 Sustainable Development Goals, subject to 230 indicators. Our ongoing involvement with project appraisal and evaluation on behalf of donors alerted us to the fact that project teams were going to face difficulties handling the scope of SDG indicators that combine national level indicators with design and implementation of actions through projects.

AGENDA 2030 PERFORMANCE ISSUES

Our field work on the identification of specific project level operational constraints and difficulties, has pinpointed the application of inappropriate guidelines and a significant lack of training in project design on the part of the majority of project team members, involving the handling of multiple factors. This indicated that an early success of Agenda 2030 in low income countries was unlikely. This judgement is based on the fact that the existing project cycle guidelines are not oriented to resolving several issues required in the design of actions addressing SDGs.

In the 2019 Sustainable Development Report[8] it was confirmed that a negative correlation exists between economic growth and three key Sustainable Development Goals:

- SDG 10 Reduced inequalities
- SDG 12 Responsible consumption and production
- SDG 13 Climate action

From internal economic policy development work at SEEL[9], reduced inequalities reflected in income disparities, have become a well-documented and are an evolving symptom of the imbalance in resources allocation resulting from unexpected incentives created by conventional macroeconomic management and, in particular, monetary policy. This is far removed from project level areas of focus and/or influence.

Since production and consumption takes up all of economic activities and supply chains in the economy the problem with SDG 12 is that the lack of transition to sustainable production is bound to end up with a general failure to deliver positive impacts on climate (SDG 13).

International agreements on "climate action", somewhat like Agenda 2030, at international and national levels, attempt to establish targets at a very high level of abstraction. There is a general failure to place in the hands of those charged with designing solutions and implementing these as projects, the necessary tools for the job. The realization of climate action and sustainable economic development is wholly dependent upon the state of domain knowledge and the quality of project design and implementation management.

Additional information in the 2019 Sustainable Development Report revealed that more than 65% of the indicators for SDG 12 and SDG 13 have not yet been specified. Several low-income countries do not collect the necessary data series.

Given the evolving scale of the challenge and the numbers of projects required, there is a growing problem of availability of qualified and experienced human resources to address this challenge. Therefore, as a result of this unfortunate lack of progress in climate action and the Agenda 2030 portfolio performance, the Foundation intensified its efforts to tackle the specific gaps in practical links between national objectives and appropriate analytical tools required to identify the required actions.

THE RELATIONSHIPS BETWEEN INTERNATIONAL AGREEMENTS AND ACTIONS ON THE GROUND

The previous section refers to international agreements, including Agenda 2030, as establishing targets at a very high degree of abstraction. This is because the evolving conditions addressed by such agreements, are externalities. Externalities are the outcomes and millions of economic units and consumers generating conditions such as air, water and soil pollution, climatic impacts through release of greenhouse gas (GHG) emissions, soil degradation and erosion. Paradoxically some externalities are the unexpected outcomes of economic policies so that the drive for nominal economic growth has created the externalities reported under the Agenda 2030 as rising real income disparity, declining sustainability and failures to reduce GHG emissions.

Critically, as far as the planet is concerned, these externalities are creating a transition that is marked by a declining carrying capacity of the earth's natural resources, as a result of increasing population

[8] The 2019 Report was published just 4 years after the initiation of Agenda 2030 which is an insufficient time within which to expect substantive results, but the specific failures are so generic and had been detected some time ago in the economic research by SEEL as a structural problem of considerable concern.

[9] SEEL is currently the lead international centre for the development of the Real Incomes Approach to Economics.

pressure and lack of adjustment of activity process technologies and techniques to counter these negative trends.

On the other hand, actions on the ground in the form of projects and ongoing business activities, as a group, are the cause of the externalities. However, the conditions that express the outcomes of economic activities as externalities are symptoms of many different causes associated with activity process technologies, technique and their combine inputs and outputs. Therefore, the indicators that record the factors of interest in measuring the externalities are not the same as the indicators needed to design processes that reduce and eventually eliminate the causes of the externalities.

Therefore, a specific effort was required to develop procedural methods and analytical tools to address the non-performant SDGs in the Agenda 2030 project portfolio.

2. SPECIFIC PROCEDURES/TOOLS ADDRESSING THE NON-PERFORMANT SDGS

In reviewing areas where the Agenda 2030 project portfolio in non-performant, it is evident that there is a gap in project team support in terms of specifications and availability of appropriate analytical procedures covering these. Therefore, a priority became the establishment of analytical procedural logics as well as the design and implementation of analytical tools for procedures addressing these critical design and operational deficits.

RELATING CRITICAL OBJECTIVES TO A DYNAMIC LPO

Our associate's applied experience in designing, managing and evaluation of projects has always cast doubt on the rigid nature of conventional project cycle management techniques. The LPO concept is a natural response to this reality. However, if the LPO is accepted to be a baseline upon which to justify the funding and implementation of a project, it is necessary to ensure that the projections of the project performance in the critical areas identified need to conform so as to also permit adjustments to be applied in real time in response to changing circumstances during implementation. These adjustments would apply to:

- Financial return
- Individual real income impacts
- Climate impacts
- Carrying capacity

OPTIONS BENEFIT ANALYSIS

After several years dealing with sophisticated ORMs and Decision Analysis Cycles it is apparent that quite often the desired information is not in the form required or, does not exist. The likelihood of objectives in any one of these factors being achieved needs to be based on the acceptance that the people working on a project, or on those activities served by a project, will need to learn "to do the job" required. Therefore, any performance benchmarks need to follow the normal trajectories of human learning curves.

On the other hand, given the urgency of the performance gaps in the Agenda 2030 project portfolio, as of 2019, it is necessary to design projects that will have an estimated quantitative beneficial impact on these criteria.

Options Benefit Analysis (OBA) is currently what we consider to be a practical solution to this dilemma. OBA is made up of four[10] analytical procedures:

- OBA1 - Cost Benefit Analysis
- OBA2 - Income Benefit Analysis
- OBA3 – Climatic Benefit Analysis
- OBA4 – Capacity Benefit Analysis

OBA1 is the well-established discounted cash flow rate of return analysis (RRE) which can be based on cost benefit analysis (CBA) or internal rate of return estimates (IRR) the two basic indicators here are cost and financial return[11]. Notice that these calculations are based on a trajectory of total project costs and revenues over the implementation setup and operational phases of a project.

OBA2 compares the configuration of real incomes within a project or paid in those activities supported by a project, against the cost of the project, calculated in OBA1. Because of the different phases in projects and evolution of "benefits", like OBA1, these calculations are based on a trajectory of incomes over the implementation setup and operational phases of a project.

OBA3 compares the configuration of carbon footprints (CF) of inputs and processes of project activities. Because of a general lack of accurate CF estimates for most products, a rough and ready Basic Feasible Solution is identified as being one that reduces likely CF in inputs through substitution or reduction in use. The effect of this on activity CFs needs to be traced through. The general objective of this very basic approach is to reduce the demand for the substituted or reduced input components. The reduction in demand attributable to a project can be measured or, at least, known to reduce the demand for CF products and therefore contributes to overall reduction in use. Because of the different phases in projects and evolution of CF reduction impacts, like OBA1 and OBA2, these calculations are based on a trajectory of CF reductions over the implementation setup and operational phases of a project.

OBA4 compares the configuration of carrying capacity (CC) of the natural resources used by the project including land area and water against what is available. This is a complex topic because overall national carrying capacity is a summation of utilized natural resources plus those that are not being used. Like the CF estimates, the objective is to attempt to contribute to the national picture by increasing productivity of physical CC. Again, the CC benefits are input as a trajectory of benefits.

TAP – TECHNOLOGY ADAPTATION PROCEDURES

TAP
Technology
Adaptation Procedures

The analysis of design options is based on the consideration of specific changes in the input-output (I/O) relationships in project activities. These options are specified by changing the proportions of inputs and nature of outputs associated with each "recipe" of inputs. The process constitutes one of incremental changes and comparisons of changes in technology and techniques. Therefore, the successive steps at arriving at the satisfactory LPO in which all OBAs attain a satisfactory trade-off position depends upon a procedure of technology adjustments in an attempt to adapt to performance criteria.

ECONOMIC RATES OF RETURN (ERR) AND RATES OF RETURN TO THE ENVIRONMENT (RRE)

By trading off the OBAs this process is essentially comparing the trade-off between Economic Rates of Return (ERR) with Rates of Return to the Environment (RRE). The final balance of a projects impacts

[10] It is likely that additional procedures will be added to the OBA applying the same logic.

[11] Gittinger, J. P., "Compounding & discounting tables for project analysis", EDI, World Bank, 2nd edition, 1984.

on the natural resources carrying capacity underlies the foundation to sustainable production linked to climate action.

3. EVALUATION CRITERIA

There are two sets of criteria applied to projects relating to:

- Performance
- Sustainability

3.1. PERFORMANCE CRITERIA

In translating national level gaps and needs to project objectives requires a set of analytical procedure with which to establish priority targets or objectives at the national level against which to establish individual project objectives. Project design can then proceed from that point to identify optimized solutions. In order to support the development of due diligence design procedures it was therefore necessary to establish the evaluation criteria to be applied to assessments of project designs as well as subsequent implementation performance. There is a well-established set of criteria with international approval contained in the so-called OECD-DAC evaluation criteria for development aid. This was based for many years on 5 distinct criteria:

- relevance
- efficiency
- effectiveness
- impact
- sustainability

As a result of a review of DAC criteria in 2018, the OECD added the additional criterion of “cohesion”.

However, the modus operandi of the monitoring and evaluation assignments is to use independent consultants so as to avoid conflicts of interest. Therefore, teams are left to record progress (monitor) through design and implementation and the external evaluators apply the criteria listed to the outcomes.

As a result of our field experience, we have found that this system does not work effectively because:

- quite often the design procedures are not evaluated
- many teams find evaluations to be a negative experience
- often there are inadequate procedures and means of recording monitoring progress in a standardized fashion
- team members with key roles can leave a project removing key aspects of knowledge relating to some activities creating difficulties for the remaining team and for new members to come up to speed on what are sometimes complex projects
- sometimes teams wait for evaluation assignment results before taking critical decisions which often come too late to benefit the project concerned with any desired impact
- invariably “lessons learned” come too late to be applied to the project in question and are archived for future reference to benefit the management of future projects

As a result of the use of external M&E personnel, the utility of evaluations can fall well below what many would consider to be acceptable because the opportunities to keep projects “on track” in the face of change are not effectively supported and many cases are lost altogether.

EVALUATION CRITERIA REVISITED

The quality of information in a Project Memory is of vital importance. In this context, and considering the current failings in the international climate change accomplishments and Agenda 2030 the OQSI re-analyzed the question of project evaluation criteria. The following changes were introduced.

The DAC Criteria were used as a basis but the criterion “cohesion” was replaced by “coherence”. The additional criterion of “resilience” was added to strengthen the climatic aspects as well as against other likely sensitivities of outcomes to instabilities and change in nature and markets.

As a result, the OQSI recommended evaluation criteria are as follows:

- Relevance
- Efficiency
- Effectiveness
- Impact
- Resilience
- Coherence
- Sustainability

3.2. SUSTAINABILITY CRITERIA

Besides evaluation criteria linked to performance there are sustainability criteria that include sustainability considerations related to the following domains of enquiry:

- Social
- Technical
- Economic
- Financial,
- Environmental
- Ecosystem

OQSI CRITICAL PATH

To combine the OBAs, ERR, RRE, performance and sustainability criteria into an intelligible map, OQSI created a Critical Path as illustrated in Figure 1.

The Critical path lies within the green boxes. Valid project designs need to generate LPOs that satisfy the listed criteria under Performance and Equilibrium (sustainability) in order to attempt to secure a carrying capacity that is not negative, i.e. not falling.

The Figure 1 shows the relationship between OBA1, OBA2 and ERR, on one hand, and OBA3, OBA4 and RRE, on the other.

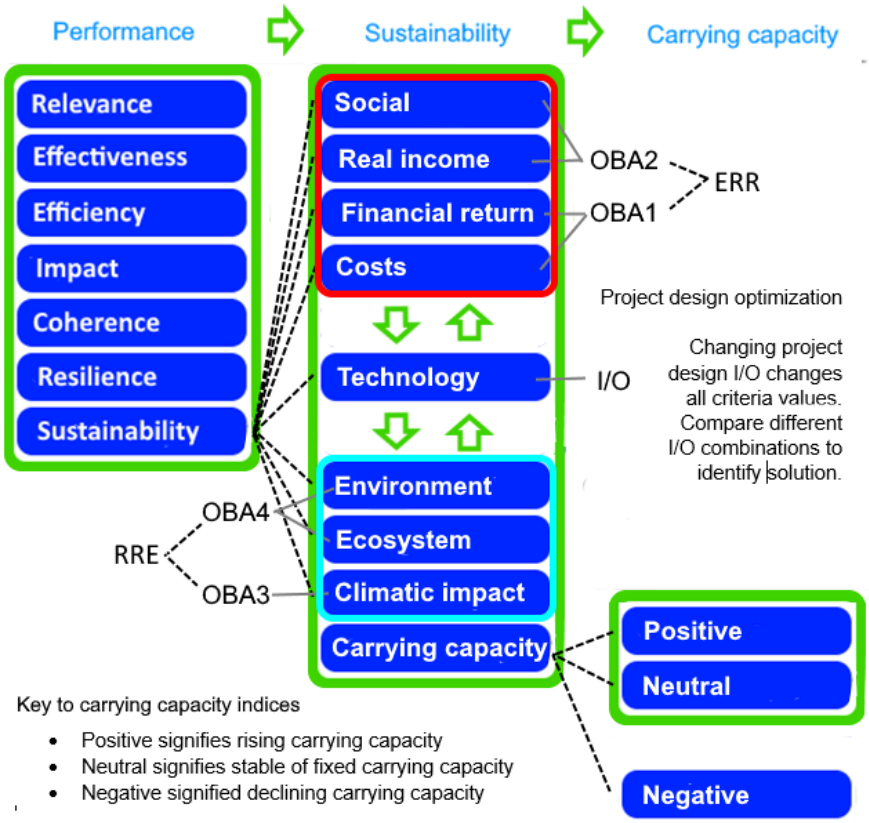
The measurement of economic rates of return and income, the ERR zone, is indicated by the red box. The measurement of rates of return to the environment, the RRE zone, is indicated by the turquoise box.

DESIGN OPTIMIZATION

The process of project design optimization is accomplished by changing input and output characteristics of a project to project the impact of each I/O combination of the performance and sustainability criteria values. The options that secure positive or neutral carrying capacity scores are worth further investigation whereas those generating a negative carrying capacity score should not be considered.

The main issue at the moment is too many projects in the Agenda 2030 have negative carrying capacity scores indicating no future sustainability with respect to real incomes, production and consumption systems and climate action.

Figure 1 The OQSI Sustainability and Climate Action Critical Path



4. SDGTOOLKIT - SOFTWARE AS A SERVICE

In order to accelerate the implementation of the OQSI recommendations as a cloud-based service the Foundation established SDGToolkit.com to provide this service to provide all of the necessary resources for better project design to address the main shortcomings in Agenda 2030 project portfolio performance. SEEL-Systems Engineering Economics Lab have implemented all of the required software and established the server facilities to provide this service.

SDGToolkit is ***a project design***, ***portfolio management*** & ***evaluation*** system. We consider this to be able to address SDG requirements.

The SDGToolkit design functional specification consists of all of the OQSI recommendations.

SDGToolkit fills in a series of gaps that exist in many project cycle management systems including:

- Providing of due diligence procedures and analytical tools
- Detailed instructions and online resources

- Full project portfolio system able to manage any number of projects[12]
- Integration of country level with project level analyses
- Can be used to manage government multi-project programmes
- Raises the standard of project design
- On-demand, real time, analysis and reporting of any aspect of any project using few mouse clicks
- Automatic narrative reports on analyses to avoid misinterpretation of data projections
- All reports, tabulations and graphics can be transferred to MS Word, Excel while user data remains in secure database
- Secure entry by authorized personnel
- Plasma.Systems operating system controls access to every analytical tool and to data
- Designs held in an Accumulog[13] a section of the Project Memory that can be locked and made unalterable and inaccessible by the Plasma.Systems operating system
- Minimized costs of entry and access through a browser running on any operating system or device

The SDGToolkit should be launched by end of October, 2020.

2020 - CHANGE IN THE FOUNDATION FUNDING MODEL TO A FEE-BASED MODEL

In the light of the difficulty in raising funds as donations in support of the Foundation, the Foundation consulted government, NGOs, agribusiness and institutional groups to identify an improved operational basis for raising funds. The outcome of this consultation was a decision to abandon the practice of requesting donations and to switch to fund raising based on a service provision model. The service provision model was to be designed to bring quantifiable benefits to clients. The obvious candidate as a service provision was an improved project cycle and portfolio management system.

The Foundation therefore placed more emphasis on the design and implementation of a next generation, cloud-based project cycle and portfolio management system to be marketed on a fee-paying basis as Software-as-a-Service (SaaS). The system to be used to provide this service is SDGToolkit. The fundamental principle is to be able to demonstrate, on the basis of return on investment appraisals and contributions to sustainability, the benefits to any specific client including project execution institutions, governments and aid donors.

As a non-profit foundation all income over and above operational costs is returned to the Foundation in pursuit of its general objective of research and development of useful digital applications.

The funding framework options are in final phases of elaboration but these will be designed to minimize the costs of entry and maintenance for users, many of whom are likely to be from low income countries and institutions with limited budgets and human resource complements.

There are several operational options for the introduction and development of the SDGToolkit.com services including field service management models to support consultants, free return on investment estimates and extension network models and a development practitioner network model to build up a

[12] The database used is a leading industrial standard capable to handing over a million projects

[13] An Accumulog is an early version of block chain identified in 1986 by Hector McNeill to support learning systems, a development initiative at the ITTTF Brussels. Accumulogs have since been developed by SEEL and Plasma.Systems as cloud-based immutable and mutable storage.

mutual knowhow and knowledge base. These are being finalized ready for the planned launch by October 2020.

The options to be offered will be posted on the SDGToolkit.com website.

CONCLUDING

To date, all objectives within the DAI have been achieved successfully.

We hope that this trend will continue in the next phase running between 2020-2025.

ANNEX 1: OPERATION STRUCTURE ADOPTED DUTING THE PERIOD 2010-2020