

outsourcing manufacturing engineering services - a case study in process planning

Manufacturing process planning is the process of selecting and sequencing manufacturing processes such that they achieve one or more goals and satisfy a set of domain constraints.



contents

1.0	Abstract	03
2.0	Generation of Master Routers	03
3.0	Challenges	03-04
4.0	Outsourcing Master Routers	04-07
5.0	Further Steps	07
6.0	Conclusion	08
7.0	References	08
8.0	Acknowledgement	08
9.0	Author Profile	09
10	About QuEST Global	10

Abstract

Manufacturing process planning is the process of selecting and sequencing manufacturing processes such that they achieve one or more goals and satisfy a set of domain constraints.

Oil & Gas industry is governed by strict requirements for manufacturing and quality assurance. As a result, manufacturers place a great deal of emphasis on creating proper process planning documentation.

Master Router(as known in the Oil & Gas Industry) is one such Process Plan Document that contains the complete set of information about sequencing of operations, work centres, cycle times and production resource tools.

Master routers are required to be generated irrespective of the work load at production, quantity required or the schedule constraints.

Master routers provide timings of manufacturing operations to facilitate cost estimation of the components. Hence it becomes vital to

select optimum machining operations, best suitable machines to carry out the operations, calculate optimum times to meet all quality requirements.

This white paper deals with the challenges involved in generation of Master Routers for the Oil and Gas equipment manufacturing sector.

Generation of Master Routers

A Master Router is generated in the SAP system developed to suit the production organization. Detailed understanding of the in-house machining capabilities & constraints, familiarization to machining vendors and costing, in depth knowledge of product application, material requirement and properties, quality requirements, knowledge of testing and production resource tooling capabilities are essential requirements for an engineer to generate a Master Router.

Once the Master Router is created for parts and assemblies, the basic cost of the product is derived based on the times entered in the router to complete the operations. After the order confirmation, a production order is released, which is extracted from the master router. This demonstrates the method to manufacture the required quantity of parts for the order.

Challenges

The key business drivers for any manufacturer are

- Mounting competitive pressure -- Globally and Locally
- Statutory regulations -- Not just from the statutes of local governance but also from international agreements like GATT, RoHS,etc
- Dwindling order sizes -- What was once a mass produced item is coming down to smaller batch sizes due to increased competition and evolving technology in product and processes
- Further, the life cycles of product itself is getting squeezed
- Escalation of costs in labor, energy and raw material

These business drivers are increasing the pressure on

the Manufacturing industry and adding to these woes are the challenges of maintaining profitability to investors while competitively pricing product/s.

These challenges and business drivers emphasize the need for a new business model that calls for close association and collaboration amongst input providers (Suppliers) and output receivers (Customers) thus helping an organization to be competitive in the market by leveraging on the core competencies not just for the product/s under consideration but in all future endeavors.

The effective planning of a products manufacture is critical to both its cost and delivery time.

For organizations of special product lines such as oil & gas upstream equipment, it is of highest importance to be cost effective in manufacturing while at the same time

producing highest degree of quality products. It is of vital importance to maintain the routers as per the latest technological developments.

Outsourcing Master Routers

QuEST offers highly efficient and cost effective modes of business engagement to different manufacturing partners with a high degree of technical capabilities in manufacturing services. While orthodox approach is to have the entire process planning team working close to the manufacturing site, it has been proved beyond doubt over reasonably long duration of more than two years, that the task could be efficiently served remotely, thus

ensuring high cost benefits through outsourcing of the service.

Process map for outsourcing Master Routers' creation is optimized to ensure higher productivity with no compromise on quality. Such established and proven process maps help one to venture readily into new business engagements without requiring a great deal of research.

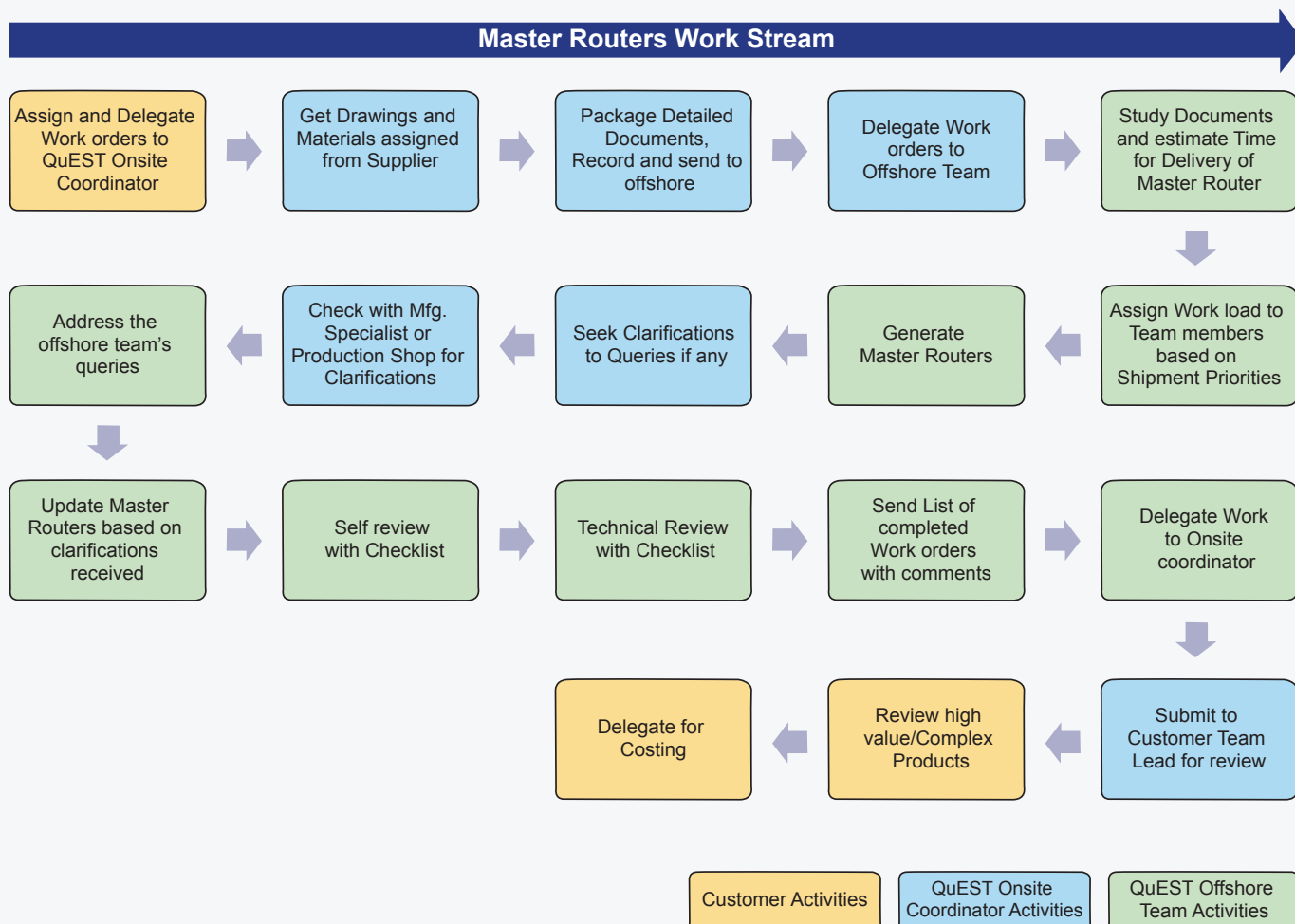


Figure-1, VSM for Generation of Master Routers

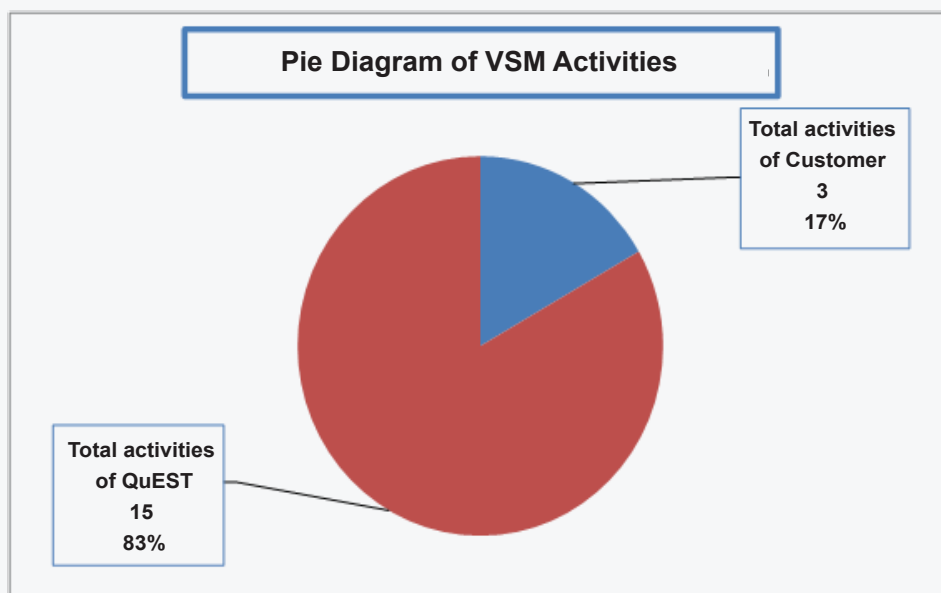


Figure-1, VSM for Generation of Master Routers

Major activities in the optimization of services of router creation are:

- Cleaning all old routers in the system
- Correcting all routers for optimum results
- Standardization of manufacturing methods of various products
- Productivity improvement for router creation
- Achieving 'First Time Right' quality

Process Standardization

Efficient cycle time for complete manufacturing with the highest degree of quality is ensured by standardizing manufacturing methods for product families. QuEST has provided solutions to its customers in accomplishing this by implementing lean manufacturing practices. As part of lean technique implementation, QuEST first analyzed the product lines, part complexities and annual quantity requirements, and carried out a Six Sigma project; as a result of which the following changes were suggested and implemented:

- Restructuring plant layout
- Elimination of inefficient machines
- Installation of new machines with desired capabilities
- Optimization of complete tooling inventory

- Supplier management

Having a plant with higher manufacturing rate, all the relevant departments aiding production must be capable of providing inputs at higher rates.

A detailed understanding of the customers' manufacturing capabilities and familiarization with the machines and process will enable manual clean-up of all master routers with obsolete or false information. This brings all the master routers in the plant to a uniform platform and facilitate for mass updation of master routers in the system, if required in future.

Productivity Improvement through Automation

To generate a Master Router, a wide range of documents are required to be referred right from raw material procurement to dispatch of the finished products. To ensure that all manufacturing engineers refer to the same set of documents, QuEST helps controlling the internal documents centrally and has developed tools for easy and quick access to the documents, which has reduced substantial amount of time of engineers in searching for the latest set of documents. By this, the quality of the master router is ensured.

PREMIUM THREADS						REV:	7				
PREMIUM THREADS	THREAD TYPE		IN HOUSE	OUT SIDE	HIRED GAUGE	COATING (Material Groups as per BCS A099)					
	BOX	PIN				BOX			PIN		
						GROUP-1	GROUP-2	GROUP-3	GROUP-1	GROUP-2	GROUP-3
VAM ACE	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAM FJL	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP	YES	YES	YES			BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP HC	YES	YES	YES			BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP HT TC				YES		VENDER	VENDER	VENDER	VENDER	VENDER	VENDER
VAMTOP HT	YES	YES	YES			BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP TUBING	YES	YES	YES			BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP CASING	YES	YES	YES			BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
NEW VAM	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAM SLU-II	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAMTOP I	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAM KSX	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103
VAM 21	YES	YES	YES		YES	BCS A401	BCS A204	BCS A204	BCS A401	BCS A103	BCS A103

Date	REV	Description
25/07/2012	0	
31/07/2012	1	HUNTING SEAL LOCK BOSS in-house cut with hired
08/08/2012	2	HUNTING SEAL LOCK BOSS 3C in-house cut with hired
17/08/2012	3	TENARISHYDRIL 3SB thread added in list as in-house
21/08/2012	4	Coating spec added
19/12/2012	4	MANNESMAN BDS changed to in house
07/01/2013	4	XT-39 w/ ACCESSORY BEVEL added out side
10/01/2013	4	TENARISHYDRIL MAC II added out side
18/01/2013	5	AIP threads updated.
25/01/2013	6	Tenarishydril Blue coating updated over 13% Cl
26/02/2013	7	Tenarishydril Blue coating note added

Figure-2, Controlled master documents

1. Select Material Group from the list		MATERIAL GROUP-1							
MATERIAL GROUP	1	In-house		Program	Times		Hired Gauge	Coating	
		BOX	PIN		Setup	Labor		BOX	PIN
2. Select Thread Connection from the list									
CONNECTION	TENARIS HYDRIL BULE	YES	YES	TAPE REQUIRED	0.75	1.5	YES	BCS A401	BARE
3. Select Thread OD from the list									
OD	9.625								

Figure-3, Quick access tools

All quick access tools and reference documents are compiled into a single control panel, which is a common platform for all manufacturing engineers to refer to the

technical information. Regular updation of such tools is required to ensure that the information is complete and as per the latest developments.

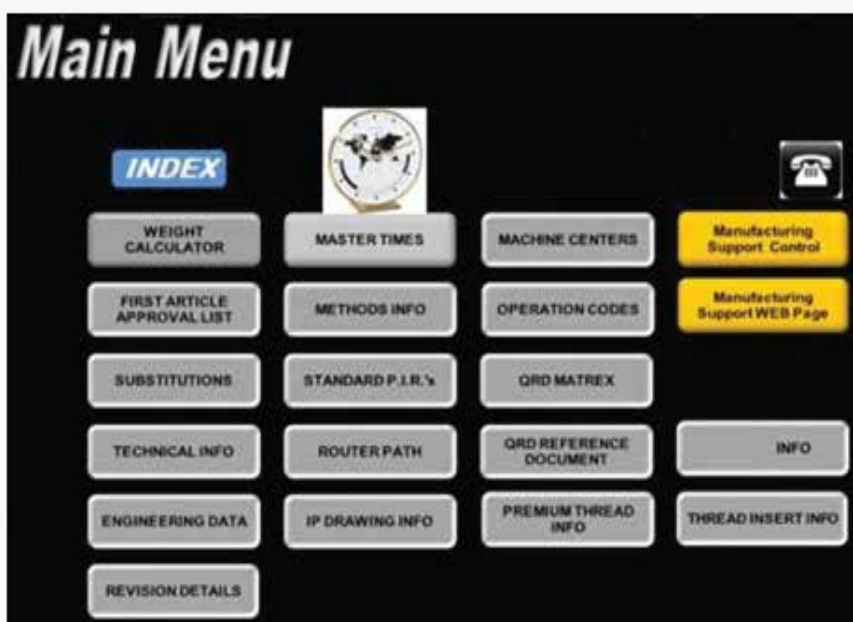


Figure-4, Control Panel

Improved Quality

Defects in routers can cause potential damage with respect to time, cost and reliability.

Some defects can cause rejection of the part while others lead to rework. With standardization of the process, the probability of occurrence of such critical defects is greatly minimized.

Yet, defects due to human errors can't be completely overruled. To ensure the routers generated are of highest quality and defect free, a mechanism for checking routers for errors is developed.

A semi automated checklist highlights the error, which exists in the routers after router creation. The highlighting signals the process planner or reviewer to relook and correct errors thereby almost eliminating the delivery of a defective router to customer.

Consolidating all the errors captured in the checklists during reviews, measurement and analysis of defects is carried out to understand significant contributors like defect rate, highest categories of defects, highest contributor, defect trend, etc.

Such analysis on periodic basis provides an insight into the need for further process improvements or training

Further Steps

If one looks at the Value Stream Map in page 4, there are 15 activities handled by QuEST as a joint team of onsite and offshore resource mix. The total number of activities handled by onsite resource is six consuming about 15% of the cycle time of router generation.

A value add can be to minimize and/or eliminate the number of activities handled onsite that drives time per router and the cost incidence to customer to the lower side.

requirements in particular areas, thereby driving continuous improvement. QuEST has strived hard and maintained the 'first time right' almost at 100% for a major oil tools manufacturer.

Benefits of Outsourcing

Due to offshore execution of the tasks, there are large margins of cost benefits to customers. Around 85% of router execution time is spent offshore for major oil field customers leading to cost benefit of more than 50%. At the same time, due to outsourcing, the customer has flexibility to ramp up/ramp down support team size according to the work flow at respective plants.

Another major benefit of outsourcing creation of Master Routers is that the offshore team centrally supports different manufacturing plants at different locations of customer. This promotes highest degree of flexibility to support different plants of customer during peak load requirement and helps in sharing best practices and improvement scopes across all locations.

Apart from all these benefits, the core team at offshore intends to standardize manufacturing methods across different locations bringing uniformity on quality of products all over and eliminates ineffective processes leading to unnecessary cost.

Though there are many possibilities, the new model of working needs to be evaluated not just from the Router Cost perspective alone but also from the kind of risks it triggers and the costs of risk mitigation, the time needed to implement the mitigation plan and buy-in from the customer for the proposed model of operation.

Conclusion

Outsourcing Manufacturing Engineering services like router creation and detailed process planning helps to achieve higher profit margins, quality and productivity improvements, process standardization and enables redeployment of customer's engineers for higher responsibilities.

QuEST has been providing Manufacturing Engineering and allied services with a team of nearly 300 members of average experience of 7+ years to several reputed customers such as Halliburton and Baker Hughes in Oil and Gas.

Expertise encompasses nearly 200,000 hours in Process Planning, CNC Programming, Inspection Planning, CMM Programming, Cost Modeling and Variance analysis, so on and so forth.

QuEST has delivered more than 100000 deliverables like Process Plans, CNC Programs, CMM Programs, etc., in a flawless manner, on time and every time leading to about \$2 Mnsavings.

QuEST recommends seamlessly integrated onsite - off shore models to outsource Manufacturing Engineering related activities to provide online support.

QuEST can extend its support in establishing and running off-shoring models in Manufacturing Engineering services to anyone interested.

For further information please write to the author & or any of the members listed in the Acknowledgement section.

References

1) <http://wwwme.nchu.edu.tw/~CIM/courses/Computer%20Integrated%20Manufacturing/x2008%20paper%20reading%202014%20Collaborative%20process%20planning%20and%20manufacturing%20in%20product%20lifecycle%20management.pdf>

2) Project Data in the QuEST Project server

3) Lessons Learnt; Corrective & preventive action (M&A) reports

Acknowledgement

Author wishes to acknowledge and thank the following team members who are also subject matter experts (can be contacted in case of any needs) in the field of

manufacturing engineering for the contributions and guidance in giving a shape to the Project since the day of take-off as well as giving a shape to this paper.

SI No	Name	Designation	Mail ID
1	Sandesh Shirodker	Centre Manager	sandesh.shirodker@quest-global.com
2	Umesh Channappa	Senior Account Manager	umesh.channappa@quest-global.com
3	Dennis Devaraj	Program Manager	dennis.devaraj@quest-global.com
4	Nagaraju H G	Lead Engineer	nagaraju.hg@quest-global.com
5	Pranam Salunke	Senior Engineer	pranam.salunke@quest-global.com
6	Sachin Paschapur	Engineer	sachin.paschapur@quest-global.com
7	Syed Asadulla	Lead Engineer	syed.asadulla1@quest-global.com
8	Vinayak Maranur	Senior Engineer	vinayak.maranur@quest-global.com
9	Virupakshi A M	Lead Engineer	virupakshi.am@quest-global.com

Author Profile



Basavaraj Dhanavade

Basavaraj Dhanavade specializes in Manufacturing Engineering domain. His expertise lies in product design and development, process planning, fixture design, press tools and forging die design. He is well versed in a number of CAD, CAM and PDM tools including Catia V5, Team Center, Solid works and Auto CAD.

Basavaraj has a Diploma in Tool & Die Making from Govt. Tool Room & Training Centre, Belgaum.

Basavaraj has about 2.5 years of experience with QuEST with an overall experience of about 10 years in the fields of CAD Modelling, Fixture Design, CNC Programming, Detailed Process Planning, and Master Router creation.

He is currently the Project Leader, and in charge of generation of Master Routers for Oil & Gas customers.

In his earlier part of the career, he has been a product designer for electrical packages of heavy commercial vehicles, Team Leader for Tool Design Division.

Last but not least, he was a key contributor for setting up ring rolling process for bearing races.

At QuEST, his role includes:

- Managing a team of process planners for Master Router creation
- Meeting the compliance requirements of the project management
- Interact with customers regularly for understanding specifications, project scoping and feedback on results and deliverables
- Drive continuous improvements
 - Ensuring quality and on time deliveries from offshore
 - Recruitment activities for Manufacturing Engineering
 - Mentoring new recruits on job-specific requirements
 - Evaluating and maintaining the competency levels of the Routers team
 - Identifying the training needs of the team and coordinating the training program

Basavaraj Dhanavade can be reached at basavraj.dhanavade@quest-global.com.

About QuEST Global

QuEST Global is a focused global engineering solutions provider with a proven track record of over 17 years serving the product development & production engineering needs of high technology companies. A pioneer in global engineering services, QuEST is a trusted, strategic and long term partner for many Fortune 500 companies in the Aero Engines, Aerospace & Defence, Transportation, Oil & Gas, Power, Healthcare and other high tech industries. The company offers mechanical, electrical, electronics, embedded, engineering software, engineering analytics, manufacturing engineering and supply chain transformative solutions across the complete engineering lifecycle.

QuEST partners with customers to continuously create value through customer-centric culture, continuous improvement mind-set, as well as domain specific engineering capability. Through its local-global model, QuEST provides maximum value engineering interactions locally, along with high quality deliveries at optimal cost from global locations. The company comprises of more than 7,000 passionate engineers of nine different nationalities intent on making a positive impact to the business of world class customers, transforming the way they do engineering.



BORN TO ENGINEER

<http://quest-global.com>