

THE PRODUCT DEVELOPMENT BOOKLET: A Supplement to The Product Development Workshop



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INTRODUCTION

What is Product Development?

Basically, product development is the stages that occur from the time a business generates a new product idea to the launch of that particular product on the market. For a manufacturing company to be successful in the long term it needs to be efficient and comfortable with this process. The people involved in this process should have a variety of expertise, it is far too complex and important to leave up to one department. The process itself should be laid out in a written plan and be clear to all involved.

In simplest terms, product development can be broken down into three distinct activities; planning, developing and launching. The planning stage is where deep thought and research provide market and product direction for the project work. This 'homework' uncovers market and technology opportunities that are the most promising and grounds the project in sound business strategy.

After the planning stage has identified many opportunities, these ideas are vetted against pre-set criteria to decide which are most likely to succeed. The development stage is where the concept is turned into a tangible product design and eventually a working prototype. Along with designing the product, the process to produce it is also worked out in this stage. Often there is some form of testing whether in the form of performance testing or market testing or both to further refine the product.

The final step in the process is the launch where the production is finalized, marketing and promotional programs are rolled out, and the product is released into the marketplace.

Product development is one of those business activities whose results (either negative or positive) are only clear in the longer term. Since it can be done poorly without immediate negative results, it often is. Some common mistakes businesses make when doing product development are;

- not having any process in place,
- allowing one business function to dominate the process,
- having a lack of market orientation and
- not doing enough upfront planning or homework.

Why is Product Development Important to the Wood Products Industry?

Product Development is important to the wood products industry quite simply because as a manufacture 'you are what you make'. A company's product(s) are at the core of the business and they define everything else that follows. A company can squeeze every efficiency possible out of modern manufacturing processes and assemble the most creative hard-working marketing and sales force possible but if the product isn't exactly what the consumer wants, when they want it, it will have limited success.

While product development has always been important to long-term business success, the fast-paced, environmentally conscious global market we find ourselves in today makes it an imperative. Having a successful product from time to time is no longer good enough, companies now need to build new product development into their core competencies so they can quickly and reliably introduce market-responsive new products.

Whether you produce low-margin, high-volume commodity products or high-margin, low-volume value-added products (or something in between), the markets that your business operate in change. Certainly some slower and some faster but all are subject to changes in things like regulation, economics, societal trends, technology etc. that require products and services to evolve.

At the commodity level, new product development relies more on product performance, durability and developing systems around stand-alone products. Whereas, the more value-added a manufacturer is, the more focused on issues like user-friendliness and aesthetics he/she will need to be.

In some ways, the wood products industry is in an advantageous position with regard to product development. Compared to many other industries (such as food, apparel, electronics or the auto industry), our industry moves slower. This is largely due to the durable nature of the products we make (building products and interior fittings and furnishings). This is not a bad thing, in fact, it allows us to watch and follow these other industries.

There are examples from every industry of product 'de-commoditization'. The food industry is a good example, consider how many choices there are for milk. For many it is not hard to remember a time when milk was available in 2 or 3 sizes and 2 or 4 levels of fat content. Consider the options the consumer has now, individual sized milk-to-go, flavored milk, organic milk etc., not to mention the milk-like options for the dairy-wary like soy milk, rice milk, and almond milk each with its own variations in flavorings and enrichments. Now consider the auto industry, apparel etc. in this way and one can see that this is a pervasive shift.

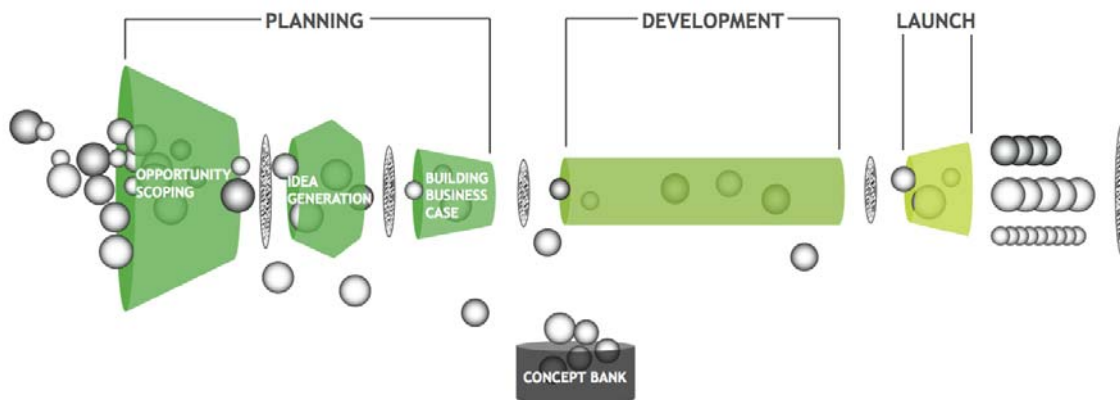
Wood products, whether commodity or value-added are starting to evolve toward differentiation and market segmentation. It is hard to imagine that it won't continue since the same people who buy milk and cars buy homes and the things that go in them. More and more buyers not only care about the price of a product but also how well it functions for their particular needs, how easy it was to purchase/service and even what meaning it brings to their lives.

What this means for manufacturers is that those for whom product development is still a sporadic, ad hoc event will need to put a system in place. Product development that happens without a characterized system in place depends on the capabilities of a few individuals' skill which becomes inadequate as the company grows. A more methodical

approach is needed, a good product development process is practiced, documented, enforced, trained and measured.

This booklet lays out a basic process that can be used as a starting point for wood product manufacturers to give their product development efforts structure and rigor. The process described here is a pared-down version of a methodology called the **Stage-Gate** process. (see model below) It is one of many widely written about methodologies for new product development. Others are: Quality Function Deployment, Concurrent Design and Superior Product Development. Manufacturers are encouraged to learn about several of these models and then pick and choose elements to create their own tailored process.

Manufacturers that use these processes tend to outperform those that do not. Adopting a standardized process can result in cost savings through decreased development times, improved manufacturability of new products, reduced launch costs and perhaps most importantly, increased customer satisfaction. While the details of each model differ, the basic ideas are very similar and can be applied to most industries.



PART ONE: BEFORE YOU GET STARTED

Key Features of a Product Development Process

While varying models for new product development do exist, differences between them are more than just subtle. The basic flow of events is remarkably consistent as are many of the key features.

Teamwork

Current thinking is that products can be developed more effectively and efficiently using cross-functional teams. These teams are generally comprised of members from various departments within an organization: marketing, design, research and development, manufacturing, engineering, and so on. Without technology a product won't work, without operational excellence a product won't be profitable, without design the product won't evoke desire and without consumer relevance it won't sell. For example, when the design people and the production people collaborate, a far more effective solution can be arrived at, one that simultaneously optimizes manufacturing and satisfies the customer.

Unfortunately, teams are difficult business units to manage, and sometimes even the most well-intentioned teams go off the rails. This is especially true when team members come from completely different backgrounds as in the case of the cross-functional teams required in product development. A production expert practically speaks a different language than a sales expert. Factors that can contribute to making a team more effective include:

- Strong and skillful leadership
- Having team members work in close physical proximity to one another
- Creating mechanisms for informal communications among team members
- Having management handle conflict and problems
- Bringing in the right mix of skills and personalities (choose team-oriented people)
- Communicating organizational goals to the team
- Training and capacity building for teams
- Performance measurement for the entire team, and not individual members.

At the beginning, teams will require leadership from upper management but as teams become more used to working together, they can become more self-directed. What tends to happen is that as team members start to understand each other's area of expertise, they also begin to respect and value each other's contribution.

Parallel Processing

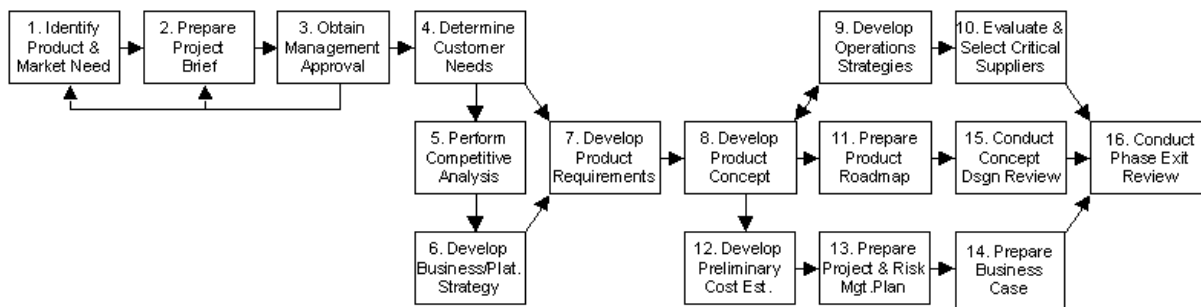
Most new product development methods recommend some degree of parallel rather than sequential processing. In other words, it is not necessarily beneficial to follow the sequences described above one step at a time, finishing one activity before beginning another one. In fact, significant time-savings happen when certain development tasks

take place concurrently. For example, once a new product concept has been approved, the marketing people can start working on the market plan for the launch rather than waiting for the product to be completed. This approach is also conducive to better communication (necessary for teamwork) throughout the product development process as it forces people to share thoughts rather than complete ideas.

Customer Focus

A customer focused approach is also highly recommended by product development experts. As the customer is the ultimate judge of whether a product is a success or failure, the needs and wants of customers must be at the core of all new product development initiatives. The "**voice of the customer**" is a term to describe the stated and unstated customer needs or requirements. The voice of the customer (VOC) can be captured in a variety of ways: direct discussion or interviews, surveys, focus groups, customer specifications, observation, warranty data, field reports, etc. Customer input needs to happen as often as possible throughout the various stages of development. A more detailed description of how to conduct VOC research follows in Part Three: Doing the Development.

Understanding the key features of a typical product development process will be central to developing a standardized process. See below for an example of one company's process flow diagram. Even with a standard development process template in place, it is necessary to tailor the process to the unique requirements of each development project. For example, a product upgrade is a less complex project than developing an entirely new product for a new market.



An example of one company's product development process flow diagram as.

With the key features to product development in mind, the reader will now be taken through the various steps involved in product development.

Opportunity Scoping

The idea of this initial phase is to get a sense of the 'big picture'. In this phase companies will need to look inward by examining their own strengths and weaknesses

and develop a plan of attack or product development strategy. They will also need to look outward toward the market to see where the business opportunities are.

Setting Strategy

The first step in *Opportunity Scoping* is to develop a high-level strategy, and /or a master plan that guides a business's new product development efforts. Not having a high-level strategy is like playing football without a game strategy. Without this direction businesses can find themselves in unrelated or unwanted markets and in products and technologies where they are less competitive. This strategy needs to be much more specific than a common vision or mission statement tends to be. It should include the following four points: specification of goals, identification of target markets and technologies, resource allocation and a plan of attack.

Goals

Setting goals is crucial so that product development activities tie in closely with the overall business strategy. Setting goals first means not wasting time and resources on new product proposals that may seem attractive on their own merits but simply do not mesh with the long-term strategy of the business.

The first step in goal setting is to conduct a strategic planning exercise for the entire business to determine the growth and profit goals. Next, determine if any gaps exist in the projected sales of current products. This will indicate what is needed from new product development to achieve the overall business goals.

Goals should be measurable so that they can be used as benchmarks against which to measure performance. There are several ways to do this. Many companies use the percentage of sales from new products. For example "By the year 2010, 30 percent of our sales will come from new products". Absolute sales can also be used, "New product sales will generate \$500 in sales by 2010". The percentage of profits within a specified time is another usable benchmark; again this can be expressed as absolute dollars or as a percentage of relative profits. Some companies find more qualitative goals easier to work with. For example defending market share, exploiting a new technology, capitalizing on a new strength or resource or diversifying into higher-growth areas are all worthy goals. And finally, simply stating the volume of new products a business intends to introduce in a specific time period, "each year we will develop five new products", may be adequate for some business situations.

Choosing Opportunities

In addition to setting measurable goals, businesses need to decide which markets or technologies to target and those to avoid. Successful companies leverage their strengths and competencies in the area of product development. The familiar SWOT analysis - strengths, weaknesses, opportunities and threats - will help to identify internal strengths and weaknesses in all facets of business.

- Examine marketing and sales to determine things like: customer loyalty, customer relationships, brand equity, sales force, advertising and public

relations, distribution and service support.

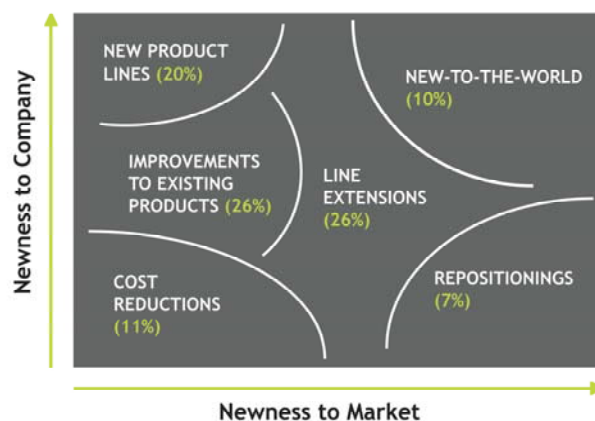
- Look at existing product technology in terms of: product quality, areas of product leadership, technological capabilities (unique skills?), access to new technologies and intellectual property.
- Look at manufacturing to judge: facilities, capabilities (unique processes?), capacities, raw material access and workforce.
- Assess these things in terms of where one sits relative to ones direct and indirect competitors.

Putting the Right Resources in Place

Once appropriate target areas have been identified for product development, developers can address the issue of resource allocation. Consider how much money should be spent on product development activities in general and how it should be split up among areas of focus. Statistically, there is a high correlation between what a business spends on product development and its success. Allocate a reasonable amount of funds to the product development function of your business and resist the urge to cut it back in harder times, since product development is the key to long-term success.

A good strategy will also lay out how funding should be split among target areas (i.e. 20% for market A and 80% for Market B), and among types of projects (i.e. 20% for new-to-the-world products and 80% for product improvements).

It is easy for businesses to focus all their funds on projects that involve improvements and modifications since it is easier and the payback is quicker. However, it is important to remember to dedicate some funds to higher-risk, longer term projects as these provide the input to future business. Successful companies tend to reserve at least ten percent for these 'breakthrough' projects while dedicating the other ninety percent to projects that involve improvements and modification or 'incremental' projects. The diagram below demonstrates how projects should be divided into types. The percentages are based on the split that most successful companies have. It is an useful exercise for companies to look at all of the products they have developed in the last year (or two years) and figure out what



should be divided into types. The percentages are based on the split that most successful companies have. It is an useful exercise for companies to look at all of the products they have developed in the last year (or two years) and figure out what

percentage fall into each of the categories in the diagram.

Planning the Attack

The final aspect to consider when developing a strategic plan for product development is the plan of attack. In general, businesses tend to fall in to one of four categories in terms of how they attack product development.

Prospectors are industry leaders. They value being first-to-market even when the risks are high. **Analyzers** are fast followers who carefully monitor the actions of major competitors in order to make improvements and then offer superior products.

Defenders seek out secure niche markets and protect their domain by offering higher quality, superior services or lower prices. **Reactors** respond only when forced to by strong negative external pressures.

There are pros and cons to each approach. Manufacturers must weigh their particular business situation, their marketplace dynamics, their competition, and their own capabilities and decide their general approach to product development. Manufacturers who have several different product categories may well choose to be a leader in one and a reactor in another if that makes good strategic sense. It is important to consider this and make a decision rather than letting it happen by default.

Identifying Market and Technology Trends

Once a business knows its internal situation well (by setting a product development strategy as outlined above), it will need to scope out its external situation including market and technology trends. By definition a trend is a change. The status quo just is, but when that changes we call it a trend. Manufacturers need to learn how to search for new product opportunities that arise from changes in their business environment.

Wherever there is change there is opportunity for innovation or new product development. There is certainly no shortage of change. **Economic factors** such as offshore competition can be seen as an opportunity to evolve a product offering so that it appeals to higher-margin niche markets. **Societal factors** such as increasing concern over personal security could prompt a door company to offer a better locking system.

Technological factors like new materials, processes, or digital technologies can also be inspirational for new product directions. Foreseeing **policies and regulation** regarding sustainability, can prompt manufacturers to introduce such things as third party certification, or end-of-life product services.

In order to keep abreast of the myriad of trends affecting their businesses, manufacturers need to have a system for **collecting information**. This information should come from as many sources as possible. Subscribe to many relevant publications or e-newsletters, survey customers or potential customers. For many wood products manufacturing sectors, architects and designers heavily influence trends so this is an important group to keep track of either by interviews or observation. Home design magazines are also useful to glean trends for building and furnishing products. Look at the big picture, beyond your own products. For example, cabinet manufacturers

should look at furniture trends since what happens in furniture finishes and styles tends to trickle down to cabinetry. They should also look at where appliances are going, and even at food and eating trends. Do not forget to keep track of trends in technology as well as market trends. Advances in material, process or systems technology are often the source of opportunity for new product direction. Wood itself is experiencing a rediscovery due to its renewability.

Once you have collected what will likely be an overwhelming amount of information, it will need to be analyzed to identify trends within. Look for disruptions, gaps, patterns and connections. Does A usually follow B? For example, environmental regulations that happen in California tend to follow in Canada. Since the California Air Resources Board (CARB) has placed strict regulations on allowable VOC's in composites, manufacturers would do well to be prepared for the likelihood that this will happen soon in Canada. Learn to keep an open mind, let the data speak for itself. It is not uncommon for people to project their own ideas as trends of the general population and this is not always accurate. Businesses will likely be unable to respond to all of the trends they discover, choose only those trends that fit in with overall strategic direction and those that your business is capable of addressing. Also, pay attention to the lifecycle of a trend. Is it on the way up or on the way out?

Once key trends have been identified, these will need to be translated into products. All competitors have access to the same information about trends; a businesses advantage will come from how well businesses are able to translate the trend into a unique superior product. Design is a useful tool to assist in this translation process. (more on design in Part Three: Doing the Development.)

After businesses have been tracking trends for a time, they will be able to begin to predict with some accuracy where things will likely go. When that is the case, they should lay out several possible scenarios that forecast the future and use these to guide product development efforts.

Take Home Points

- Take the time to set up a high-level product development strategy - it will prevent getting side-tracked as opportunities present themselves.
- This strategy should have explicit goals, indicate which markets and technologies will be of focus, allocate resources and be only as complex as it needs to be to do the job.
- Change equals opportunity for new product development - learn how to capture market and technology trends and translate these into unique products.

PART TWO: GETTING STARTED

Writing a Problem Statement

Once the direction has been set for a product development project, it is a good idea to write a problem statement. A **Problem Statement** defines the problem in the context of the market in order to determine an appropriate solution. It clearly states the problem with enough contextual detail to establish why it is important. It serves to keep the development focused on the market problems and results in better solutions.

All product development efforts should be thought of in terms of solving a problem, and doing so better than the competition. There are two ways this can be achieved; by solving a more important problem than your competition or by solving it better than your competition (that is, of course from the customer's point of view). An example of solving a more important problem would be the Westin Hotel's success with creating the 'perfect sleep' which proved to very important to business travelers. An example of solving a problem better would be Apple computer's user-friendliness (compared to PC) which allows them to garner a higher margin and capture a sizable portion of the market.

Problem statements should be; specific, based on observed measurable fact rather than opinion and include any known boundary conditions. Below is an example of a problem statement.

"Our customers in rural areas are having custom treehouses built at a premium cost. If we could come up with a concept for a tree house kit that sells for significantly less than a custom one we would have a sizable market."

Idea Generation

With a concise problem statement in hand, the next step is to generate as many ideas about how to solve that problem as possible. Companies need to be able to continually generate new ideas. Ideas are the feedstock of the new product development process.

The idea generation phase of product development is sometimes referred to as the 'Fuzzy Front-End'. 'Fuzzy' because it requires things like spontaneity, creativity, empathy and various other intangibles. In this step, ideas are collected or generated for the new product development process.

Product ideas can come from either external or internal sources. Manufacturers should consider input from both during the idea generation phase of product development.

External Sources

External sources for product ideas can include customers, distributors, retailers, suppliers, partners, inventors, universities and R&D organizations. There are many ways companies can capture ideas from these external sources. Customers or suppliers can be brought to idea generation sessions (or focus groups) to identify problems, gaps and emerging opportunities. Companies can also develop feedback systems with customers and suppliers. Comments and complaints can be a very useful starting point for new product ideas.

It is also becoming increasingly viable to buy or license ideas or intellectual property from online inventor sites such as: www.ibridgenetwork.org, www.innocentive.com, or www.ideaconnection.com. These sites list inventions or ideas by industry.

Manufacturers can look to this resource for ideas or they can post their problems to see if anyone has ideas about how to solve them.

Internal Sources

There are many ways companies can harness their internal creative ability for product development ideas. The obvious sources are design, engineering, sales, marketing and production but ideas can come from anywhere within a manufacturing organization.

In-House Suggestion Schemes

Consider implementing an in-house suggestion scheme. Companies can use this method to capture serendipitous discoveries, 'eureka' moments or to solve specific problems. A key to the success of such schemes is to select someone to manage it and publicize it well. Make sure it is easy to submit ideas by using simple submission forms either in hard copy or by email. Most importantly, build in recognition and fair rewards. Some companies even provide 'scouting' time where select employees are given a certain amount of time to work on their own 'discovery' projects.

Idea Generation Sessions

In addition to suggestion schemes, companies will need to conduct directed idea generation sessions. Product development experts use a variety of techniques for conducting these sessions. While the details of the formats vary, the general approach is often quite similar. The discussion that follows lays out some common methods for holding successful ideation sessions.

Preparation - The first step in preparing for a productive idea generation session is the careful choice of participants. A diverse mix of backgrounds and personality types is best for arriving at creative solutions. Choose some doers and some thinkers, some right-brainers and some left-brainers. Some people are better suited to teamwork than others, choose those who demonstrate the ability to collaborate and respect people with differing ideas and backgrounds. Five to eight people usually make a group that is varied yet not unwieldy. Consider including experts from a related field. For example a cabinet company could invite a professional chef to discuss his/or her needs or experience with kitchen cabinetry, or a flooring company could bring in an expert on

coatings. And last but certainly not least is the moderator or facilitator. If you do not have someone in-house who can do this job well, hire a professional until someone from your company has enough experience to take over. Ideation needs to be an ongoing activity so it makes sense to work toward developing the competency in-house.

Bringing participants in to an idea session 'cold' is a bad idea. The results are much better if some **fertilization** of the minds of those participating happens before the session. Participants need to have a good understanding of the goals and intensions of the new product. At the very least, they should be given the product development problem statement (described above) about a week before the actual session. When a new product development project is particularly involved, experiential exercises such as field trips or ethnography may be warranted. These activities immerse the participants in a problem allowing them to fully understand it before trying to solve it. An example of a field trip would be having ideation participants who are solving an issue related to early failure of cedar fence panels take cameras around to document failing fencing in use. An example of ethnography would be having the ideation participants shadow fence installation crews for a day or shadow customers throughout the fence purchasing process.

The **setting** of an idea generation session can be more or less conducive to creative thought and risk-taking. Ideally, the physical space should be comfortable with ample space to move around. Keep tools and materials handy for quick models or sketches to illustrate ideas. Keep stimulating images and artifacts in the space. Things like material samples or prototypes are good to have around since they can often spark solutions. The psychological setting of an idea generation session is also extremely important. It is absolutely necessary to create a risk-friendly environment. A good environment for idea generation is one that is free from interruptions, light-hearted and humorous, supportive and most importantly, non-judgmental. A good moderator will set the tone for this kind of environment.

A Typical Three-Day Ideation Session

Once the preparation has been done, that is, the team and moderator chosen, the participants have adequate knowledge and experience related to the problem at hand and the room is poised for a dynamic session, you are ready for the actual session to start. The following discussion outlines a typical three-day ideation session for new product development. A session can last from a few hours to a week depending on the scope of the task at hand. It is best when there is 'hang time' and a sleep cycle with the ideation session. 'Hang time', like going for lunch or dinner together offers an opportunity for informal interactions which can be very productive. Spreading the session over a few days allows participants to 'sleep on it' which allows space for the subconscious to play a role.

Day One

The first day should be about gaining maximum breadth. Begin with broad scale idea

generation, building on what is known. Keep the product problem statement and a limited set of criteria from previous research available. This will help drive and focus the ideation. These criteria will be used later to edit the list of ideas generated. The criteria should include things such as;

- the product's essential features and benefits,
- the key characteristics of the target customer (their rational and emotional drivers),
- the competition (positioning, status and direction of other brands and products in the target marketplace),
- the technologies that can be leveraged, and
- the relevant macro and micro trends from local to global that might shape the offering and connect with the target today and in the future.

It is a good idea to start with a warm-up activity to ease participants into the brainstorming mode. For example, the moderator may ask participants questions like 'name things that are blue?' or 'what would the world be like if there was no combustion engine?' just to get everyone loosened up. Most moderators will then use a standard brainstorm to solicit first-run ideas. This is often done verbally with someone recording suggestions or it can be done by having participants write down their ideas. Either way it is important to establish ground rules for a productive brainstorming session. Some typical rules are:

- go for quantity not quality
- don't filter your own ideas
- don't judge other's ideas (either negatively or positively)
- crazy ideas can lead to other things
- there is no such thing as a bad idea
- piggy back on others ideas
- push yourself
- have fun!!

In order to achieve true innovation ideation needs to go beyond where others (competitors) have gone. While brainstorming downloads ideas and allows them to bounce like pin-pong balls off each other, **innovation exercises** are designed to push ideas even further. These exercises fall into three distinct categories: creativity exercises, analytical exercises and experiential exercises.

Creativity exercises encourage making new connections by forcing ideas together that would not normally be connected. For example, randomly open a newspaper and put your finger on an article. Then try to use ideas in that article to solve the problem being worked on. **Analytical exercises** can also drive new thinking. A simple matrix analysis comparing top customer needs (y-axis) by key technologies (x-axis) can provide new insights. Draw up the matrix and examine each block for logical or fantastical connections. **Experiential exercises** include things like the field trips and ethnography mentioned in the section on preparation. Collages can be made from images taken on these trips to capture a particular situation. Experiential exercises can also include drawing, model building and acting/play. These activities can help teams lift thinking to longer-term vision, by accessing emotional content. Cartoon strip-like storyboards can be made to show what is going on in the lives of customers or in the world of

technology. Skits can be acted out to imagine what it would be like to use or purchase a particular product. Having people role play will be awkward at first but when they get more comfortable the learning that happens when developers put themselves into the shoes of the buyer can be very valuable.

Once a sufficient quantity and depth of ideas have been identified (it would not be uncommon for a one-day idea generation session to generate at least 200 ideas) they will need to be organized. This has been traditionally done using flipcharts or sticky notes but more recently idea capture software is being used. Some of the more common software packages are MindManager, OpenMind, Semantica and FreeMind. They tend to be inexpensive and can help groups organize the plethora of information that is generated in these sessions. They are also very useful when ideation sessions are conducted remotely, with participants in different physical locations. By the end of day one, the ideas generated need to be mapped in some way.

Day Two

The second day of a three-day ideation session should be about being sure that all the bases are covered. After ideas have percolated overnight, identify the ideas that warrant more exploration and use targeted breakout groups to focus on solving these tricky problems. Brainstorms and/or innovation exercises can again be useful in this session. **Outside guests** like customers, experts or even just someone with a fresh perspective can be brought in to present to the group. These guests can often shed light on the current picture or even postulate future changes of a market or technology.

Once the group feels it has done an adequate job in bringing as many ideas to the table as possible, these ideas must go through an **initial screening process**. Give each team member ten votes to cast on their favorite ideas.

Day Three

The third and final day should be about reviewing the screening results and turning ideas into concepts. Once a reasonable number of ideas are selected, ten to twenty minutes, these ideas need to be clustered and refined into formal concepts. What constitutes a concept? Ideas can be expressed in a sentence whereas concepts fill out the ideas, and are often based on several ideas. Dedicate one team to each concept and have them draw-up a **concept poster**. This poster is basically an 'advertisement' that lays out the concept as a business proposition. Include customer benefits and technology advantages. Encourage the use of imagery and language that will 'sell' the concept. A concept should be enough of a statement to drive the idea into the next stage, formal development.

Have groups present their final concepts to the decision makers. Put together a core team to evaluate the concepts against the criteria established at the beginning of the session. Think of this screening process like culling plants, some plants need to be culled in order to adequately nurture the remainder.

The final step in the ideation session is to develop an action plan. This plan lays out the next steps for the development stage.

Follow-Up

Make sure to keep ALL of the ideas generated for every session. These ideas can be recycled over and over again. Often an idea that is cut in last year's session is perfect for this year's product development. Have a quick post-mortem to evaluate the process and to ensure continuous improvement.

Take Home Points

- Setting out to make a 'thing' is far more limiting than solving a problem so start your product development process with a problem statement.
- The ability to generate a continuous stream of new product ideas is central to a progressive product development process.
- Manufacturers should capture both external and internal sources of product ideas.
- Develop a process for conducting regular idea generation sessions.
- Choose the participants and moderator carefully and prep everyone involved.
- Spreading the session over several days makes for better quality ideas.
- Ideation is a time to develop the customer-centric and innovation-friendly culture necessary to drive your product ideas through to market.
- Creativity takes practice, keep improving.

PART THREE: DOING THE DEVELOPMENT

Screening/Portfolio Management

Typically there are several points along the development process called screens or gates. These checkpoints do two things. Firstly, they keep the project moving forward and on track since they involve managers, deliverables and outputs for the next phase. Secondly, they serve as quality control checkpoints. That is, ideas or projects are evaluated and scored before moving to the next stage. Even resource decisions, committing people and money to specific projects, can be made at these gate meetings. Gates are designed to weed out bad ideas early, so that resources can be directed at good ideas at the resource-intensive development stage.

In our model shown on the last page, there are five screening gates. The first one is after the 'Opportunity Scoping Phase'. Its output is to generate a list of viable new product development opportunities. The second one is after the 'Idea Generation Phase' and it serves to select the best ideas based on strategic fit. If the idea generation phase of your product development process is doing a good job it should be coming up with far more ideas than your company has resources to develop. The third screening gate happens when the 'Business Case Phase' has been completed. This tends to be crucial screening since it chooses which projects are most viable to develop into products. Development is the most resource-intensive phase so it is important to choose well here. There is another screen after the 'Development Phase' where the product is given one more test before it is launched. After the 'Launch Phase' there is typically a post-mortem to review the project. What was good and what could be improved next time? Keep in mind that some projects like minor product improvements would require a truncated development process and thus fewer screening points.

Checklists and scoring models are useful tools for decision making at screening meetings. Make sure that exact requirements / criteria are determined for the next phase. Common criteria would include:

- Strategic alignment
 - Consistent with organizational strategy
 - Importance of project to the business
- Product advantage
 - Does it offer unique benefits?
 - Does it offer good value to the customer?
- Market attractiveness
 - Market size
 - Market growth rate
 - Competitive situation?
- Synergies
 - Leverages business's marketing, distribution and selling strengths/resources
 - Leverages technological know-how, expertise, and experience

- Leverages manufacturing/operations capabilities, expertise and facilities
- Technical feasibility
 - Size of the technical gap
 - Complexity of the project
- Risk versus return
 - Expected profitability
 - Percent return
 - Payback period
 - Degree to which project is low cost and fast to do.

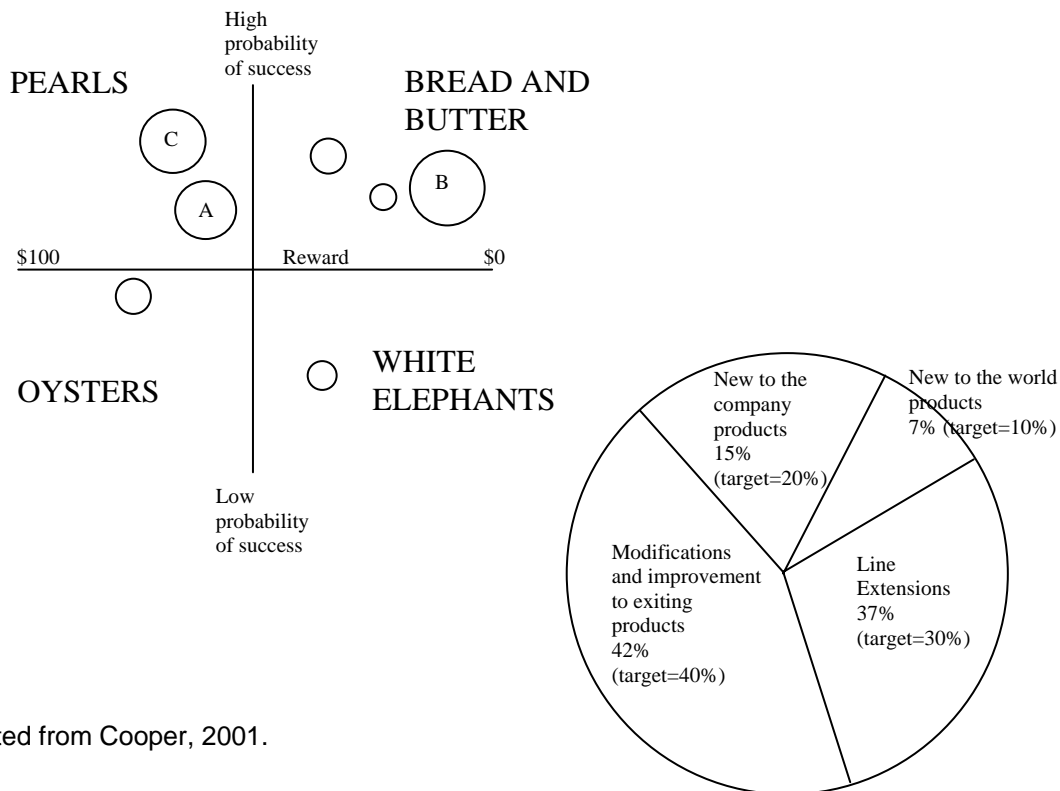
The screening gates take care of which individual projects proceed but product development efforts also need to be balanced in terms of the entire mix of products. This is referred to as **portfolio management**. Companies should conduct portfolio reviews once or twice a year to make sure that the total mix of projects pursued is optimal. Portfolio reviews are more important as companies grow, since smaller companies tend to do only a few projects at a time. Portfolio reviews have three goals: value maximization, balance and strategic alliance.

Risk is inherent to new product development so managing it is crucial. From a product development manager's perspective, a high-risk situation is one in which much is at stake or one where the outcome is uncertain. A project that has a lot at stake is one that involves a lot of money or is strategically critical to the business. An example of an uncertain outcome is if it is uncertain whether the product is technically feasible or if it will do well in the market. A rule of thumb is, if the uncertainties are high, keep the amounts at stake low and as the uncertainties decrease, the amounts at stake can be increased.

To maximize value from a product portfolio, projects need to be ranked in terms of some business objective, such as profitability. A simple spreadsheet shown in the example below can be used to rank according to project attractiveness. List your product concepts in the left hand column and the criteria across the top. Go through each concept and rate it from one to ten. Those that fall below a certain number can be shelved or terminated.

Project (product concept)	Strategic Fit (1-10)	Market Attractiveness (1-10)	Fit with Core Competencies (1-10)	Technical Feasibility (1-10)	Etc.	Project Attractiveness (out of 50)
A						
B						
C						
D						

To evaluate the balance and strategic alignment of projects, visual charts are effective. One can use pie charts and bubble graphs like the examples below to visualize where the whole product mix sits in terms of key parameters such as: long-term versus short-term; high-risk versus sure bets; and across various markets, technologies or project types. Using a variety of charts like these allows you to see the condition of your product portfolio at a glance.



Adapted from Cooper, 2001.

Much like stock market portfolio managers, those product portfolio managers who can select the right mix of new product projects win in the long run.

Take Home Points

- The various screening gates scheduled throughout the product development process keep the project on track and serve as a quality control checkpoint.
- Using a Stage-Gate process takes care of the choice to fund individual projects, but portfolio review meetings should be held once or twice a year to look at the big picture.
- Graphs and charts are useful to visualize your product portfolio.

Building the Business Case

This phase is where the 'meat' is put on the project. It should culminate in a mini business plan that has three main components: a product and project definition which answers "what?" and for "who?"; a project justification which answers "why?"; and a plan to proceed which answers "how?" and "by whom?". Preliminary research will have been carried out in previous phases, but now higher stakes warrant a closer look.

There is a document that compiles a list of resources devoted to secondary information on market trends and information in the wood products sector, as well as the specific

industry segments that it comprises (building materials, flooring, cabinets, mouldings and millwork, furniture, etc.). “Sources of Market Information for the Forest Products Industry” (Wagner *et al.* 2003). Available to download at <http://www.apawood.org/pdfs/unmanaged/MarketInfoNov03.pdf>.

Voice of the Customer

As mentioned in Part One, it is necessary to capture the voice of the customer throughout the product development process. There are multiple customer voices: the buyer, distributor, retailer, building professional and the end-user(s). Even within one buying unit there are sometimes multiple voices (for example a couple buying new bathroom cabinetry may have different needs and wants). In order for the development team to get the best information possible they need to be as directly involved in the process as possible. Direct involvement provides a better understanding of customer needs and helps to develop greater empathy on the part of product development personnel.

If a company has a small number of customers it can be useful to have a customer representative on the product development team. If the product under development is aimed at a current market then the company should target current customers. If the focus is on a new market, the company should talk to potential customers as well as competitors’ customers.

Lead customers are those that are particularly advanced users of the product. For example, a building professional may have more technical knowledge about engineered wood flooring than home renovators. Lead customers can provide particularly useful feedback, since they push the products to their limits and sometimes adapt products to better suit their needs.

The way that questions are framed is key to any customer discussions. The goal is to identify the basic customer needs. Customers may try to express how a need can be satisfied (often by describing an existing product) rather than what the basic need is. For example, a customer of a ladder manufacturer might suggest they make a telescopic version. This is usually less valuable than getting to the core of what the need is, which in this case might be a ladder that is easier to store or perhaps easier to carry. Development personnel need to ask why until they truly understand the root need. In addition to ‘stated’ needs, ‘unstated’ can be intuited from the interaction.

Once customer needs are gathered, they have to be organized. Whether the information has been collected in the form of interview notes or surveys, the customer data needs to be distilled into a few key customer needs.

The following list describes opportunities to capture the voice of the customer for each phase.

1. Opportunity Scoping Stage
 - a. Capture major market trends by keeping track of what is going on in your

sector

2. Idea Generation
 - a. Bring customers to the idea generation phase to identify problems, gaps and emerging opportunities
3. During Development
 - a. Do a more in-depth study face to face with customers to determine their needs and wants
 - b. Do concept testing of the various prototype or model iterations to determine market acceptance
4. After Development
 - a. Do user tests of the finished product to confirm intent to purchase
5. Launch
 - a. Allow customers to give feedback on the longer-term performance of the product.

Even informal customer interactions, say at trade shows, can be useful for customer feedback providing there is a way to get good information and record it.

Take Home Points

- Market research is necessary to link your company to its customers - there are many simple inexpensive ways to collect market information.
- Methods to capture the voice of the consumer (including distributors, retailers, end-users, etc.) should be built in throughout the entire product development process.
- The voice of the customer can be captured in a variety of ways: direct discussion or interviews, surveys, focus groups, customer specifications, observation, warranty data, field reports, etc.

Development

New product ideas that show strong promise are put forward for development, which typically involves taking the product idea and creating a prototype (a physical model of the new product concept), and perhaps even testing the prototype in select ways.

The Role of Design in Product Development

The value-added wood products industry, with its diverse range of products, requires at least two kinds of design input. As mentioned in the introduction, the more commodity-based a product is, the more its success relies on issues like performance and durability; the less commodity-based a product is, the more it relies on issues like user-friendliness and aesthetics. Therefore products like wood composites and building products will rely more on design engineering and products such as cabinetry and furniture will rely more on industrial design. In some cases, where products have both strong structural and aesthetic/functional qualities (as in the case of doors and windows), input from a combination of the two is optimal.

Since engineering is better known to the wood products industry, this section will focus on the lesser utilized area of design.

The word '**design**' is used here to refer to the process of identifying and creating specifications that optimize the function, appearance and value of products and processes in order to generate commercial advantage.

The profession generally associated with this work is **industrial design** (or product design). Industrial design is a unique field that lies between science and art, between technical analysis and look and feel. Industrial designers are responsible for the way everything from backpacks to cordless drills function and look. Designers are uniquely positioned to develop products that are highly responsive to both manufacturing capabilities and the demands of the market. The unique perspective of 'design thinking' is valuable to manufacturing and business in many ways.

Designers are trained in **divergent thinking**, which is crucial to arriving at truly innovative product ideas. Many highly successful products have come from out-of-the-box thinking. The hula-hoop is an example of a product that would not exist if it were not for somebody imagining something completely new.

The designer's ability to visualize solutions and communicate them through models or drawings results in **tangible artifacts**, such as drawings, models and prototypes. These artifacts are extremely useful to the product development process and can be used both in-house to communicate ideas, and as tools for the sales and marketing functions to obtain important, early feedback from customers.

Design concentrates on the **user's perspective** which is more specific than the typical customer focus which may include the retailer or distributor. 'Users' are those who will actually interact with a product during its lifespan. All products will be handled, installed, repaired, refinished, by people whose experience with the product will determine whether it will be a commercial success. When careful consideration is given to the end-user during product development the resulting products tend to be more user-friendly and have stronger emotional appeal.

Design is critical to the **evolution from the commodity mentality** (mass markets) to niche markets. There are many examples in the market today where design has been successfully used to transform what was considered a stagnant commodity product to a variety of more specialized products. The simple toothbrush is an excellent example. Less than ten years ago manufacturers of toothbrushes were focused on trying to make cheaper toothbrushes, and all toothbrushes were pretty much the same. Today, consumers can buy disposable toothbrushes that fold for travel, any number of brightly coloured, ergonomically correct brushes with a variety of features (convenient grip, nice handling action, special bristles to reach the tough spots, etc.), as well as a huge variety of electric brushes ranging in price from \$10 to \$350.

Working with a Designer

Typically, manufacturing companies fall into two categories with respect to their use of professional design. They can be described as either having **innate design** or **acquired design**. In the former, design is a core competency from the company's inception. In the latter, design has been integrated at some point in the growth of the company when it was deemed necessary.

Hiring a designer is a first step in acquiring design. Typically, industrial designers work either as in-house staff or freelance consultants. The volume of work required by small or medium sized manufacturers may not financially justify hiring a full-time staff designer. Even larger firms may decide to use an independent designer, as outside designers bring with them the experience of working for a number of companies and can bring a fresh creative mind to the task at hand.

Finding the right designer, whether for one specific project or to hire on an on-going basis, is very important. The relationship between a company and a designer is very much a partnership, so manufacturers need to find someone who will fit in well with their company.

Once a manufacturer has hired a designer, they still have a significant role to play in the process of developing new products. As mentioned earlier, successful product development is a team effort. The designer will work closely with, and sometimes even lead this team. Design needs a supportive culture to work, and manufacturers who are new to design will need to keep an open mind and embrace risk and new ideas.

The 'Design Brief'

Whether a manufacturer has in-house design or out-sources to a design company or freelance designer, a design brief is an essential part of the design process. A **design brief** is a written document that thoroughly explains the problem that needs to be solved by a designer or design team. It should primarily focus on outcomes of design and the business objectives of the design project. It should not be prescriptive or tell the designer what to do but rather to give them the best possible chance of delivering the work the client needs by being very clear about what the new product needs to achieve. It is the designer's job to create the most effective and creative design solution to solve the problem.

Usually it is the manufacturer's job to develop the design brief but in the case that the manufacturer is not used to this process, the designer will offer a template and work with the company to develop one. At the point of embarking on a product design project the manufacturer will have already addressed the information needed in one form or another so it would be mostly a matter of collating this information into a concise document. In many cases, the exercise of developing a design brief will coalesce differing ideas and notions into a focused roadmap.

The size of a design brief can vary from a couple of paragraphs to 20 pages depending on how familiar the two parties (the manufacturer and the designer or design company) are with each other and the project at hand. In-house designers or design teams need less information than freelance design companies. One thing is for certain though, the more a designer knows about the situation the better the solution will be.

A good design brief will include the following;

Organization Background - Here the manufacturer provides enough information about their organization to understand where they have come from, and where they are trying to go. Extend this background information to a synopsis of the market in which the business operates, explain who the competitors are and how the company and its products or services differ from the competition. Explain the company's brand personality.

Project Objectives - Explain the need for this particular project. For example, 'this new prefabricated fence panel is needed to extend our existing product line and capture a growing market for a modern, more durable panel'. Design can have a huge influence on the success of a company's product development process but in order for success to be ensured, clear goals must be set.

The Product Itself - Describe the materials, medium or media in which the design will be realized, the design cycles, the distribution, the design parameters in general including (marketing issues, technical/engineering issues, production issues, functional issues and aesthetic issues). Sometimes including images of examples that may indicate a direction that seems appropriate can be included here. Images of things that won't work are also useful here, often it is easier to know what one doesn't want than what one does want.

Logistics - The timeline and deliverables should be laid out. Responsibilities and tasks should be made clear. Measurable project outcomes are usually determined (for example, increased percentage share of market, an increase in sales, increase in customer satisfaction).

Design for Manufacturability

In addition to adding value by making products more desirable, design can improve products by reducing the cost of manufacturing. Research has shown that decisions made during the development period determine 70% of a product's costs, while decisions made during production only account for 20% of the costs. This speaks to the great leverage that Design for Manufacturability (DFM) can have on a company's success and profitability. In order to develop a product that will capitalize on a particular manufacturer's production capabilities without compromising the value to the customer there is much to consider. The manufacturing specialist within the development team has a key role in designing for manufacturing.

It is crucial for the product development team to have a basic understanding of product cost build-up. The major cost factors in developing a product are direct materials, direct labour, assignable capital and operational overhead. Each of these can be thought of as a knob that can be turned up or down. Turning one area down tends to negatively affect another area. For example, reducing material costs can often increase direct labour, as in the case where thinner material is used but structural reinforcement is then needed to compensate. It is important to balance these decisions carefully so there is no compromise in terms of value to the customer. Turning these knobs up and down to arrive at the best solution becomes quite a challenge, but can result in highly marketable, highly manufacturable products.

In order to reduce **direct labour**, the development team needs to consider whether the number of parts could be reduced to simplify assembly. Can any changes be made that would allow automated operations to replace manual work? On the other hand, if the introduction of a new product involves major capital investment in equipment it must be carefully considered. Can the product be designed in a way that requires less skilled labour? The per-hour cost can be significantly reduced by designing products to be simple to assemble and relatively easy to adjust. Can the product be designed for foolproof assembly? For example, if a product has a part that is only slightly asymmetrical, can it be accentuated so there is a clear left and right side so it won't be accidentally flipped during assembly? Can the product be designed in such a way as to reduce testing and inspection?

In order to reduce the cost of **direct materials**, minimizing waste needs to be a key consideration at the development stage. Can the product be re-designed to enable better part nesting? Can the number of parts be reduced or standardized? Standardizing parts results in reduced material handling, purchasing and inventory costs. It also yields volume discounts for outsourced parts. Can less expensive materials be substituted without compromising the required quality? Inspired design can often reduce the need for expensive materials. A well-designed piece of furniture made of alder with aluminum hardware may well garner a higher margin than a 'me-too' oak and solid brass piece.

The issue of **assignable capital** is a delicate one. Acquiring capital equipment means keeping it utilized, which can constrain future product development directions. Do not forget to consider the overhead necessary to maintain it and train operators. A rule of thumb is to consider at least three other alternative manufacturing processes before committing to purchasing new equipment. Although there are exceptions, small, rapid-throughput equipment is generally more economical than batch equipment that has long set-up times.

In order to develop products that minimize the **operational overhead**, production people need to play a key role. Avoid designs that require changes to a factory layout - production personnel need to explain how to capitalize on the existing layout as much as possible. Try to develop products that look like they are customized for every

customer but look the same on the factory floor. Consider the cost of inventory in the design phase. Reduce the number of subassemblies required, for example. Can the product be designed to require minimal wear on tools, lubricants, abrasives, glues and finishing materials? Can products be designed for easier handling within the factory and during shipping?

Manufacturers will typically develop their own checklists of relevant principles of designing for manufacturability to guide their design processes. Below is an example of a simple “design for...” checklist.

	Yes	No	N/A
Design for Manufacturability and Assembly			
Minimize # of parts			
Develop a modular design			
Use standard components			
Design parts with multiple functions			
Minimize handling			
Design parts to be self-aligning and self-locating			
Design parts that cannot be assembled or installed incorrectly			
Design for Serviceability, Shipping and Maintenance			
Ensure that components that will require replacement/service/maintenance are easily accessible			
Consider strengthening areas that are vulnerable in shipping			
Consider providing spare high-wear parts			
Design for Safety and Reliability			
Test parts in extreme use conditions			
Avoid wear-out mechanisms when possible			
Avoid sharp protrusions			
Make sure the product is ergonomic			

Testing

There are three elements of a new product that need testing somewhere within the process. Firstly, prototypes need to be tested for quality. Some products need to be put into real usage or simulated usage until they fail. Others need to be tested for usability. Put the product in the hands of users and see if it performs well. Is it easy to assemble

or install; is it easy to keep clean? etc. Prototypes or drawings can also be used to do a consumer attractiveness test. Perhaps a soft launch would be useful. And finally, production kinks can be worked out by doing a small production run.

Take Home Points

- The design function is key to new product development as it translates the needs of the customer and a company's manufacturing capability into products that respond to both.
- Finding the right designer is important since they need to fit in well with your company.
- Wood product manufacturers can use either design engineering or industrial design expertise.
- Designing products for ease of manufacturability is key to keeping costs down since it is much harder to trim costs later.
- An efficient way to ensure products are designed for optimal manufacturability, serviceability and safety, is to develop checklists.
- Testing product for quality, market appeal and production is often useful.

PART FOUR: LAUNCHING THE PRODUCT

Once development teams have a new product, fully developed, tested and production-ready, it is ready to be launched into the marketplace. The marketplace is the battleground on which the new product's fortune will be decided. Thus the marketing plan, which guides the product's entry into the market is a pivotal facet of the new product strategy. Actual marketing plans vary in length and scope but they typically specify the marketing objectives, marketing strategies and marketing programs.

Remember that the marketing plan can and should be started long before the product is ready to launch. In fact, much of the information will have been collected in previous phases and needs only to be verified at this stage. For example, the target market will be defined, the expected sales revenue will be considered, and product benefits and features will have been defined. Things like photography, promotional material and sample preparation can be done ahead of time. Some concepts that are key to the product launch phase are described here.

Market Segmentation

Market segmentation is the delineation of groups or clusters of people within a market such that there is relative homogeneity within each group and heterogeneity among groups. The more specific you can be about targeting a market, the more successful your product is likely to be. Market segmentation goes far beyond the standard issues of age, sex and income by looking at variables such as 'state of mind'. That is, they delve into customer's attitudes, values and lifestyles in a realm referred to as '**psychographics**'. As an example, listed below are eight types of consumers based on their self-identity and resources. (Stanford Research Institute)

1. Actualizers: high resources with a focus on principle and action; active, take-charge expression of taste, independence, and character; college educated
2. Fulfilled: high resources with a focus on principle; mature, satisfied, well-informed people for whom image has little importance; married, older, and college educated
3. Believers: low resources with a focus on principle; traditional, moralistic with a predictable lifestyle tied to family and church; non-innovative; older and high school educated
4. Achievers: high resources with a focus on status; successful, career oriented; low risk-takers; respect authority and status quo; highly image conscious; college educated
5. Strivers: low resources with a focus on status; impulsive and trend-conscious; seek social approval; money defines success; younger
6. Experiencers: high resources with a focus on action; young, enthusiastic, risk-takers; single and impulsive purchasers
7. Makers: low resources with a focus on a practical action; conservative, practical, family oriented; work with their hands, high school educated
8. Strugglers: poor, little education, few resources; focus on living for the moment; cautious; older

Consider the wood flooring market. Some customers may be handy and want to save money by doing the installation themselves, and are less afraid of any necessary upkeep required in maintaining a floor. Other customers may be looking for prestige and will buy the 'look' they see in the magazines with little attention to other factors. Each of these segments requires a product with different attributes and a different marketing strategy.

Another way markets can be segmented is by product usage. Some customers are heavy users of your product, others are light users and others are non-users. Does the 80:20 rule apply to your market?

Customer loyalty can segment customers. Some are loyal to your company or product; others are loyal to a competitor and some waffle in between. Customer's motivations for buying are often very different. For example, some people buy a new bathroom to accommodate a growing family, others to 'keep up with the Jones'.

Pricing strategies

Pricing strategies vary according to the type of product being introduced. For example, a common strategy for a product which required a great deal of research and development is **price skimming**, wherein high prices are charged in an attempt to recoup product development costs. An alternative strategy is known as **price penetration**, wherein artificially low prices are charged in an attempt to build up as much consumer interest and market share as possible upon product release.

Advertising and Communications

The best product in the world will fail if the right people don't know about it. The product's virtues must be communicated through advertising. If the advertising and sales are done in-house, make sure both of these groups have been at least peripherally involved in the development process. If they have input and watch as the product takes form they are much more likely to be able to effectively market or sell the product. E-communications have and will continue to change the game rules for advertising. Now you no longer control what the customer sees, the customer does. Consumers contribute to your brand image through chat rooms and blogs.

Take Home Points

- A marketing plan that includes marketing objectives, strategies and programs is needed to provide a smooth, successful product launch.
- Do not wait until the end of the development process to start planning the launch.
- Market segmentation gives a more precise view of customers and allows for better targeting with products and marketing.

- There are two distinct pricing strategies for new products - skimming is charging more to recoup development costs, and price penetration is charging less to get the product out there.
- It is important to get buy-in within the advertising and sales function so they will be genuinely excited about the new product and thus, be better able to sell it.

Metrics

Companies need to be able to measure the success of their product development processes. Companies that have effective processes get products developed faster, spend less money doing so, get more products to market, and generate more revenue from new products than companies that do not.

There is no universal view on what should be measured but the following list outlines several options.

To measure how well projects are executed:

- Number of projects that meet scheduled launch (strive for predictability so estimates can be accurate)
- Time spent in phases (strive for as short as or shorter than competitors)
- Percentage of products that meet or exceed the goals set at the outset (measures success of planning)
- Percentage of projects that were within budget targets.

To measure the value projects are delivering:

- Profitability (payback period, break-even time)
- Percent of commercial successes
- Percentage of sales generated by new products
- Percentage of growth generated by new products (profits).

Metrics should be simple, practical and fit with business objectives. Do not wait too long to implement measurement tools.

Take Home Points

- Gauge effectiveness of product development activities by using a variety of metrics either during the process or after.
- Keep metrics simple at first and then add more as needed.

PART FIVE: EXTRAS

Sustainable Product Development

Sustainable manufacturing involves balancing human needs (social and economic) with environmental needs. No discourse about product development in the 21st Century would be complete without a section on sustainability. Manufacturers have a major challenge ahead of them to evolve current practices to those that are more sustainable. To get an overview of the materials' economy, view the 25-minute video called 'The Story of Stuff' at www.thestoryofstuff.com.

The first two things wood product manufacturers need to know about sustainability are that it is not a trend as much as a societal shift (don't count on waiting this one out), and that it is a complicated issue (there is no quick fix). The best approach to tackling this issue is to start with planting seeds not forests, in other words, don't try to do it all at once. Start with what is most important and achievable and keep moving.

The following is a list of concepts of sustainability to consider when developing products.

Reduce

This concept has been around for long enough for most manufacturers to understand and implement. Reduce the amount of material used or the energy used to produce a product. Can thinner stock be used? Can fewer parts be used? Reduce the amount of waste or dangerous toxins and emissions involved in the production of a product. For manufacturers of wood products the two main material concerns are with adhesives and finishes. Can you substitute materials with low volatile organic compounds (VOC's) for regular ones?

Re-Use

Re-use parts or the entire product at what would traditionally be considered its end-of-life. The intent here is to keep products out of the landfill for as long as possible. A furniture company could offer a buy-back program to re-sell used pieces.

Recycle

The concept of recycling is taking used components, breaking them down into basic materials and then remanufacturing them into new products. Currently wood products are being recycled into wood/plastic composites, animal bedding, surfacing for playgrounds, filling material for composts and charcoal production. Can new products be designed for easier disassembly?

Servicizing

By 'servicizing', manufacturers can change the focus of their business models from selling products to providing services. Instead of selling carpet, several carpet manufacturers 'lease' carpet tiles to companies and service those tiles by replacing them as they wear. Could any of your products be sold as a service?

Biomimicry

Biomimicry is the study of the way that nature does things so that we can adapt nature's methods to modern production. Nature has evolved processes that are efficient and that generate no pollution. An example of innovation derived from biomimicry is the dirt-repelling surface properties of a lotus petal being replicated in self-cleaning paints or fabrics or water-proof adhesives based on the chemistry and structure of the system mussels use to attach themselves to rocks.

Design for Longevity

In our affluent culture, products tend to find their way to landfills long before their functional life has expired. However, a growing percentage of consumers are recognizing the benefits of products that are built (and designed) to last. Wood products (building products and furnishings) are particularly well-suited to be designed for longevity. Approaches to designing for longevity can include:

- Design that improves a product's physical durability
- Design that improves a product's emotional durability
 - when people are emotionally attached to objects they are more reluctant to replace them, and the time spent with a product develops this attachment
- Designs that can evolve
 - like a crib that turns into a child's bed
- Design that provides for ease of ongoing repair and upgrade
 - include services with your product or put information on how your clients can do simple repairs themselves on your website.

Cradle-to-Cradle

This concept is about closed-loop manufacturing. From the uptake of materials into products, through the use of the product, to the disposal of the product, the system attempts to be completely closed - that is, not producing any waste products. All materials used in production must fall into one of two categories: naturally occurring elements that can be safely returned to the environment and metabolized by organisms, and materials and chemicals that can be used indefinitely in a closed-loop manufacturing system. Certain plastics and metals can be recycled without degradation and so would be allowable, while others can only be down-cycled and eventually end up in landfills, so these are not acceptable.

The Role of Technology in Product Development

Advances in digital technology have helped to expedite the product development process. Software and digital technology can assist in every step of the process, from brainstorming software to help with idea generation to product life-cycle management software. Two areas where technology is useful for wood product manufacturers are: software to assist the design process (including software that links drawings to manufacturing) and software that helps manage the product development process.

Computer Aided Design software or CAD, automates the design process. Over time CAD software has become easier to use and more affordable for small- and medium-sized manufacturers.

There are two main categories of CAD - 2D CAD and 3D CAD systems. **Two-dimensional CAD** systems are akin to electronic drawing boards, providing different views of the product in various 2D planes. Using 2D CAD is generally faster than manual drawing, and it's easier to use than 3D CAD. It's suitable for products with very simple geometries.

In comparison, **3D CAD** depicts designs in three dimensions, providing a virtual prototype. 3D CAD software is based on one of three modeling methods: wireframe, surface modeling or solid modeling. The simplest of the three, **wireframe** modeling, shows the part shape using interconnected line elements that convey information about edges, corners and surface discontinuities. **Surface modeling**, depicts the outside part geometry and in so doing, clears up some of the ambiguities of wireframe models. And finally, **solid modeling**, which is the most sophisticated form of 3D modeling, defines both the exterior surface and the interior volume and mass of an object.

One of the inherent problems with CAD systems is data exchange across software variations. There are a plethora of CAD software packages available, some are free to download, some cost thousands of dollars. Some are directed at the engineering community, some at the architectural community and still others are intended for specific industries such as the cabinet industry. Working with a common platform solves some of the problems in transferring files, although even different versions of the same software can be problematic. Data exchange through neutral file formats has been developed so that files can be converted to a basic computer code that can be read by many software programs. A few common data exchange formats include IGES, DXF, STEP and DES.

When using CAD software it is important to adopt clear file management systems for **drawing version control** - that is, to ensure that the correct version of the drawing is used throughout production. With digital files that have been emailed back and forth it is difficult to keep track of which version is the latest. Using FTP servers is one way to manage and control communication of a design by keeping a central file. This file should be accessed and updated by a single source.

3D modeling software is not only a tool to help the designer/engineer develop a product but it also provides a digital document that can be used to communicate with the production department and others. In addition to modeling, many programs also offer advanced rendering capabilities to help present an almost photo-realistic image. This feature is helpful for presenting the final design for sales and marketing purposes. If the product model changes, the rendering can be updated in minutes. It can also reduce the need for extra physical models, since variations in finish etc. can be represented in a digital format. Some software is capable of generating animations that can be used to

simulate products with moving parts.

Increasingly, manufacturers are able to download pre-drawn supplier components (such as hardware) and import them directly into their own CAD drawings. At the same time it is becoming common practice for manufacturers of building products and furnishings to supply their customers (builders, interior designers and architects) with CAD drawings so they are able to import a particular product into their project plans.

CAD systems can greatly reduce product development costs, but when integrated with **CAM (Computer Aided Manufacturing)** software they become even more powerful. Whereas CAD defines design features and creates something digital (the product's computer image), CAM identifies manufacturing features and creates something physical (the actual product). CAM systems use CAD-generated data to create the code needed to operate CNC machines. CAM software facilitates the programming of machine tools. It lets users define geometry and set machining strategies, create and confirm toolpaths, and share programming data with other shop-floor machines.

There are several fully-integrated CAD/CAM systems. These CAD/CAM packages deliver many advantages: a common user interface that allows CAD operators to quickly learn the software; ease of transferring CAD data to the CAM system without worrying about translation errors or other difficulties; some integrated systems provide *full associativity*, which means that any modification to the CAD model will prompt the associated toolpath to be automatically updated; and, some systems can also manage such tasks as parts ordering, costing, scheduling and tool replacement. The drawback is that they tend to be very expensive.

Rapid prototyping is another tool that can assist in the product development process. Rapid prototyping takes 3D designs from CAD and transforms them quickly into a physical prototype. There are a variety of technologies used but stereolithography is the most common. Think of a 3D printer that prints in resin. This process would be useful for the design of drawer or door handles since several models could be made to compare for ergonomics and feel.

Not only does digital technology like CAD/CAM software create process and manufacturing efficiencies but, coupled with CNC machining, it also allows for the design and production of buildings and products that would otherwise be very difficult or even impossible to realize. This technology's influence on product design and development can be readily seen in today's wood products. Features like complex curves, intricate cut-outs and carvings, and products that involve high complexity or precision are becoming more available.

Software is also useful for managing the product development process. It is important to store and maintain all specifications associated with a given product throughout and after its development. This way all team members have access to it during development and this data will prevent the team from having to re-invent the wheel with each new product development cycle. **Data management software** is important to

keep track of items such as:

- Re-usable design elements
- Material use guidelines including properties, specifications, costs and availability
- Lists of parts e.g., standard fasteners
- Process information such as use guidelines, capability and yield
- Supplier information including product information, capabilities, lead times and costs
- Patents and other intellectual property
- Industry standards
- Lessons learned from previous product launches.

Project management software is very useful to keep a team project on track. It can be as simple as a Gantt chart or as sophisticated as a dedicated new product development software application. There are integrated packages available that cover all phases of the product development process, that can capture suggestions and ideas for new products and provide a repository for information related to the product idea. They can be used to screen and evaluate product ideas. This software can also coordinate dates for product reviews and ensure that appropriate information (such as marketing plans) is considered at the appropriate stage. Bills of material, integrated supplier planning, target costing and even design for manufacturability checklists are included in the more sophisticated packages. However, for most small- to medium-sized wood manufacturers, standard software packages like MicrosoftProject will suffice.

Video conferencing software can be very useful for facilitating teamwork when team members are not always in the same location. This can be as simple as using free software such as Skype or Microsoft Live Meeting. Being able to see gestures or drawings is particularly useful when developing products.

It is very important when implementing technology tools to match the degree of maturity of the product development processes to the tools installed.

Take Home Points

- Designing products that are sustainable is a complex challenge but one worth embarking on since it is surely the way of the future.
- Technologies such as CAD and CAM software are making the process of developing products faster and easier.
- CNC technologies are radically expanding the possibilities of wood products.
- Project management software is very useful for keeping track of the many facets of development.

CONCLUSION

The need for product innovation is becoming crucial to the survival and prosperity of today's wood product manufacturers. The market for specialized products will continue

to grow as the needs and wants of customers diversify. So even though it is a significant task, manufacturers would be well advised to characterize and improve their product development systems. Implementing a product development process that considers the myriad of issues raised in this booklet will help to create high value products on a consistent basis. It will also help keep development costs and risk at a minimum.

As with any type of improvement program, commitment from management is key to success. It will also be important to involve the people who will be doing the development in structuring the process to facilitate buy-in. Every business and industry sector is unique so tailor the process to suit the company's particular needs.

RESOURCES

“The PDMA Handbook of New Product Development”, Second Edition, Milton D. Rosenau, 2005.

A compilation of articles on various aspects of product development put together by the Product Development Management Association (www.pdma.org)

“Winning at New Products: Accelerating the Process From Idea to Launch”, Third Edition, Robert G. Cooper, 2001.

The author developed the Stage-Gate™ process and is a Professor at Mc Master University. A detailed look at the product development process from idea to launch.

“New Product Development for Dummies”, Robin Karol and Beebe Nelson, 2007.

In true ‘For Dummy’ fashion, a book that explains product development in relatively simple terms.

“Superior Product Development: Managing the Process for Innovative Products”, Clement C. Wilson, Michael E. Kennedy and Carmen J. Trammell, 1996.

Offers a different model for product development.

“The Seeds of Innovation: Cultivating the Synergy that Fosters New Ideas”, Elaine Dundon, 2002.

This book outlines a system for innovating which involves creative thinking, strategic thinking and transformational thinking.

“The Art of Innovation”. Tom Kelley, 2004.

The Art of Innovation tells stories of how IDEO, one of the best product development consultancies in the world, comes up with innovative products like; the Palm Pilot, the in-car beverage holder and things we nearly take for granted like Ivory soap.

The Product Development Process

