



Developing and Implementing Roadmaps – A Reference Guide

PART 1: INTRODUCTION TO ROADMAPPING

ROADMAPS TAKE MANY FORMS, BUT THERE ARE SOME COMMON ELEMENTS IN THE PRODUCT DEVELOPMENT SPACE

A roadmap (the noun) is a graphical representation of the interaction of multiple forces over time, generally aimed at technology, markets or product development platforms. A roadmap is an information organizing framework that brings together diverse issues into a common view.

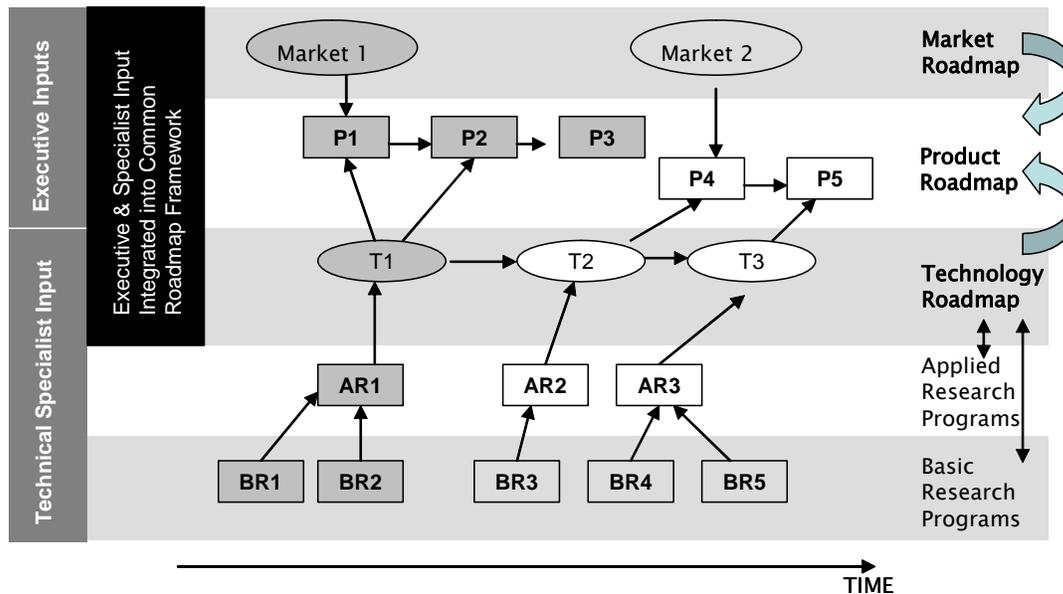


Figure 1: Roadmapping Captures Both Strategic and Tactical Aspects

When we refer to roadmaps we are often speaking of a *set of roadmaps* rather than a single effort. In Figure 1 we see a composite roadmap that captures in a single graphic activities and issues that are happening across several silos within a traditional organization. Here we see that basic research programs roll up into applied research programs that support specific technology solutions. Note that the BR and AR programs feed into the Technology platforms (T) and technology roadmap in terms of time. This is to insure that the technology is ready for the product when it is needed – in essence managing any technology that might be on the critical path.

But the product roadmap – the set of product offerings and their migration over time to a new platform (from grey to white above) is really the result of the combined influence of the technology opportunities and the market gaps. In the example above, two different product platforms are envisioned to support two different markets. In reality, this may actually be a gradual transition.

Roadmapping (the verb) is the process whereby companies bring together a diverse group of staff to consider how different aspects of the internal and external environments will interact and influence the product portfolio choices. Roadmapping and roadmaps are distinctly different from project planning and project plans (aka, Microsoft Project). In project planning and project plans, the emphasis is on execution to completion, with a focus on tasks and resource management.

Though there are multiple forms that roadmaps can take, there are some common traits. First, in roadmapping, companies are seeking to decompose complex systems into subsystems and ultimately into elements. It is the elements that are represented on the roadmap. In this way, the elements can change individually and we can see the impact that an element change will have on the outcome and/or timing of the more complex system. When the complex systems are decomposed, it is often done along functional lines. In Figure 1, for example, the information is organized in functional layers such as marketing and technology, with technology further subdivided into basic and applied.¹

For many companies, the technology roadmap emerges based on technology forecasts, supplier information, other industry roadmaps, and technology developments in key supporting industries. In the technology roadmap, companies seek to capture the capabilities and timing of different, often competing, technology solutions.

The market roadmap is derived from key user roadmaps – if the company is a supplier then it can gain insight from roadmaps that its customers might create and share, from general demographics, customer feedback, governmental regulation, and global competition in the product space.

ROADMAPS FACILITATE COMMUNICATION AND DECISION-MAKING

Recently a director of R&D at Proctor & Gamble, Inc. likened strategic planning in the product development space to having a conversation.² He distinguishes two types of conversations – one about *possibilities* and the other about *action*. The goal of these conversations is to create a common view of the opportunity space and then to create a common understanding of the best path forward. This distinction is quite relevant to roadmapping and roadmaps.

Roadmapping helps different individuals in the company discuss their view of the possibilities. Because it is an information organizing framework, a roadmap quickly helps these different individuals find linkages, common ground, and differences of opinion. Duane Oda, Product Development Chief in Boeing Commercial Airplanes (BCA), noted that the roadmapping process changes both the caliber of discussions and the participants.³ In his experience with roadmapping over the past several years, roadmapping has enabled BCA to consider opportunities and possibilities with its suppliers and with its customers. These in turn have informed design.

Ultimately, roadmapping and roadmaps should help units within the company articulate what they will do in the context of the organization's goals and objectives. In this sense, roadmapping and roadmaps help to link actions with strategic intent. Nowhere is this more crucial than in the technology development arena, where there is uncertainty around how to translate high level product requirements into technical approaches and activities. Here, R&D managers are deciding whether or not existing technology solutions can be adapted to near and longer term needs or, conversely, whether new investments in research are necessary to develop a new solution. Often this decision is paired with the Make versus Buy decision – should the company invest in its own technology or partner with or acquire a company that

¹ For a comprehensive description of the different forms that roadmaps might take, see Phaal, R., Farrukh, C.J.P., and D.R. Probert (2004) "Technology roadmapping – A planning framework for evolution and revolution," *Technological Forecasting and Social Change*, 71: 5-26.

² Personal conversation at the Innovation Future Forum, Cincinnati, OH, October 2-4, 2007. By-invitation forum sponsored by Boeing and Proctor & Gamble, Inc.

³ Personal conversation.

already possesses a similar solution or capability.

Figure 2 below highlights the different types of roadmaps that typically emerge and the way that these roadmaps feed into the strategic and operational decision-making processes of most companies.

Basically there are three types of roadmaps:

1. Assessment roadmaps capture key elements of particular issues like the market, technology, product or other basis for competition. Assessment roadmaps reflect the lay of the land around a particular issue and the horizontal layers in these roadmaps are generally unrelated to one another. Instead the common element is time.
2. Composite roadmaps capture the relationships between competitive issues and thus the relationships between the layers is critical. Here is where we begin to align activities in one area with those in another. Often companies use composite roadmaps to think about alternative sets of actions that might support strategic initiatives.
3. Finally, operational roadmaps are where we translate the strategic intent that is captured on the composite roadmap into individual operating unit plans that can then be executed and managed through various processes.

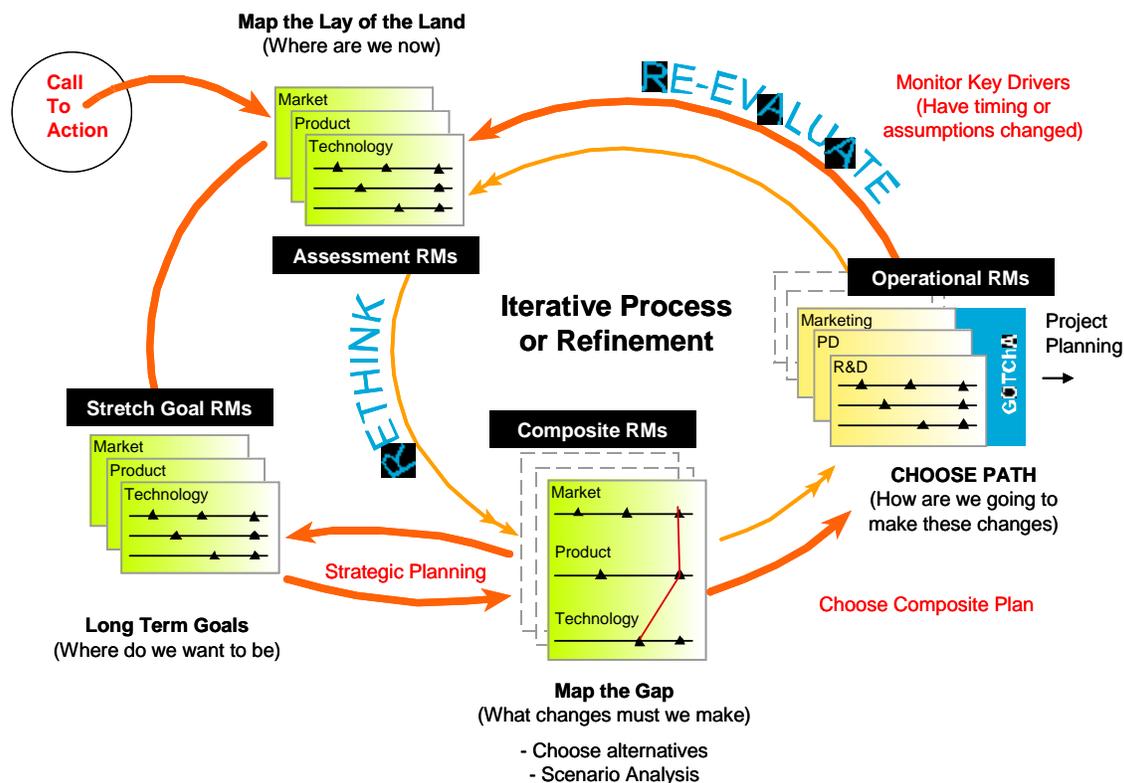


Figure 2: Different Types of Roadmaps Feed into Company Decision-making Processes

Roadmaps help companies to determine where they are now in the context of important market and other drivers. These lay of the land maps can then feed into the strategic planning process to help inform what stretch goals the company might choose to pursue. Strategic planning is informed by roadmapping as companies begin to think about their goals in the context of composite roadmaps that capture all of the necessary actions, investments, partnerships, and other issues that might be needed to achieve these stretch goals. Ultimately choices must be made between the alternatives presented in composite roadmaps during the strategic planning process. Once choices are made about the best alternative path forward, then these composite roadmaps can be translated into individual operational roadmaps that

merge the needs of strategic initiatives with ongoing initiatives within the unit to help balance resources, people, and facilities.

It is at this point that roadmaps (and roadmapping) at the operational level might transition to stage gate or project management, depending on the timing and uncertainty of activities. Throughout the cycle, operational plans must be monitored to determine when they must be updated as the result of changes to the internal and/or external environment, a point we'll return to later in this guide.

DISTINGUISHING BETWEEN A MAP AND A ROUTE

In the transportation domain, a map shows various options a traveler can use to reach a destination. A route, on the other hand, is a subset of those options that specifies the particular set of roads to arrive at that destination. By having a map, however, the traveler can select alternative routes when something occurs to make the first choice no longer viable, for example, a traffic detour or accident. Similar to a geographic map, a roadmap shows the various options, the lay of the land if you will, that describes the product development space. With the roadmap, a company is seeking to describe the key drivers and their likely timing.

Conversely, a route is a subset of the options that the company might take. When companies select a route in the new product development space, they are choosing a migration path for technologies, a series of additions and/or changes to product features, and a set of existing and target markets over time. The route is based on the company's "best guess" about what combinations will be most effective and efficient, and which will be compelling in the market space at a competitive price.

In thinking about maps versus routes, companies need to consider the requirements needed to develop each. Table 1 summarizes the differences between participation, format, and intent in the two.

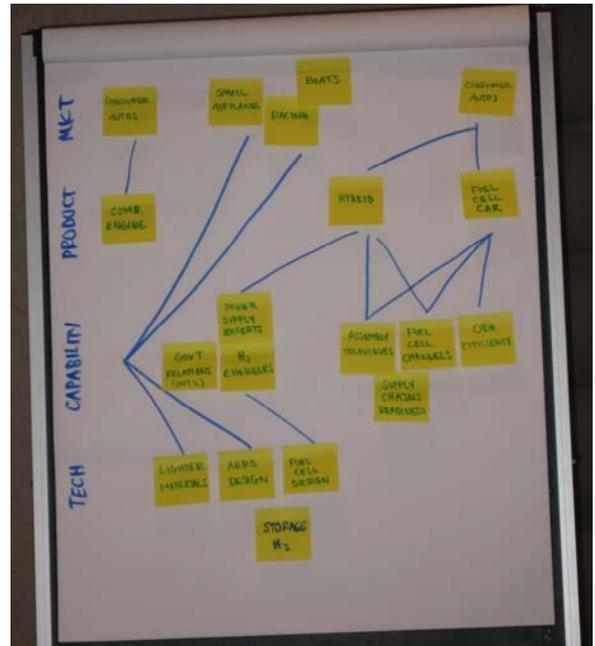
Table 1: Comparing Routes and Maps

	MAPS	ROUTES
Participation	Cross-functional teams drawn from a wide range of corporate functions	Cross-functional teams or small groups, often drawn from similar functional areas
Information Scope	Diverse information from across the corporation, its suppliers, customers, etc.	Focused information on particular target markets, product portfolios or technology platforms
Intent	Describe the "lay of the competitive landscape" to determine the organization's goals and objectives	Describe the best set of actions to respond to the organization's goals and constraints
Timing	Continuous monitoring of critical drivers, with updates when critical drivers change (See triggers and scenarios in Part 2)	On-going and often frequent (and often as the result of basic and applied research project outcomes)
Format	Often uses different formats across functions in the company to communicate trends/issues that are important to that function	Standard formats across functions facilitate comparisons between opportunities and/or options
Primary Use	Used internally to build consensus on key dimensions and to stimulate ideas (sometimes paired with scenario development activities)	Used internally and externally to communicate corporate direction, coordinate activities and evolve future project plans over time

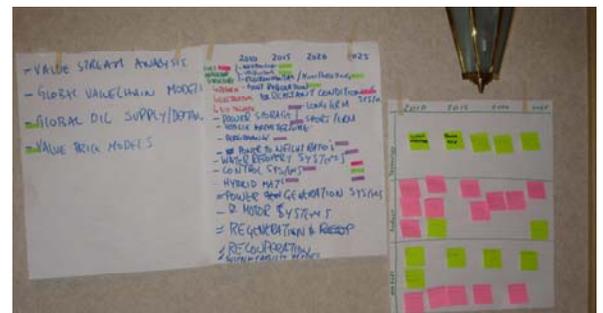
PART 2: TOP TEN ISSUES IN GETTING STARTED WITH ROADMAPPING

The roadmapping process represented earlier in Figure 2 has many forms, but in general there are ten basic issues that must be addressed. The graphics included here are from seminars on roadmapping offered by Dr. Petrick, but the use of post-it notes is quite a common first approach. Although software is available to support roadmapping efforts, and is used by many companies to great benefit, the most important thing is to understand the value of roadmaps and the roadmapping process. Thus, you should note that these graphics reflect the high level of interaction among team members, the use of post-it notes, markers and flip charts to support discussion, and the multiple linked steps in going from brainstorming ideas to thinking about R&D work packages (related to R&D portfolio management).

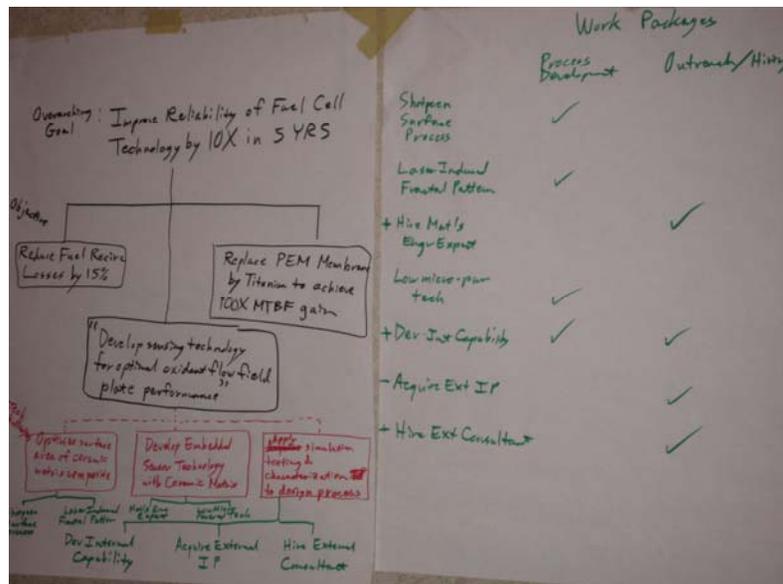
1. **Format.** Roadmapping can be initiated at any level, but is often a grass roots effort. The format of the roadmap, though somewhat standard as we've already discovered, is generally tailored to the initiating unit's emphasis.
 - a. Marketing tends to start with the external environment and the company's current customer environment
 - b. Technology tends to start with the product platform as it stands currently, then to think about the technology and R&D projects that might be needed to support future product opportunities. Often this leads to more conversation about enabling technologies and how these might actually change the product offerings & features. Ideally the discussion turns to technologies that are "over the horizon" and which require monitoring and assessment as possible viable future alternatives.
 - c. Human resources tends to start with current employee experience and considers gaps in critical knowledge or expertise given future product opportunities or plans. Often HR (along with others in the organization) uses roadmaps to consider how to either hire, collaborate or partner to acquire access to these resources.
 - d. Despite the initiating unit, **THE KEY** is to identify critical drivers, decompose the complex system into elements across functional layers and across time, and to develop a rough assessment of the linkages between elements.
2. **Stand-alone versus integrated roadmaps.** The difference between these is that stand alone efforts generally drive decision-making in a functional area while integrated efforts drive decision-making across multiple areas and often across multiple responsibilities (accounting, R&D, information technology, etc.) Many roadmapping efforts start as stand-alone efforts. Integrated efforts require significant buy-in and almost always have a key champion who is in a leadership position.
 - a. Stand-alone efforts can be successful as a discussion support for the unit and don't necessarily need to be linked to other execution processes (stage-gate, etc); whereas
 - b. Integrated efforts nearly always need to be linked to other planning and execution processes to be sustainable.



3. **Decide your motivation for roadmapping before you begin.** Establishing goals for your roadmap, often framed in the statement “When we develop this roadmap we will be able to more clearly articulate.... [a challenge]... [the relationship between ...].” You need to make sure you capture the data needed to drive discussion about whatever is motivating you. Often trying to recreate the data underlying some of your roadmapping elements after the fact is difficult, and certainly more time consuming. This is particularly important as you expand roadmapping efforts.
4. **Think about who cares or might be impacted.** It is critical to understand who will benefit from the organization of information into a roadmap format...and who might be challenged or threatened by it. Plan your roadmapping process to include a cross-functional group, and try to anticipate the critical managers and/or staff to bring on board.
5. **Developing the roadmap.**
 - a. Identify the complex system (s) you will tackle
 - b. Decompose them into elements
 - c. Plot those elements over time (generally on the horizontal axis) and arranged by category (layers)...note: sometimes these layers themselves become roadmaps
 - i. Select the layers to match your motivations (3, above)
 - ii. Try to think about the key goal (often product portfolio) as the central piece of the roadmap into which other activities feed
 - iii. Think of your roadmaps as coming in sets (often nested)
 - d. Use a cross functional group to brainstorm, with depth in the area you are concentrating on (3, above)
 - e. Post-it notes and informal beginnings (on a white board of flip chart) promote discussion



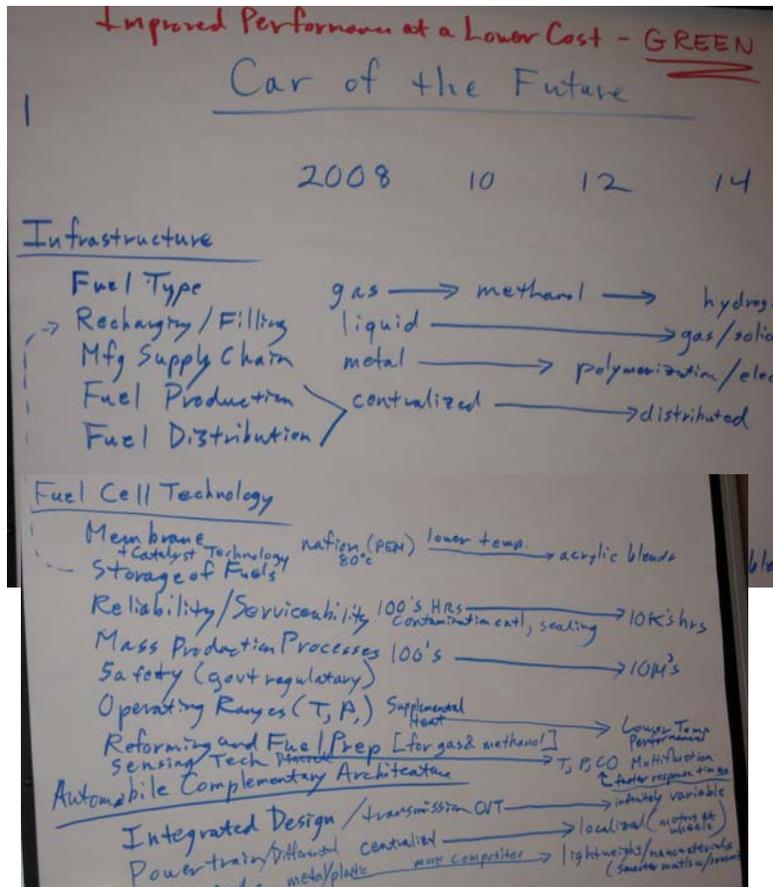
6. To get from the roadmap to specific work packages (from a technology perspective this is particularly useful, but can be adapted to other things), use the GOTChA method. [Goals, Opportunities, Technical Challenges, Approaches methodology]⁴
- Identify the high level goals
 - For each goal decompose this into objectives that can be expressed as technical challenges that must be met
 - Develop a set of approaches that might meet each technical challenge (posed as a one line statement of work for each)
 - Group similar statements of work into *preliminary work packages* (your groupings will depend on your specific activities, but often include groupings by staff who would work on this, groupings by location, etc.)
 - Review the preliminary work packages looking for....
 - Overlaps....can work packages be combined in whole or in part to eliminate unneeded redundancy
 - Gaps...did you create a set of preliminary work packages that when taken together still don't address all of your technical challenges? In other words do you need to expand or otherwise change a work package? Or do you need to develop another new one?



7. Don't worry about the form – focus on the content. An experienced group of roadmappers with depth in the area of interest can accomplish quite a complete, complex (and somewhat messy)

⁴ The GOTChA methodology was first developed at NASA and has been refined by Ben Almojuela, Associate Technical Fellow, Boeing Commercial Airplanes. It is now used extensively at BCA to translate roadmap high level goals into a portfolio of R&D projects.

outcome. In the Car of the Future example below, the group was able to focus on a Goal: Improved Performance at a Lower Cost, and then to think about Infrastructure issues, Fuel cell issues, and Automobile Complementary Architectures that might have to come together over the course of the time period they were considering, beginning in 2008 and going beyond 2014. Roadmapping on a three to five year timetable is common, but the specific timeframe is generally linked to the life cycle of the product and technology. For example, Boeing Commercial Airplanes develops an outlook that goes 30 years, typical of the life cycle of their airplane platforms. Consumer electronics companies, on the other hand, are typically planning in 18 month to 3 year horizons, with an emphasis on the migration to new platforms and technologies.



After you have decomposed the complex system into its layers and elements, and determined the linkages through extensive discussion, you can worry about putting them into better looking formats. At the first stages, the intent is to capture the relationships, linkages and gaps.

As you grow roadmapping efforts, consider your maturity level. In discussions with over 150 executives over the past four years, a six-stage roadmapping maturity model has emerged which begins with an ad hoc stand alone activity that is spearheaded by an individual unit at the most basic level and goes through increasingly networked and integrated activities to stage 5 which is company-optimizing and then to stage 6 which is network optimizing. Because innovation is increasingly happening across companies and because innovation is often one of the goals of

roadmapping activities, this maturity model suggests that companies with the most mature roadmapping processes are those that consciously and formally include their supply network (See Figure 3). Certainly the move to open innovation strategies suggests that deep linkages to suppliers will be a growing trend.

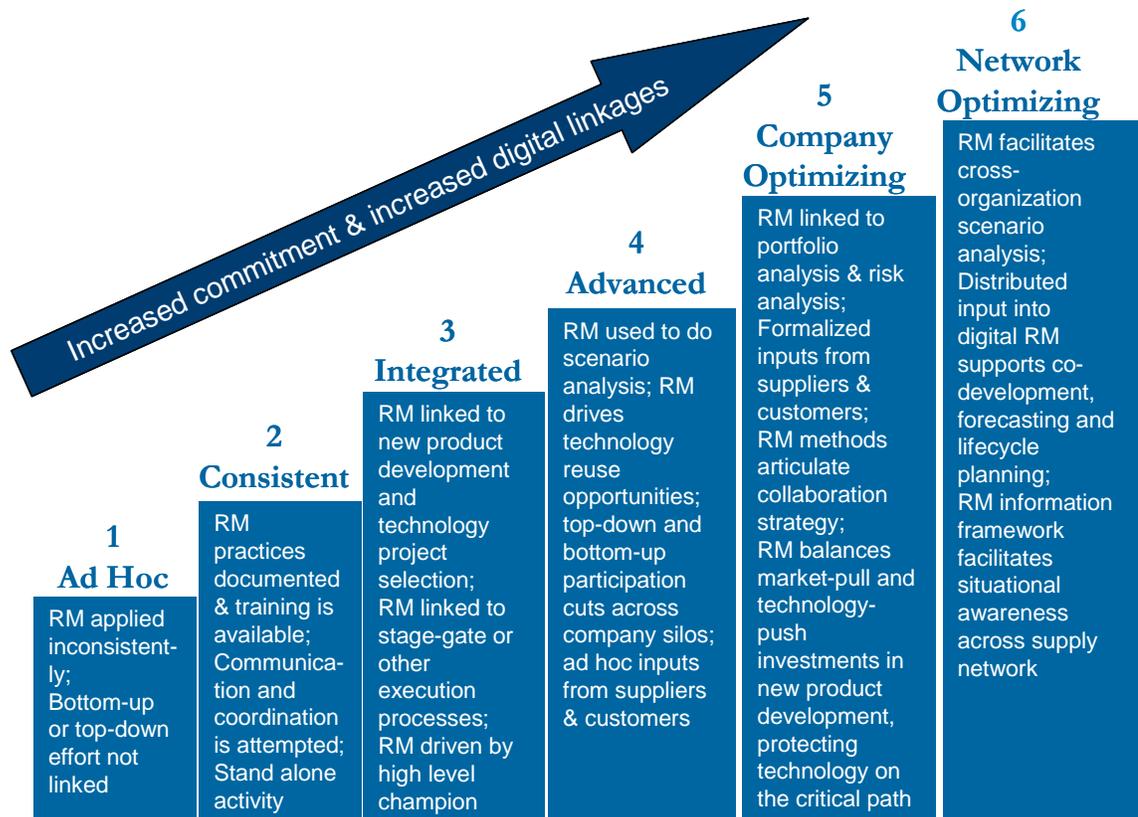


Figure 3: Roadmapping Maturity Model

Interestingly when company representatives are asked to identify where their company falls within this maturity model, beginners to roadmapping note that there should be a Stage Zero to reflect the initial efforts. When company representatives are asked to identify where they think their company wishes to be, many identify stages that are more than one incremental step to the right. Remember it is easier to make an incremental step than a leap, and plan your roadmapping roll-out and growth accordingly.

- Updating the roadmap using triggers and scenarios.** Think about scenarios in which the roadmap you've developed is "true." Then think about the key elements that are driving your assumptions. These are triggers. Triggers are the data elements that you will use to track the roadmap over time. Triggers must have a set point or tipping point. When reality begins to approach or exceed these tipping points, you must reconsider your roadmap – either the elements are wrong, the timing is wrong, the path forward is wrong...or some combination of the above. By using triggers and tipping points to initiate discussion and possible revision to the roadmap, we are focusing resources on tracking the critical drivers, rather than trying to monitor and update every aspect of the roadmap (See Figure 4). This is particularly important when we try to identify the experts who are most appropriate to monitor the assumptions. The challenge is to empower these experts with knowledge

about organizational goals and roadmap assumptions so that they can glean key changes from their respective environments.

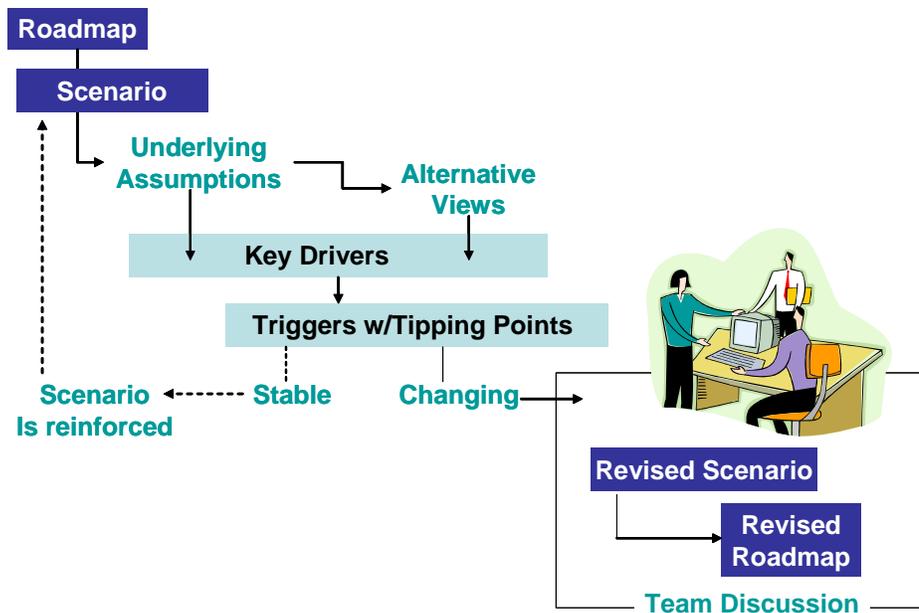


Figure 4: Linking Roadmapping to Scenarios – Developing a Monitoring & Updating Strategy Based on Key Drivers, Triggers and Tipping Points

9. **Develop a plan and assign responsibilities for roadmap updates.** A roadmap that is created once and evaluated only once a year in preparation for the strategic planning cycle yields little value compared to the time intensive nature of this method. Make sure when you are starting the activity that you have considered how frequently roadmaps might need to be updated. Also think about how other planning and budgeting cycles occur in your company. Should roadmapping efforts be linked in any way to these, and if so, what are the implications for updating? Don't leave this to chance and remember that your supplier and customer base may be good sources of information, and allow time to gather inputs from them.

PART 3: ASSESSING ROADMAPPING SUCCESS

Roadmapping is a very labor intensive effort. It requires staff commitment for brainstorming, significant fact-finding when we identify gaps in our knowledge about competitor or market trends, and it requires extensive information monitoring with respect to the key drivers (triggers and tipping points). Below are a list of metrics that have been identified by companies engaged in roadmapping as possible measures of success/value. This list is certainly not intended to be exhaustive, but has been compiled during discussions with over 150 industry roadmappers.

- Number of people who touch the roadmap
- Number of updates

- Number of meetings and engagements where the roadmap is discussed/updated/used
- Regularity of updates
- Customer participation
- Number of active pursuits tied to the roadmap
- Increase in the span of the “Visible Horizon”
- Number of triggers established and assigned for on-going monitoring
- Number of decisions driven by roadmap information
- Fewer surprises
- Increased number of “game changers”
- Number of division’s whose objectives are captured in the roadmap
- Formal assessments of the activity including surveys
- “Right” targets for acquisition
- Ability to recall (increased/enhanced institutional memory)
- Use of the word “roadmap” by leadership in a way that means value added
- Decreased capability scramble (the right people, with the right expertise at the right time)
- Attrition rate of roadmappers (a negative, but useful measure)
- Number of business processes that require roadmap referencing (also breadth of processes)
- Reduced cost and time to reach plan consensus
- Increased funding due to roadmap suggestions
- Reality tracking along the timetable that the roadmap suggests (we really are creating a visible horizon that’s correct)
- Decreased waste and delay
- Decreased percent of reversed decisions
- Decreased number of projects that were not used (effectiveness of planning the right project)
- Increased “kill rate” (we don’t continue projects that don’t add obvious value to some objective/goal)
- Redeployment of later phase dollars to more useful projects (opportunity value)
- Decreased number of “chairman’s baby” projects
- Decoupling of the R&D project from the target product insertion (so that when a product is killed, we don’t necessarily kill all related underlying investments if they have value elsewhere)

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