ABSTRACT
The development of a web supported service for project teams is described. The Interactive Work Analysis & Simulation (i-WASP™) contains over 190 structured process maps of the building project process from concept to handover. Laid over this are the management processes to manage each step in the project. For each task in the process, the system provides a definition of the task together with advice and guidance on how it should be managed. This is further supported by practice guides that develop the management methods and give an in-depth description of the latest approaches. Each practice guide contains checklists that can be downloaded for the user to adapt and modify to their own needs. i-WASP is focused at the operational level and is compatible with the current improvement agendas. It brings together guidance and practice into a single tool to support all project team members in their work, so delivering research findings and consolidated best practice for the practitioner.

Keywords: Process Mapping, Modelling, Integration, Project Performance, Practice Guidance.

1. INTRODUCTION
The UK construction industry has been undergoing a series of radical initiatives designed to raise its effectiveness, be innovative and deliver projects in a consistent way to meet clients’ objectives. They are, for instance, captured in Rethinking Construction (Construction Task Force 1998) and, subsequently, Accelerating Change (Strategic Forum For
Construction, 2002). More than 375 Demonstration Projects worth over £7 billion (Constructing Excellence, 2003) are being undertaken under the Strategic Forum and Constructing Excellence in probably the largest experiment in innovation in any industry. They are being used to realize the ambition of achieving change and adopting best practice through the involvement of a wide section of the construction industry. However, Gann (2000) has identified the difficulties faced by project organisations in capturing knowledge from experiences generated on individual projects.

The success or otherwise of the demonstration projects will be in whether or not this experiment achieves a wider take up of innovation than conventional approaches. The nature of a project is that the participants will be placed in an innovative environment such that those involved have an opportunity to be innovative themselves or to take advantage of others' innovation. This is in addition to any technological innovation that may be used to satisfy product development.

The emphasis of the Demonstration Project process is predominantly process improvement, rather than product improvement. Each company is exposed to novel knowledge acquired on the project and the main questions are the degree to which this exposure is welcomed and whether or not the company’s processes and procedures are geared to change via adoption? It is not just an issue for the Demonstration Projects; it is a general issue for the industry. In order to be successful, project-based organisations need to embed their experiences into their ongoing business (Gann, 2000). This brings in issues of how an organisation learns and consolidates its experience (Nonaka and Tackeuchi, 1995).

The purpose of this paper is to describe a working solution to the need for a consistent approach to project management through the definition of a process model that is capable of supporting a range of procurement approaches. The i-WASP system has been conceived as a means for providing this consistency through the modelling of good working practices reinforced by the latest research findings. As Egan and others (Hammer and Champney, 1995) have said, unless you understand your processes improvement cannot take place. This is built upon the understanding of Japanese manufacturing (Womack, et al, 1991). Egan was really saying that construction does not have a consistent set of processes on which to build a strong performance base and that it should if it is to move forward.

2. CURRENT PRACTICE

The weakness as Gann indicated is that the capture of innovative practices, good working practices and even best practice is still embedded in individuals through a combination of individual experience, shared experience and by observing the change process that others are progressing. The effectiveness of this approach depends upon the receptivity of the individual and their parent organisation to embrace the
experience and the ability to transfer it into established practice. Rarely is this formalised into an operating set of processes backed up by an explanation or overall philosophy of management. Some projects have a Project Execution Plan (PEP) which attempts to state the particular processes and practices for the project; but as shown below, these documents are rarely completed and implemented.

‘Failings on projects of the team to be working to the same management standards, procedures and protocols often leads to poor performance. In extreme cases such as the building of the Scottish Parliament building in Edinburgh the results can be quite devastating. As the Rt. Hon. Lord Fraser of Carmyllie QC said in his review of the project “I endorse the Auditor General’s conclusion that the failure to finalise this key document (the Project Execution Plan) was a significant shortcoming”. There were over 10,000 design changes to the project which the client failed to manage.’ (Audit Scotland, 2004)

This and other project failures have led to the call for a consistent approach to project management that draws upon current best practice and demonstrates how to avoid such project disasters.

2.1 Development of Online Support to Deliver Consistent Project Management

Is it time to think differently? The iPod generation is used to information on tap. Downloaded music is ubiquitous, so why not download best practices? Laptop computers, PDAs and telephones can search the web and receive information. The music providers have done the hard work for consumers; information providers must now do the work for construction practitioners. By understanding the production process and linking relevant information to it, the information manager can present the information to the user in a way that is relevant and timely. The information itself can be at a variety of levels: broad strategic direction, good technical information, custom and practice, leading practice and relevant legislation. Links to other sources enable the user to have confidence in the quality of the information if they wish to delve deeper into the background of the guidance and advice. It is time that construction joined other industries, such as health (see www.mapofmedicine.com), in providing online support to busy practitioners. Interestingly, as with medicine, construction has a fragmented delivery process involving a large number of practitioners who conventionally access information in a random way. As in health care, it is vitally important that as many people as possible are working to the latest practices. The legal process assumes that is the case. In response to this, individual companies manage their own responsibilities; but little effort, due
to pressures of time and delivery, is placed on integrating across organisations for project delivery.

3. FEATURES OF THE I-WASP SYSTEM

Any system to support construction project managers must contain the following features: a total project perspective, an easy to follow work logic, relevant guidance for each work stage based on the latest information (management practice, good practice and best practice), checklists to help busy practitioners and sources for further explanation of the practice and guidance.

3.1 Total Project Perspective

The most effective projects integrate project management, i.e. the stages of decision and design within the client’s domain, with construction management, i.e. the integrated design and construction domain. Across the project stages are laid the management skills of design management, risk management etc. in a matrix (see Figure 1).

Figure 1. Overview of i-WASP matrix.
Each of the ‘building project stages’ has a logical series of tasks as does the ‘project management discipline’. So at each intersection in the matrix between the stage and the skills, the manager has to make decisions and apply his/her expertise. It is here where the consistency has to be built into the approach. Everyone at these intersection points must be aligned to operate with the same goals and objectives, and understand why and what these are. The current failing is that not everyone is at the same level of capability. There are many reasons for this, for instance, different exposure and experience development; variations in education and training; different organisations are pursuing different goals and objectives; parties have not worked together before; and little or no practice in the current project type or its requirements.

![Diagram](image)

**Figure 2.** Section of one of the many process maps in i-WASP.

### 3.2 Process development

Each process map (see Figure 2) has been evolved from extensive research into current practice and modified through iteration and discussion with practitioners. The maps have been evolved by one of the authors over a number of years with a wide range of companies in the design, project
management and construction management fields. A Delphi approach was adopted. The basic map was developed from the literature and current practice that was iterated until an agreed and generic map was produced.

The advantage of the process based approach is that the user gets a clear picture of all of the tasks in the area that have to be done as an integrated whole. The user can probe deeper as the process boxes with the shadow effect lead, with a click, to further process maps to explain the process in greater depth. In all, over 190 process maps have been developed in conjunction with leading UK project and construction management companies.

3.3 Relevant Guidance for Each Work Stage and Task

The operational information attached to each task in the process map (see Figure 2) can be specific instructions on what to do to implement the task or guidance on how best to do it given that this will need to be modified to suit the context. Whilst the advice can be quite prescriptive it has been generalised to be widely applicable. However, the strength of the guidance provided by i-WASP is that it has been compiled from world-class research, tried and tested leading practice and authoritative guidance information.

Hundreds of sources of information are published every year which would be impossible for the typical practitioner to search. By pre-digesting this information, i-WASP presents the user with a fast-track to best practice, thus enabling the rapid adoption of good practice across the industry. This is the same approach that is adopted by the producers of the Map of Medicine. However i-WASP is more advanced in the presentation of the material and as the cursor passes over the task box a drop down box with the information appears – see Figure 2 – so reducing the clutter on the screen and making the application suitable for mobile phone or PDA use.

4. UNDERLYING MANAGEMENT PHILOSOPHY

Conventional construction is largely custom-built, piece-by-piece and mechanically fixed in a robust way to ensure that the building has high life expectancy. This leads to a lengthy sequence of interrelated operations.

The larger and more complex the project then the longer will be the operational sequences leading to the lengthy construction periods that are now being questioned. Fast construction requires that these sequences are broken down into parallel activities, which means that managing the interfaces between the parallel paths is the new challenge. Added to this is the increasing complexity of the sequential supply chain for components that are manufactured off-site. Within these complex supply chains are a large number of interfaces between the organisations involved in the
process. The challenge is to find ways of simplifying the management of the interfaces both within the supply chain and between supply chains.

Fast construction requires that the parallel paths are constructed as near simultaneously as possible. A balance has to be struck, therefore, between separating the parallel paths and managing each path well. Clearly, if every component was treated as a separate path then a project would have thousands of parallel paths which would be impossible. A compromise is sought in the form of clustering similar technologies and systems together.

4.1 The Technology Cluster

The key to success in complex, technologically-driven environments is to relate all contributors to the constituent parts and to the whole to ensure that the value chain operates coherently from start to finish (Gray, 1999). In practice, this requires all necessary skills for a given system to be represented and integrated within the given technology cluster. Technology clusters facilitate focused procedures, by providing for tasks according to the following criteria:

- functional unity of structures, envelopes, spaces;
- unity in time and place, a sufficient level of synchronisation within the schedule; and
- unity of means organised around common working methods.

Bringing in specialists just to resolve details is not enough – they must be given the chance to use their plant and methods effectively.

4.2 Integrated Team Working

This interlinks three core approaches to design management, which are in themselves proactive in designing the working context in which groups work together: the cognitive frame to exchange ideas; the project organisational framework to ensure communication across the silos; and the social frame to ensure the informal communication is allowed and managed back into the formal system.

4.3 Work Area Control

This approach attempts to consider construction in a way that enables the best practices of manufacturing to be applied, but also recognises the special nature of the process. A fundamental characteristic of construction
is that it is constantly producing new areas of work as the building and project grows. A work area is an area of work where the gang has complete control over it for a period in excess of two days. For example, a six-day week can contain three two-day work areas and a five-day week can contain two 2.5-day work areas. This is a radical departure from established norms and requires site management and designers to think differently. Instead of work being design-led at this level, design is work-led.

4.4 Checklists

To support changing practice, the guides have been formed as checklists which can be modified by the user. The checklists are presented as three columns. The first lists that task, the second is blank and the third contains phrases or statements of practice. Users can either cut and paste column three into column two and accept the recommended practice or modify it to suit the particular project requirements. Alternatively, users can develop their own requirements whilst being informed by the leading practice.

5. SUPPORTING CONSISTENT AND INTEGRATED WORKING

By being downloadable from the WWW the tool is accessible without barriers so enabling a wide range of uses:

- A user can use the system individually to ensure that he/she is using the latest practice and guidance in managing projects.
- A whole company can incorporate it into its intranet to form the backbone of its practice thus ensuring that it is working in a consistent way. The company could make its use mandatory across all projects.
- A project team can use the system to ensure that all organisations are working to the same approach as they have a common understanding based on the latest practice.
- Project-specific versions can be posted on the project extranet for downloaded by all staff.
- Tailored Project Execution Plans (PEP) – within I-WASP there is a PEP framework that embodies the management practices to ensure a consistent approach to project and construction management. The framework for the PEP is preset to embody the details of the approach which can then be modified for the specific nature of the project.

An Integrated Computer Supported Collaborative Working system should address four basic areas of concern: Communication, Collaboration, Coordination, and Control (Ganesan et al., 2001). Although this was said in a review of collaborative tools where the user added the information rather
than with i-WASP which is knowledge rich, the same principles apply. Collaborative working is supported within i-WASP through the PEP. A team can be given access to its own version of the PEP framework which can be adjusted and modified to suit through input from anyone in the team who has been given access. There must be key manager who authorizes all changes to the basic concept but nonetheless this approach allows consistent communication, a collaboration framework, coordination around a common core of knowledge and practice and control through the key manager authorising all changes from the core.

5.1 International Project Applications

As i-WASP is web-based, it is accessible from anywhere without the need for adaptation. This enables internationally-based teams to work in a common way. The web removes international barriers. Every organisation in an international project can use the same approach as if they were a local organisation. The self-learning nature of the guidance and information means that anyone from any background can bring himself/herself up to a common level of understanding at whatever level or position they are in the project. Users can take as much or as little as they need but knowing that everyone is working to the same processes and with a common understanding of what each task is and how they should best perform it.

6. CONCLUSIONS

Unlike other industries, such as health-care, construction is poorly served with specific, readily-available information on best management practices. Users have to solve problems quickly so they need information immediately. The iPod generation is with us and construction needs information delivered in this way. i-WASP is the construction equivalent of iTunes and the Map of Medicine. It has adopted a process-mapped approach to achieve a structured approach to project delivery and has gone much further than any other existing approaches with over 190 process maps. By overlaying management specialities, an integrated project approach can be taken to the management of construction.

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