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IT SUPPORT OF INTEGRATED PROCESSES IN MODERN SHIPBUILDING

Summary

The overall processes to build a ship can be divided into several sub-processes, which can vary slightly between the different shipyards: Design, Planning, Material Acquisition, Production preparation and Production. Typically the various processes are performed in separate departments, however sometimes having a project organization across the departments. It is important to have effective information routines as the work and results in the various departments/processes are very important for the other departments/processes. One of the major challenges for a modern shipyard is therefore to establish processes and tools that contributes to the optimisation of the overall processes without losing the focus on the sub-processes. This requires specialised IT-systems that can take into account all the specialities of shipbuilding. E.g. the planning system must be an efficient tool for the planning department itself, but more important it should contribute to the optimisation of the production.

Key words: planning, material management, production control, shipbuilding processes

IT PODRŠKA INTEGRIRANIH PROCESA U SUVREMENOJ BRODOGRADNJI

Sažetak

Cjelokupan proces gradnje broda može se podijeliti na nekoliko podprocesa koji mogu varirati u različitim brodogradilištima: Projekt, Planiranje, Nabavka materijala, Priprema proizvodnje i Proizvodnja. Uobičajeno se različiti procesi obavljaju u odvojenim odjelima, premda se ponekad organizacija projekta može protezati preko odjela. Važno je imati učinkovite informacijske rutine budući da su rad i rezultati u pojedinim odjelima/procesima vrlo važni za druge odjele/procese. Zbog toga je jedan od najvećih izazova modernog brodogradilišta utvrditi procese i alate koji pridonose optimizaciji cjelokupnog procesa bez gubitka fokusa s podprocesa. To zahtijeva primjenu specijaliziranih IT sustava koji uzimaju u obzir posebnosti brodogradnje. Sustav planiranja mora biti učinkovit alat za sam odjel planiranja, ali još je važnije da pridonosi optimizaciji proizvodnje.

Ključne riječi: planiranje, upravljanje materijalom, upravljanje proizvodnjom, brodograđevni procesi

1. Introduction

This paper will focus on the overall processes that are typical on a modern shipyard with the focus on sub-processes of design, material planning, planning, production preparation and production. Each sub-process will require input from other sub-processes and will generate valuable input to other sub-processes.

Shipbuilding is a discipline that can be characterized by:

Concurrent engineering,

None or short repetitive series,

Frequent interaction between design and production

Short planning horizon for the detailed work

Frequent changes arising from customer requests, re-design and others

Huge requirements for co-ordination

The processes performed in shipbuilding are often iterative and there is a demand for exchange of information between processes. A typical pitfall that is observed in shipyards today is that the information flow between the processes are not streamlined and also the overall process is not streamlined. The result is of course that projects are delayed, budget is not kept and the quality is not sufficient.

2. Overall process description

The price competition in the shipbuilding industry is traditionally strong and is possibly even getting stronger during the last years. To keep the market position and gain new contracts every shipyard is working hard to become more productive and cutting down any possible overhead. To achieve these goals short delivery time and reduced cycle time is a very important factor.

Shorter delivery time and reduced cycle time is closely connected to the business processes involved in handling a ship project. The main phases are:

Basic design

Detailed design

Material Definition (Project or Standard Materials)

Procurement (Procurement Planning, Enquiries, Purchase Orders, Expediting)

Production planning (From initial plan to work orders)

Production (own fabrication and assembly)

Delivery to customer

Besides the phases mentioned here there are other phases involved in a shipbuilding project but these will not be handled in this paper as the main focus is for the phases involved in engineering, procurement and production.

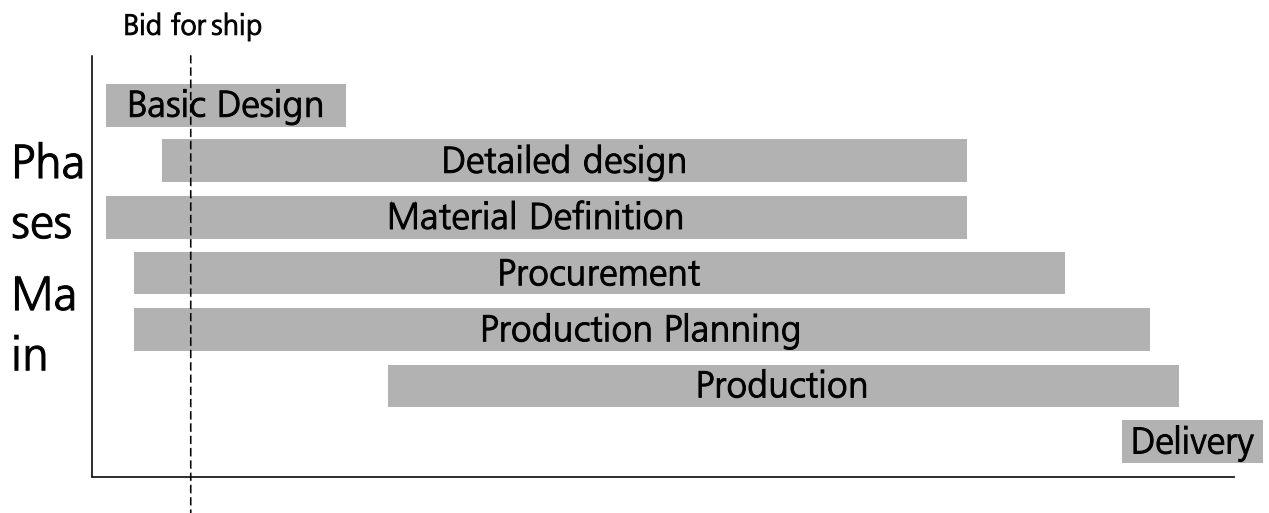


Fig. 1 Main processes in shipbuilding

Slika 1. Glavni procesi u brodogradnji

In figure 1 the main processes are illustrated and as it can be seen there is a great deal of overlapping of the processes, i.e. the problems and issues with concurrent engineering have a very high focus in a shipbuilding project.

To handle these issues it is therefore very important to have a good organisation and very good tools supporting the business processes. One of the tools needed is the IT system. The most successful way forward includes good IT systems support as well as good business processes. Therefore the architecture and functionality of the IT systems should go hand-in-hand with the business processes and information flow both within the different organisational units and as interaction between them.

In the following chapters, the seven main processes, the information flow and key issues for good IT support will be described.

2.1. Basic design

The basic design is performed in a very early stage and for some parts even before the final contract with the ship-owner has been signed. In this phase the main geometry is defined and even some of the key outfitting components are defined. At the same time negotiations with potential suppliers will start to be able to give final price offer for the ship.

A lot of departments are involved in this process; Design, Procurement, Planning, Finance and in some cases as Production and external parties could well be involved too.

In this process a lot of valuable information is collected and will really be the basis for the final offer and also the start up of the further project. Therefore it is very important that within the different departments there are good IT systems where this vital information can be stored and handled. Furthermore it is important that the other departments have access to this information and can use this for their part of the job.

The identification and definition of the main equipment can be used as an example of this. These will as a first step be defined in the design department. The purchase department will based on this and the initial plan from planning create enquiries to potential suppliers asking for prices, delivery terms and deadlines. The suppliers will respond with offers that should be registered and compared and final selection should be made.

Based on this information flow it is therefore important that Design, Planning and Purchase in this phase works on the same core data and the IT systems support this procedure of working.

2.2. Detailed design

Some parts of the detailed design will also begin in the bidding phase as a basis for the final offer for the ship. After getting the contract the detailed design will be continued and will reuse all the information collected and defined from the earlier phases. Therefore both the design system and the administrative systems should be able to directly reuse this information and gradually refine the information as well as adding new information.

One characteristic is that from the beginning of a project very little information is known and during the life cycle of the project more and more information becomes available. This also applies to each individual material or part, see figure 2.

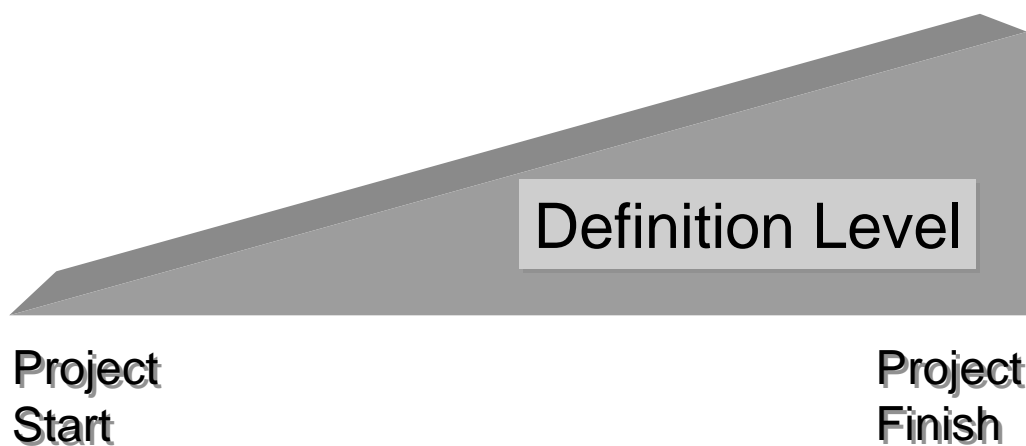


Figure 2. Project life cycle
Slika 2. Životni ciklus projekta

In the detailed design phase the complete modelling of the ship is performed and the assembly structure is defined according to the building strategy made in the initial planning phase. Much information for the project in this phase is generated for Material Definition, Procurement, Planning and Production and it is therefore vital that the IT systems support this process and all systems use the same core data. If on the other hand the systems are stand-alone systems there has to be a lot of re-typing of data with the risk of making errors and this clearly requires more resources in all departments.

As discussed before a ship project is a concurrent process and therefore changes in design happen all the time. Having good IT systems the consequences of changes can much more easily be foreseen and actions can be taken to minimise the problems.

2.3. Material Definition

For the strategic material needed for a project only a very small part can be considered as ordinary stock material and reordered based on regular consumption. Most of the material is defined specifically for each individual project although they might be standard materials. The material definition are performed as a part of the engineering process and concurrently when building up the part lists for the Assembly Structure.

When the engineering process is performed as a concurrent process it is not possible to complete the material definition and material requirements before the purchase process can be initiated. By reason of this it is important to focus on the right material and quantity rather than focusing on trying to bulk the material requirement which most likely will change at a later stage due to changes in plan and/or design.

The Material Definition phase mainly involves persons from design but also from purchasing department. As all materials defined should go through the purchasing department for enquiries, purchase orders etc. it is important that the IT systems are integrated, i.e. all definitions made by design will be available for Purchase without having to retype the information.

2.4. Procurement

For the procurement process there are some characteristics for handling a shipbuilding project:

Need for early purchasing of “key” items

Information required is created iteratively and final information is often only available after a purchase contract is placed.

The purchasing process is very technically driven and requires teamwork between designers and buyers.

Purchase of material is often made before the final need-date in production is decided.

The procurement process is dependent on the category of material to purchase. For project components and standard project material the purchase process is initiated by the designers creating the technical purchase orders. The buyer can then decide to perform an enquiry process.

At a very early stage it is also, in some cases, necessary to do a planning of the procurement for the key items, i.e. based on the key milestones defined in the planning, the need dates of the key items can be identified. Important information for this process is therefore the definition of the key items, the milestone planning and knowledge of lead-times from the Suppliers. All this information is vital to have available for the process.

For other categories of material the purchase process is initiated by dealing with requisitions from designers and by checking the material status.

The overall philosophy is that this process is partly manual performed. The challenge in shipbuilding is not to have highly developed functions for reordering of standard catalogued items but to focus on the critical items. The purchase process is seen as an on-going process that collects the information from all different parts of the design system and the material control system.

In the procurement phase the main input comes from design and it is therefore important that the design system and the purchase order system work on the same core data. Using the same data source can indicate for the design that the materials have been purchased and maybe delivered and changes therefore should be handled in a special way, possibly not being performed unless it is highly required.

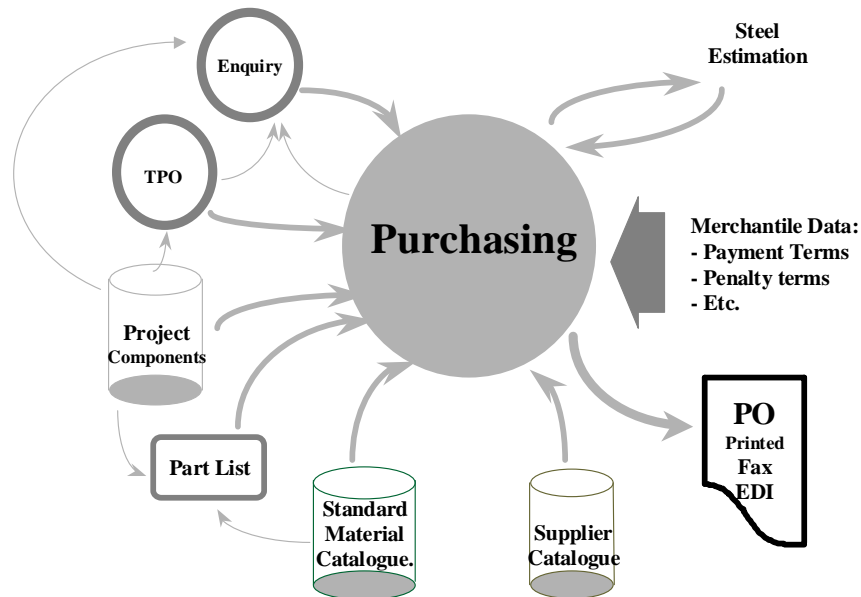


Figure 3. Purchase processes

Slika 3. Procesi nabave

2.5. Production Planning

The planning of the work is performed as a building strategy defined through the creation of a work breakdown structure. Most planning is performed in steps starting with a rough schedule that is refined during the phase for the basic design and more elaborated on during the detailed design and production design phase. In the final production planning, the work orders for production are produced based on the overall planning, the assembly parts lists generated, and the capacity and materials available at a given time. For this process it is of great importance that a total overview of design status and procurement status is available. Furthermore, the progress back-reporting from production is important to make as realistically detailed planning as possible.

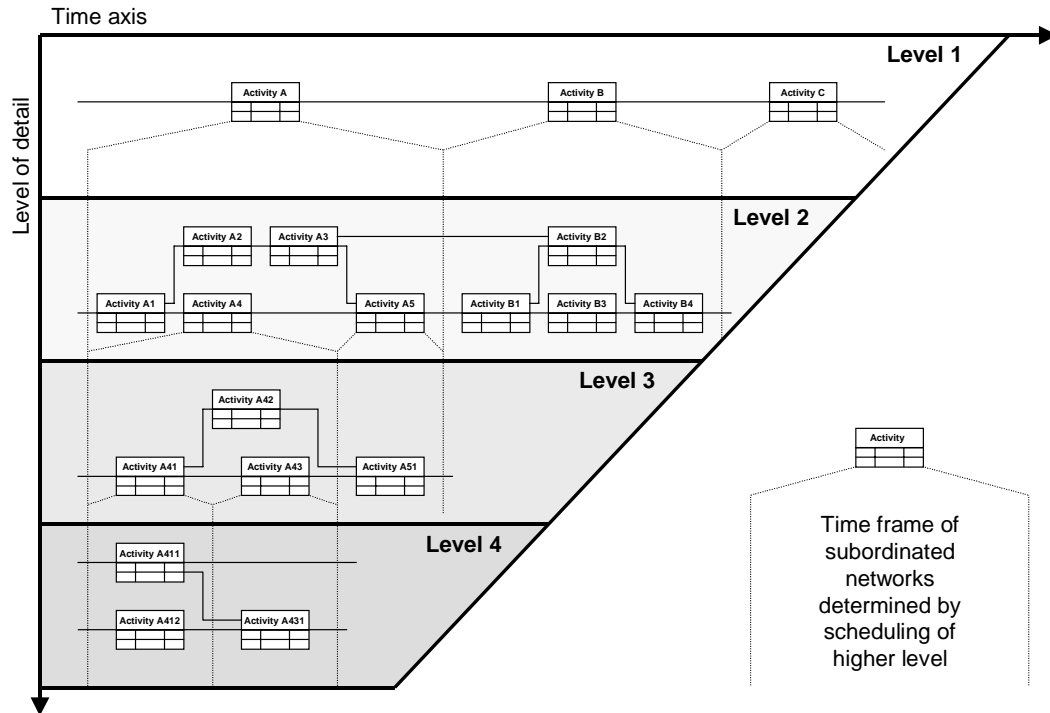


Fig. 4 Hierarchical approach in production planning
Slika 4. Hijerarhijski pristup planiranju proizvodnje

2.6. Production

In the production phase all information collected through planning, design and procurement will be used for the real production. Production needs information like:

- What to build?
- When to build?
- Where to build?
- How to build?
- Availability of materials?

All this information is input to the production phase either for manufacturing or assembly. The output of information from production on the other hand is just as vital for the process. This is information like progress, exact use of material and other resources, which materials have been used and where etc.

When high productivity is the overall goal it is of great importance that all this information is stored and easily available for other departments in the company. There could for example be a requirement for a change in design but in case production has completed their part it will be very difficult and expensive to make this change. In an integrated IT system the design will have the production progress available and can in that way make a better and easier judgement of the consequences for a design change.

Production will on the other hand also be able to have a better and earlier overview of the design and in that way be able to do better, more detailed production planning even though the final design is not released to production. There will be a clear indication for production of what is going on in the design phases and actions to prevent problems can be taken more easily when having an effective IT System.

In shipbuilding the production plan is never that detailed that routing information can support a delivery of material to a specified workshop. Since the production planning is highly decentralised and performed by the foremen in production the materials are not delivered to production without any 'Request for material' made.

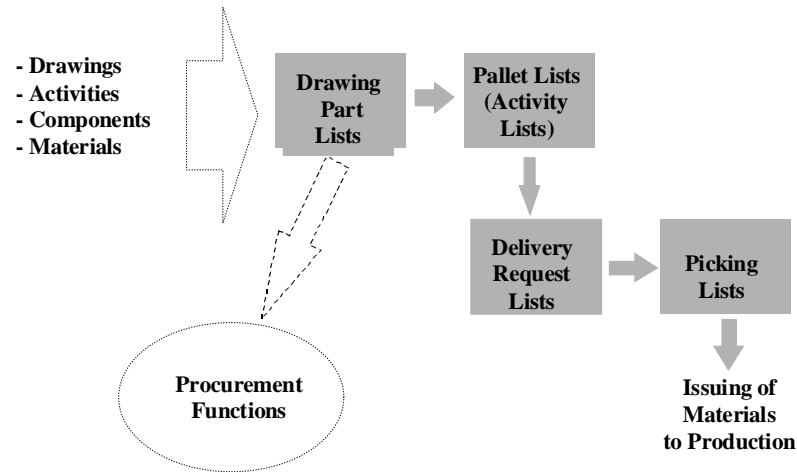


Fig. 5 Outfitting process
Slika 5. Proces opremanja

2.7. Delivery

In the delivery phase all information for design, procurement, production etc. is necessary to perform both the commissioning and delivery of the vessel inventory or assets register (all items included in the vessel including installation information and procurement information).

Collecting this information can be difficult as this information is traditionally stored in many different systems and the question is really: "where is the master?"

Therefore good IT support for this process is very important and an integrated solution will be of great importance in order to do an easier and more consistent job.

REFERENCES

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