

Standardisation

Standardisation of steel plant building in a portfolio of projects

Standardisation of plant building projects provides a more manageable, scalable and representable method of undertaking a steel plant project, this resulting in fewer unknowns compare to a non standardised project. The time and cost to implement a standardised project can be estimated at its start with high accuracy and this has great advantage for the client.

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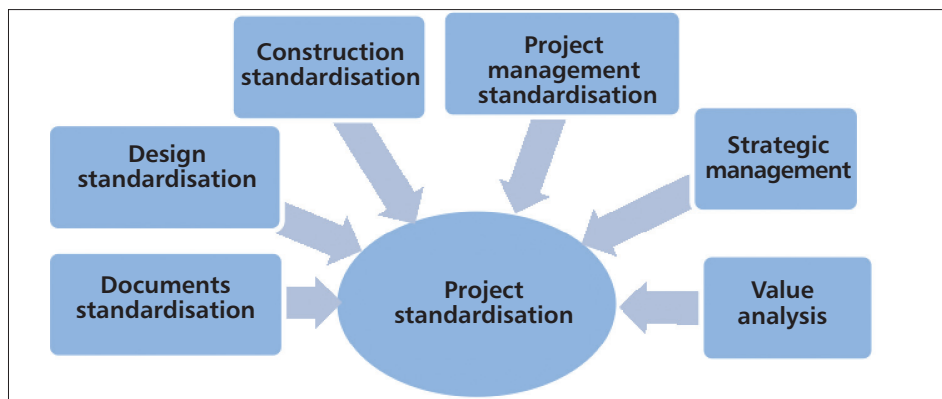


Fig 1 Constructing elements of standardisation of project

STANDARDISATION offers a more manageable and scalable method of plant construction compared to other project execution techniques and is much less complex with broader parameters set at the start of the work. This method is most suitable for plant builders which have a portfolio of projects which can be replicated at various locations. The benefit of standardisation for their clients is a saving in both cost and time by purchasing 'off the shelf' plant, already designed, with builds proven in operation.

Standardisation offers great advantages in cost saving, shorter time of implementation and improved quality of plant construction. Also, calling on the experience of previous projects, prevents the need to start from zero in designing and running the plant.

Standardisation of large scale industrial projects is a fairly recent idea which has emerged in leading companies in the past few years and is still under development and spreading through other companies. Standardisation sets a high benchmark for engineering and management of replicable projects and provides a more manageable and presentable outcome facing fewer unknown factors during the construction of large projects such as for steelmaking plant or direct reduction modules.

This article is based on the real experience of implementing standardisation in the build of high profile projects, merging academic knowledge of project management techniques with engineering management. Implementing this requires a strategic decision at a high management level and could be applied to a portfolio of projects of a similar kind.

Although, there are existing examples of standardisation in construction and modularisation in both theoretical and practical aspects, with regards to standardisation of design, project management and integration of these steps, there is considerable room for improvement.

The standardisation of a project refers to all the activity which make a large scale project identical to other similar projects. Standardisation could be achieved by means of uniformity in engineering, construction and project management by reducing product variability, implementing strategic planning and implementing a project orientation strategy

instead of a product orientated strategy.

The DIN Handbook defines standardisation as; 'Standardisation is an instrument in the creation of order in our technical world. It is an integral part of the existing economic, social and legal structure'^[1].

In the real industrial world, standardisation is a strategy to build two plants exactly the same as each other by means of using uniformity in basic designs, in detail design, in layout, and in the technical specification of equipment.

Below is a brief description of terms used in this article:

Similar Project: Projects, performing similar tasks but the technical specification of equipment and sub-systems are not identical. For example, a steelmaking plant of 1Mt/y capacity compared with a plant of 1.1Mt/y capacity can be similar eg both EAF based and charging scrap, but the sub system and equipment inside these plants need different specifications to cope with the differing capacities.

Standard Project: Projects which perform similar tasks and where the technical specification of equipment and also all layouts and detailed design are identical to each other. For example two steelmaking plants each of 1Mt/y capacity and each of similar design are standard.

Benefits: Standardisation of a project allows the client to use all the experience gained from previously constructed plant and add value to these. Also, standardisation enables a new project to start from the finishing point of the previous project, enhancing the experience gained from the earlier project and the quality of operation. This prevents any duplication of work and the experience of having to start a design from nothing. By standardisation, the new project has accumulated the engineering and management efforts of all previous similar projects and prevents unnecessary work and effort. Such projects act as a number of projects in series, each building on the experience from the previous.

Standardisation

Accepting a standard build project instead of a

custom built project requires the agreement between all parties involved. The end user or client of the project must agree to a standard project instead of a custom built plant and agree to the technical specification of the standard project in order to benefit from the advantages of accepting it.

If a customer needs a product, whether it is an automobile, a machine tool, a semiconductor chip, or a software programme, there are three basic options:

- Obtain a fully customised product from a vendor or an in-house department;
- Obtain a standardised or 'packaged' product;
- Obtain a semi customised product from a vendor or an in-house department that customises a purchased standardised product^[2].

Thus three options are presented to the client to procure the project. As the project becomes increasingly customised the price will rise. Providing three options or two options to a client in a large scale project will give the customer the chance to complete within a tight budget and on time.

Design standardisation

Standardisation of projects starts with a standard design. This is the first step and results in minimising the waste of materials and time and maximising the project value.

H Smith^[3] says; 'Standardisation in design is the activity of applying known technology and accepted techniques in the generation of new products. By standardisation in design, time is not wasted in 'reinventing the wheel' and starting every project from zero'.

Taking the steel industry as an example; one client considered building three steel plants in various locations, one of 750kt/y capacity, another of 650kt/y capacity and the third of 700kt/y capacity to produce carbon steel billets. If the designer could design one plant of 700kt/y capacity, and use the same design and layout, general arrangement and technical specification for all three, instead of separate designs for the 750kt and 650kt plants, the result would be a 'standard plant'. In this case, the client should be convinced to purchase a standardised plant of 700kt/y capacity instead of the three different plants. By standardising

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Standardisation

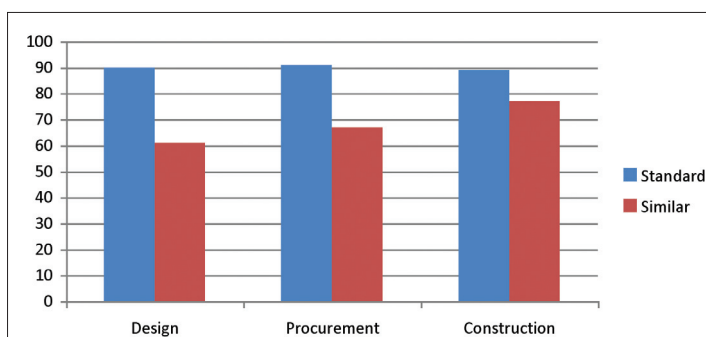


Fig 2 Comparison of degree of unification of standard and similar project (%)

Table 1 Comparison of the different aspect of project management between standard and similar projects

	Project cost estimation	Scope management	Planning and control	Work break-down structure	Project organisation	Time management	Critical path method	Project design	Project procurement	Cost	Quality management	Project communication	Risk management
Similar project	✓	✓✓	✓	✓✓✓	✓✓✓	✓	✓✓✓	✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Standard project	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
	✓ Largely Identical		✓✓ Highly Identical		✓✓✓ Very Highly Identical								

the output of each plant to 700kt/y and reducing output variability both in capacity and product specification, a standard plant is produced.

Standardisation in practice means uniformity in all plant layouts, general arrangement, general assembly, calculations, technical specifications, enquiries and all main construction drawings and documents as far as possible using a standard project of the same capacity and product specification. Although some design depends on the site's geographic location and available raw material input, many of the main specifications can be standard and uniform.

For example, some of the design fundamentals for direct reduction iron (DRI) projects is the iron ore analysis, which may result in minor changes between different plants, and this is acceptable, no two plants can be completely identical to each other, and so 100% standardised.

Construction standardisation

Standardisation in construction is the most developed concept in project standardisation so far. Many publications and websites refer to this concept. However, by standardising the design and management and combining these, there is a much greater degree of standardisation in the construction phase.

AGF Gibb^[4] says: 'Standardisation is the extensive use of components, methods or processes in which there is regularity and repetition'.

The main benefits of standardisation of construction are predictability and efficiency.

Green and May^[5], point out one of the most practical methods of applying standardisation in construction is off-site manufacturing, prefabrication and modularisation.

Standardised construction requires fewer people to assemble the prefabricated units and these can have a lower level of training and skills.

Project management standardisation

The most widely used sources of project management guidance, bodies of knowledge and the tools/techniques used in projects in the construction sector, are also generally focused on achieving single project objectives. Yet closer scrutiny of construction activities shows that

many projects are increasingly undertaken in a multi-project setting. Payne^[6] estimates that up to 90% by value of all projects are carried out in a multi-project context of some sort. Against this background, the need for new approaches, processes and techniques suitable for multi-project management is therefore obvious.

Increasingly projects are moving toward a multi-project context. Consequently new method and techniques are required to manage a project portfolio. As noted by Kähkönen^[7] a project management model will be changing according to the changing global requirement. 'Project Management models are reflections of our understanding of the project management content, its elements and their priorities,' he comments. Again applying a new project environment in the methods of management is highlighted by Kähkönen.

Also lean project management concept and principles, which involve a more generic concept to standardisation of project management, is discussed and presented by Karim and Nekoufar^[8] in 'Project Perspective' the annual publication of the International Project Management Association.

Project portfolios

A project portfolio is a collection of projects or programmes which are grouped together to facilitate effective management of that work to meet strategic business objectives.

Project management for standard projects can be taken from a project portfolio of management techniques beside other common techniques of project management such as the Project Management Body of Knowledge (PMBOK).

A group of related projects managed in a coordinated way can obtain benefits which cannot be realised by managing them individually. The project management of a few standard projects happens in the same environment as a portfolio of projects. Concepts and techniques related to project portfolio management can be used for standard projects as well.

Standardisation of projects could happen in parent companies which have similar projects in a specific field or have incoming of similar projects. This technique will spread through all its

subsidiary companies after a while.

Table 1 outlines the scale of unification of project management aspects in similar and standard projects.

Strategic management

The main step for strategic management of a standard project is to consider the project as part of a portfolio of similar projects and to have a strategic plan for these projects. This view is a crucial step for achieving standardisation of a project.

According to B Aritua et al^[6] 'Multi-project management provides a vehicle for considering both internal and external environments and thus integrates projects and strategic planning. An empirical study has shown the important role of multi-projects in aligning strategy and projects'.

Standardisation is not a short term goal for companies and requires enough time for substituting current projects with a standard project. Thus, companies should consider standardisation as a long term strategic plan.

Designers need to take into consideration a wide view undertaking standardisation of all incoming projects and modularisation so that only minimal changes to designs are necessary for use in new projects of a similar nature.

Value analysis

Value analysis is a system of views, methods and procedures aimed at achieving a substantial decrease of costs required to carry out certain functions of an object.

According to Value Analysis any project requires the following expenditure:

- Necessary for carrying out required functions; and
- Excessive as a consequence of surplus capacity in product designed on the basis of a conventional approach.

It is estimated that 20-30% of any technical system's cost is related to its main functions, approximately 50% to its auxiliary functions, and 10-20% to functions that are never used. The challenge is how to cut the cost of a product and improve its quality. Using Value Analysis we can meet this challenge.

By applying the Value Analysis method to the steelmaking plant example, it can be evaluated that the construction of a new plant of 750kt/y capacity was uneconomic and would increase the initial investment of the plant. However selecting a plant of 700kt/y capacity from an existing, 'off the shelf' standard plant, already designed and operating elsewhere would reduce the cost of design and construction significantly, making its operation profitable despite the reduced capacity.

Standardisation of a steelmaking project requires integration and adoption of all the techniques and concepts so far described. These elements are summarised in Fig 1. Each of the principles illustrated in Fig 1 are frequently used in industry, but as isolated separated approaches. Integrating all these principles together and applying these techniques in combination and also considering a project within a portfolio of others is necessary to achieve standardisation.

Result of standardisation in steel-making plant

Fig 2 illustrates the average degree of unification for similar and standard project in design, procurement and construction.

One of the great advantages of a standard

project is the use of existing basic and detail designs and documentation, which greatly reduces the degree of rework and revision required.

By applying the procedures described in a real steel making scenario a standard project is derived with the following fixed parameters:

- Basic design;
- Process Flow Diagram & Drawings;
- General layout of plant;
- General arrangements of equipment and systems;
- Technical specification;
- Scope of works;
- Bill of material;
- Purchasing enquiries;
- Structure and level layouts;
- Civil design;
- Electric arc furnace;
- Ladle furnace;
- Continuous casting;
- Downstream: Bar-Section mill-Hot strip & Plate mills;
- Detail design of conveyors.

The effect of standardisation on some typical equipment is listed below:

- Conveyor: Various belt widths for different capacities of internal conveyors;
- Chute: Sufficient standard chute dimensions to achieve the required flow rate and match the conveyor width.

Consequently, many detailed parameters and designs are fixed from the start of the project, and there are not many parameters unique to that project at the start. This is especially useful for equipment such as conveyors and chutes which have enormous details in design which can be almost set at the start of the project.

Thus the documentation and specifications which are the main important parameters of a steelmaking project are fixed and defined at the start of the project so avoiding major changes during implementation of the work. These parameters will be a great help to the client in easing the implementation of the work.

However, outdoor conveyors and structures largely depend on site geography and cannot be standardised.

Standardisation procedure

Fig 3 shows the procedure for applying standardisation methodology to a large scale industrial project. This schematic summarises all the techniques which were described in the preceding sections of this article.

In conclusion, the following advantage will be achieved by standardisation of large scale projects.

- Uniformity and standardisation;
- Reducing complexity and unknowns in the project;
- Increasing manageability of project;
- Reducing cost and time of project implementation; and
- Quality of implementation is improved.

Due to the replication of the project in a manner identical to previous projects, the quality of implementation of the work is enhanced. Standardisation will set a benchmark in construction and management in the construction of any replicable large scale industrial plant and has a great impact on such projects. ■

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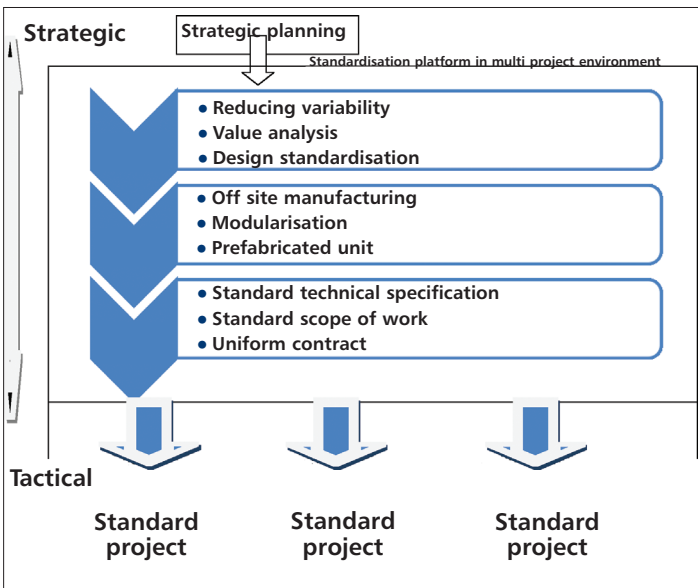


Fig 3
Procedure
of standard-
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making
project