

Roadmapping Considerations

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Roadmapping is usually described as an effort to address pre-competitive issues, but the term “pre-competitive” is not so easily defined: Manufacturing and technology challenges that are common to many organizations can be defined as pre-competitive by some but areas of competitive advantage by others. A more accurate definition is that roadmapping is an effort to indicate difficult challenges and imminent areas of need, and to project where competitive opportunities may arise as the industry and research community seek solutions in the competitive space.

As we approach the 20th anniversary of the semiconductor industry roadmap, this collaborative model is still considered one of the most valuable tools for industrial technology management. As part of this extraordinary activity for 19 of those 20 years, I have witnessed the evolution of this effort, and have a few observations about roadmapping I feel are worth sharing.

The early process of the semiconductor roadmap yielded many lessons learned as the effort staked out new territory in collaborative work. The process was intensely scrutinized by chipmakers, suppliers and researchers. While the first semiconductor roadmap was initially presented as a final report, it was immediately determined that more work and some correction was needed. This resulted in

another edition and a change in the process to include routine revisions. Criticisms of the new roadmap led its leadership to mandate the inclusion of all industry representatives from across the supply chain and to issue an open invitation to participate in the working group teams and public forums, as well as to undertake a careful examination of the information and roadmap goals for the industry. Above all, producing a credible set of projected data – backed by empirical data as well as cited works – that was consistent throughout the various technology chapters was requested of and met by the working group teams. The subsequent roadmap reports eventually achieved high credibility through good guidance and careful vetting throughout the process.

Over time as the controversial effort called “roadmapping” proved valuable to the chipmaking industry and its supplier and research communities, other industries took note of the value of this type of collaborative effort. Indeed, the semiconductor industry roadmap is the “gold standard” for industry mapping. It has been used as an example and model for many industries and organizations and is currently part of the curriculum in several business schools. The term “roadmap” now commonly indicates a long-term plan or assessment in the typical business lexicon.

As more industries use this approach to project their manufacturing or technology needs, numerous roadmapping success factors have emerged. These include having contributors as team members that represent the entire industry base (e.g., either manufacturing supply chain or technology systems); corporate support for the effort; and a centralized, neutral communications infrastructure for ease of information sharing. Additional but lesser-known elements of roadmapping that are critical to maintaining its credibility and relevance include industry analysis and cost modeling; understanding of the phases of roadmap maturation; and awareness of roadmap use through solid demographic data.

First let’s look at the more common success factors of inclusive membership, corporate support and a neutral, centralized information hub ...

Having all sectors of the industry engaged in the effort is critical. For example, including representatives from the entire supply chain as well as from the research community ensures a comprehensive assessment of future needs, from the perspectives of research, development and manufacturing. The synergy of all groups engaged in the process uncovers dependencies among the various industry sectors, and the consistency of the data and the careful reviews by a variety of experts provide a solid vetting. By considering a host of variables such as processing and product attributes from various perspectives, a roadmap is more credible and more likely to contain valuable insights and guidance on manufacturing solutions and areas for technology innovations.

Corporate support and sponsorship of the roadmapping effort allows the teams that serve as working group members – mostly volunteers that take on the activity in addition to their assigned job tasks – the necessary freedom to be thorough and thoughtful. When their roadmapping activity is seen as complementary to their “real” job activities, their expertise helps feed the roadmap knowledge base for their working group and contributes to pre-competitive assessments. Likewise, they and their companies garner valuable information from partaking in roadmap sessions with others who have similar expertise and job histories, and they learn firsthand the latest information resulting from the roadmap sessions, well before the roadmap reports are released at the end of each year. This is one of the value propositions of roadmapping – “firsthand” knowledge of the latest roadmap information.

Another well-known success factor is a neutral and centralized infrastructure for communications and information sharing. Impartial management of roadmap communications reinforces the “pre-competitive” position required in industry roadmapping. Unbiased editorial and publication support maintains continuity and consistency for those involved in the roadmapping effort as well as assistance and contact support for the roadmap users. For this reason, nonprofit organizations or consortia are uniquely positioned to manage roadmap communications and information.

In addition to these more commonly known attributes for successful roadmapping, several other components are critical to a roadmap’s relevance and usefulness to industry and research. These

attributes include current knowledge of the industry's health and economics, roadmap process evolution, and roadmap demographics. They are crucial to a solid roadmap, as they help maintain the roadmap as a current set of information capable of evolving as its respective industry matures.

1. While technology working groups are a major component of any roadmap initiative, a central team for defining overall roadmap characteristics and metrics is the cost modeling and industry analysis group. The value provided by an industry analytical team is the collection and presentation of data from respected sources as the unbiased view of the current industry indicators and the governing trends for that industry's economy. These data are the basis of the roadmap metrics that the working groups use to grade future trends. The roadmap industry analysis team lays this critical foundation. As such, the industry analysis team and cost modelers are the first "cartographers" of the effort. They develop the first maps that detail industry historical trends and indicators and offer assumptions for roadmap manufacturing or technology trends. These teams present the current map for the working groups to measure against. While all the teams determine the set of roadmap drivers or metrics, and help determine where to go next, industry analysis sets the reference points.

Additionally, cost modeling identifies the assumptions, variations and permutations associated with all aspects of

manufacturing and product attributes in a consolidation of models that are useful to the entire industry, not just those who use the models internal to their own companies. Having connections between a cost model team and a roadmapping effort creates a feedback loop that provides a critical "sanity check" while assessing technology values, realistic innovation projections and potential solutions. This feedback loop provides a set of the best economic tools and knowledge to those who will ultimately guide the industry at large using the roadmaps. This team then provides a constant "system check" of overall industry characteristics.

2. Understanding the life cycle of a roadmap and enabling its evolution are essential to its development and progression. Roadmapping should be perceived from the onset as a dynamic and evolving process, with achievable expectations that match the effort's maturity. A new roadmap initiative has activities that differ significantly from a mature roadmap program. Team members that participate in the new effort must understand that there is a "startup phase" of establishing goals, building teams, identifying overall drivers and assembling good project management practices that are clearly communicated to produce a timely outcome for the user community. Working through these steps methodically, while also trying to "build a roadmap," is challenging, as the attention to management details can encumber the development of actual content unless the teams have

clear instruction and leadership through the early part of the process. These instructions include the level of detail and correct focus.

A new roadmap has information useful to the industry with the right level of detail for manufacturing or technology assessments of current as well as potential challenges and needs. The data must be factual and provable, and consistent throughout the roadmap. With the challenges of starting a developing roadmap, the first roadmap reports should have a more narrow and high-level focus until the activity is established. It is achievable then to be clearly focused with solid information that is concentrated and vetted in a few areas of need.

The next phase of maturation involves review and improvement with the inclusion of more detail and, in many cases, correction and adjustment, since the foundation work has been accomplished with earlier versions. As roadmaps mature, they typically become broader in scope and detail. The working groups mature as teams, too, and become more efficient in their assessments. Feedback from users, as well as industry reaction as the roadmap is implemented, also affects the information contained in the reports.

Having this knowledge of how a roadmap evolves and advances over time with seasoned teams is important in the beginning phase of the roadmap. Communicating expecta-

tions about the end result of a "first pass" and vision of an early roadmap with the ultimate goal of subsequent roadmap work improves a roadmap's chance of success because all involved are working toward the same goal.

3. Collecting demographic information about participants, users and reports substantiates a roadmap's importance and relevance and provides metrics on roadmap information use. Team membership information, such as company representation and industry sector involvement, indicates who is participating in the effort as well as the gaps in participation. Targeted recruitment of potential new members to fill these gaps ensures the roadmap participation remains inclusive. Roadmap information use data that can be collected while respecting personal privacy through general IP monitoring such as unique visits to Web pages and suffixes that indicate location such as city, country and type of organization (e.g., corporate, educational or governmental). Additional analysis may include counting the number of individual file downloads to show which reports are of greatest interest. These details of roadmap users and report interest data indicate what information is popular among the users and what information may have more of a niche interest. This information can then be used to continue improving the roadmap.

Many of us involved in roadmapping have seen its evolution and maturation, and participated in roadmap initiatives

with a variety of success. I have had the good fortune to work on a successful roadmap effort – complete with the challenges of growing pains and subsequent lessons learned – and to work with talented individuals who contribute to its success with good leadership and steady, committed working group participation. Ultimately, the people who volunteer for this effort and believe that such collaboration can work, proactively address criticisms and strive for continual improvement are the most important success factor of all. ■

About the Author

Linda Steele Wilson is the program manager for the International Technology Roadmaps for Semiconductors (ITRS) and the U.S. CIGS PV Roadmap. Before joining International SEMATECH, she attained a broad background in the semiconductor industry assignments in manufacturing operations, process engineering and R&D, and research consortium activities, with a focus on failure analysis in chip test and packaging. She graduated from St. Edwards University.