Scaling Supply Chain Operations For Growth and Profitability

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Semiconductor IC and device companies are constantly juggling competing internal resource demands with a need to conserve cash for product investment. As a result, many fail to invest adequately to meet operational and production goals that require flawless supply chain execution to speed time- to-market and maximize both profitability and revenue. This article examines how ramping semiconductor organizations typically evolve in terms of staffing, process and systems, and makes recommendations for improved evolution at specific stages of company growth, with emphasis on the fabless business model.

GROWTH STAGES

For purposes of this discussion, the following five stages in the development of a fabless company will be used:

- *Pre-Revenue Stage.* The company's business priorities are market and product. The market is defined, initial customer discussions occur and the product must work. Supply chain efforts focus on establishing vendor relationships and production success.

- *Product Acceptance Stage.* Customer service becomes a business priority when product starts to ship. All the hard work in market and product must pay off. Supply chain efforts focus on timely production to meet early customer delivery needs.

- *Production Ramp Stage.* Marketing and engineering cheer this early success! Supply chain execution must now scale, integrate seamlessly with the rest of the company and meet multiple corporate imperatives. Product complexity often grows during this stage, and all weak points in the existing process are glaringly exposed.

- *Breadth Stage.* Production has ramped and sales grow. The company starts to build compatible product lines and mature into a broader organization.

- *Maturity.* Firing on all cylinders – the company is as much a business force as it is a product and market force.

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By the time a company is in the breadth or maturity stage, it usually has an established supply chain model, appropriate staffing and appropriate systems to support the team. The most challenging supply chain structural changes occur as a company moves between the pre-revenue stage, product acceptance stage and production ramp stage. Many of these required changes take fabless companies by surprise and, at times, require dramatic and sometimes painful structural changes. This article will focus on the common issues and requirements associated with these changes, from pre-revenue to the breadth stage.

IMPORTANCE OF SUPPLY CHAIN EXECUTION

The case for the importance of supply chain execution needs to be stated. Once production starts to ramp, inventory becomes part of corporate planning. Prior to this point, materials were part of new product planning or introduction. Ignoring the finance classification of inventory, it is now an asset as well as a liability. Inventory is an asset to a company if it helps meet timely shipments to customer orders. It is a liability when carried, due to potential product obsolescence as well as carrying costs.

The cost of production is now critical and must decrease. Insight into the factors that drive production cost and how cost can be lowered is needed.

Finally, customer service, finance and the executive team all now depend on timely and accurate information from the operations group. This requires integration of not only information, but also of process.

COMPANY EVOLUTION

Supply chain operation requires a combination of people, processes and systems. The nature of change, moving from the pre-revenue stage to the production ramp stage, dramatically changes the implementation of these three elements.

A pre-revenue company starts with people who can wear many hats, or who have depth in the most important product areas. The company's processes are created and implemented by a key supply chain person based on his or her previous experience. There is no need to document a process if it is supported by only one person who embodies the process. Systems are simplified, usually spreadsheet-based, and fit the logic and needs of the person using them.

During the product acceptance stage, a new player is added to the process. This person supports sales operations (or customer service): the interaction with customers related to orders, scheduling and on-time shipment. This new order management employee is similar to the operations employee – the one person who embodies the processes and systems required. The evolution of a company is based on its addition of people. Complexity grows with regard to communication between entities, and process needs are hashed out by negotiation between people's needs.

By the time the production ramp phase occurs, the "people as the process" model starts to break down in several ways:

- Adding people to the "people as the process" model doesn't scale. Two people using their personal processes as the company's systems creates a corporate process that is significantly less than the sum of the people participating. If the company experiences dramatic growth, this breaks down very quickly. The processes need to move to the company, and the systems need to separate from the people executing them.

- The need for communication between departments – as well as the velocity of information required – no longer matches this advanced model.
- Efficiency breaks down quickly although it may be hidden from executive management. People scramble to meet these new requirements and often use creative and heroic attempts to meet them. However, the results of these workarounds leave the company less effective and more vulnerable to employee burnout.
- Often, the operations employee may not understand the full nature of the processes that need support. This is discussed in more detail in the next section.

If one is not involved in the day-to-day operations of the supply chain, there are some signs that can be viewed externally which indicate that supply chain operations are breaking down:

- Missing and misleading information or mistakes made because of missing or misleading information.
- Execution is requiring all available time; there is little or no time left for analysis or forecasting.
- Team members focus on what can be avoided, rather than priority needs. The fire that is blazing gets all the attention, regardless of importance.

OPERATIONS SURPRISES

There are several requirements for the operations area as production ramps and product complexity grows:

- The specialization of personnel and departmental restructuring must be considered and built into staffing decisions.
- The clear delineation and identification of core business processes is required. This is crucial for appropriate internal communication, overall corporate efficiency and clear understanding.
- Transaction volumes often surprise the supply chain team. What was once easy to track and manage now becomes difficult very quickly.
- The requests for information from – and coordination with – other departments grow, compounding the strain during this time of change.

The initial small, flexible team needs to evolve to meet more complex execution needs. Specific supply chain execution needs include planning, production control, vendor management and product configuration support. At the same time, the most common staffing model at the pre-revenue and early adoption stage is to hire personnel with depth in planning, vendor management or product quality. There is almost never an emphasis on production control, yet that is where most of the pain and impact of the ramp is felt.

Production control encompasses three critical business processes:

- *Manufacturing Execution.* For fabless companies, this includes detailed genealogy tracking, yield tracking, cycle time tracking and cost tracking. It includes managing work-in-process (WIP) and tactical execution of the production flow.
- *Procurement Execution.* This involves the request to build material and the acknowledgement of successful completion of the procurement function. Procurement completion tracking is usually the biggest surprise since it does not scale. More on this later.

- *Material Ownership and Value Change.* Fabless companies own material in-process as it moves across the supply chain. From a purely operations perspective, this material is in-process or at inventory points. From a corporate ownership and financial responsibility perspective, the supply chain is a series of moves of consigned material. What is owned and the value of what is owned changes at specific points in the supply chain process.
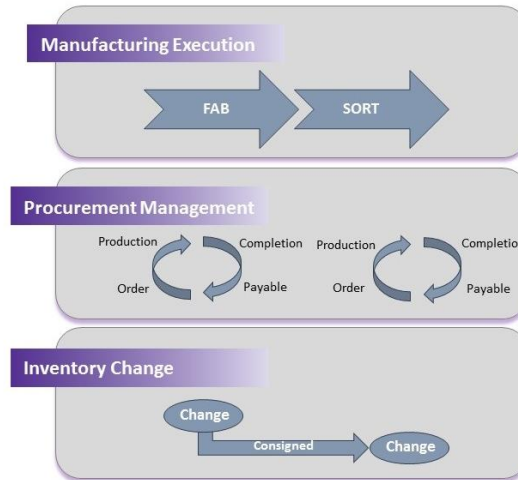

Fig. 1. Three Key Production Control Processes Intertwined

The need for production control sometimes surprises people outside supply chain management. Outsourcing production decreases the need for many areas of manufacturing execution, but adds other needs, which are germane to the outsourced model. The volume of transactions related to procurement is often a surprise to the company. There is no benefit-of-scale related to these transactions. Vendors at the back-end of the production process (assembly/test) size their production lots based on their production lines. As a company moves from ordering hundreds of thousands of units to millions of units, this lot size does not change. It is not unusual to go from receiving a few monthly invoices from supply chain vendors to receiving hundreds or thousands of invoices. At the same time, good corporate control requires a process for acceptance of these invoices in a timely but approved manner.

The operations group can operate as a silo of information in very small and very large organizations. All stages in between require communication and corporate efficiency. The efficient use of customer service, product engineering, production, finance, and operations personnel and processes is mandatory.

REQUIRED SYSTEMS AND INFORMATION TECHNOLOGY

Productivity and information velocity require robust information systems. The importance of systems grows as information and communication complexity grows because the risk for error can have an exponentially bigger impact. Clear leadership is needed to ensure:

- Priorities are clearly understood and willed to happen with enduring commitment.
- Priorities are set for the company and not departmentally. The company's goals include system process, productivity and information velocity. These do not happen without a clear vision and corporate guidance.
- Mastering routine operations is given the same level of importance as executive reporting. Efficiency, dependability and reliability are the foundation of everything else that will be achieved.

GROWTH PLAN FOR INFORMATION TECHNOLOGY

Summary of Information Systems needs and issues at stages of company growth-

Pre-Revenue to Product Acceptance

Needs
- Minimal cost for non-"product" activity.
- Minimal non-"product" development personnel.

Typical Environment
- Spreadsheets.
- Standalone PCs
- Finance-in-a-box solutions.
- Minimal info systems personnel.
- Vision is strongly tactical.

Issues
- Disjointed and competing solutions throughout finance, operations, human resources and sales departments.
- Minimal data integrity.
- Multiple sources of inconsistent "answers."
- Minimal written procedures.
- Little or no formal training.
- Spreadsheet and transposition errors.

Product Acceptance to Production Ramp

Needs
- Integrated solution to get the truth.
- Minimal non-"product" development personnel.

Typical Environment
- Easing of financial constraints on business systems.
- Spreadsheets and enterprise resource planning (ERP) software for the finance department with software workaround for inverted bills.
- Info Systems personnel not needed by leveraging cloud subscription model.
- Vision is tactical.

Issues
- No vendor support for a customized solutions
- Information systems resources focused on tactical imperatives with single points of failure.
- Limited system ownership by functional entities.
- Internal systems add cost, time, and complexity – in direct conflict with core outsourced operations model.
- Increasing senior management frustration and demand for timely information.

Production Ramp to Breadth

Needs
- One source of information easily accessed by all with a need to know.
- Minimal non-"product" development personnel with potential for strategic development

Typical Environment
- Fully integrated business systems covering finance, supply chain, human resources, marketing, sales, engineering, and research and development.
- Specialized information systems personnel using formal procedures and a dedicated help desk with broad skills to support the user community.
- Daily information systems operations tactical with management attention to strategy.

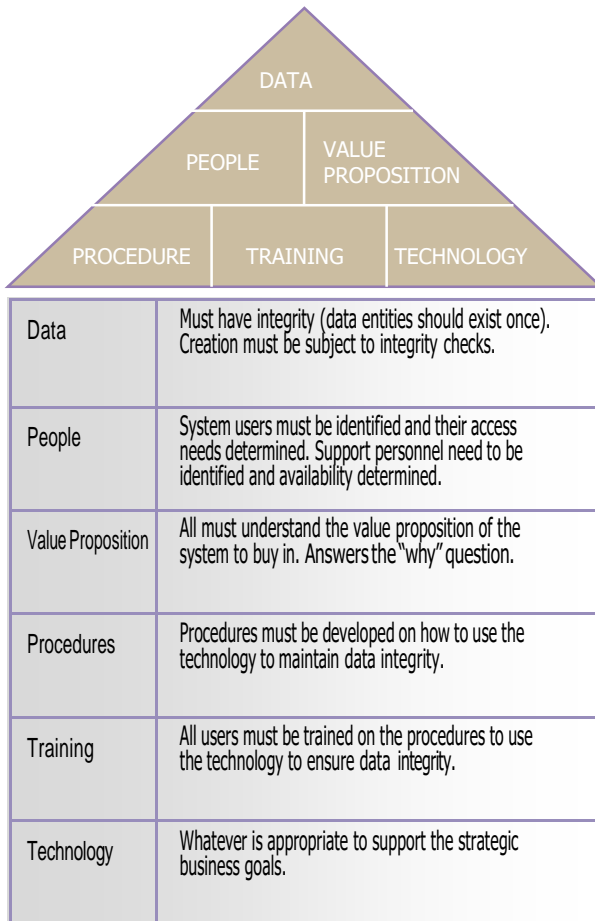|	
Data	Must have integrity (data entities should exist once). Creation must be subject to integrity checks.
People	System users must be identified and their access needs determined. Support personnel need to be identified and availability determined.
Value Proposition	All must understand the value proposition of the system to buy in. Answers the "why" question.
Procedures	Procedures must be developed on how to use the technology to maintain data integrity.
Training	All users must be trained on the procedures to use the technology to ensure data integrity.
Technology	Whatever is appropriate to support the strategic business goals.

Fig. 2. Components of the System & Their Relationship

1. *Lack of Organizational "Pull" for the New System with Insufficient Enduring Commitment by Management.* They must be 100% behind the implementation with visibility through to the corporate board.

2. *Lack of Funding.* This includes inadequate or inconsistent availability of internal team members as well as dollars. Implementations often require the people that functional groups can least do without, yet without this involvement the end result suffers.

3. *Customizing not Implementing.* Teams often focus on how they can accomplish goals rather than the business objectives apart from the current process. Customization should be focused on areas of very high value-add. Most successful implementations start with a best practices approach based on the system, and then extend the application once the knowledge base and comfort with the solution increases. Insisting on modifications extends the lead time to go-live, increases cost and introduces the potential for bugs, resulting in a non-standard solution with limited commercial support.

4. *Choosing the Wrong Technology.* It is important to "right-size" the technology when choosing systems – one that fits current needs and anticipated growth over the next five to 10 years. Technology that is too big will be more complex, expensive to implement and demanding of personnel to operate. At this time this also includes on premise solutions instead of a cloud solution. The added complexity, cost, and IT resources needed to manage a system on premise solution are a deterrent for overall solution success.

5. The biggest roadblock is *Believing the Software is the System*. The system is defined in Figure 2. Without attention to all factors, most implementations will fail.

About the Authors

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