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Abstract: This research lists the literature and abstracts on product development

ANNOTATED BIBLIOGRAPHY OF ARTICLES ON PRODUCT DEVELOPMENT

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EMP-9125

'ANNOTATED BIBLIOGRAPHY OF ARTICLES ON PRODUCT DEVELOPMENT'

MURAT A. INCEOGLU
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1. CONCURRENT ENGINEERING

ANONYMOUS, *'THE CHANGING FACE OF PART DESIGN'*, MACHINE DESIGN NOVEMBER 1989 PP:4-16

A fundamental shift is under way in design engineering. No longer is engineering just one step in a long series of discrete steps. Instead, design now is done in parallel with other manufacturing processes. In an effort to reduce long lead times, simultaneous engineering is bringing teams of manufacturing and design personnel to work on their respective tasks at the same time. On the technology side, the tremendous increase in the number of new materials has made computers indispensible in retrieving and analyzing information. Computers also enable statistical experimental design, which improves quality and saves costs by providing the data needed to design more reliable products and manufacturing processes. In addition, experts see the use of robust solids as opening the door to different algorithms for the production of machine tool paths. Many vendors are introducing software that moves manufacturing information up into design, and rule-based systems that capture manufacturing knowledge early in design soon may be standard in design and manufacturing software.

ANONYMOUS, *'CONCURRENT ENGINEERING AT THE PROTOTYPE PHASE'*, PRINTED CIRCUIT DESIGN, MAY 1991 PP: 36-38

R&D Circuits, a prototype printed circuit board (PCB) shop, has been using concurrent engineering for several years. R&D president Vincent Russell recognized in the mid 1980s that, to be competitive, the company needed complete control and integration of all prototype PCB production. Once a client's computer-aided design and manufacture design data are received, they are logged into a panelizer software system. All design dataare reviewed for errors or inconsistencies. A C. A. Picard multilayer registration system automates the various registration processes of PCB production. Advanced technology has replaced hand and eye alignment, improving quality and substantially reducing the potential for human error. Each board R&D produces undergoes stringent automated optical inspection, electrical testing, chemical analysis, and cross-sectioning. Among R&D's in-house test and inspection hardware are: 1. KLA automatic visual inspection station and verifier, 2. Probot Series Six bare-board tester, and Glenbrook X-ray inspection station. Russell attributes R&D's effectiveness to the use of concurrent engineering.

ANONYMOUS, *'CONCURRENT ENGINEERING, GLOBAL COMPETITIVENESS, AND STAYING ALIVE: AN INDUSTRIAL MANAGEMENT ROUNDTABLE (PART 1)'*, INDUSTRIAL MANAGEMENT JULY/AUGUST 1990 PP:6-10

In a roundtable discussion, industrial management executives discussed the concept of simultaneous engineering and initiatives that are being undertaken to guarantee competitiveness. Common initiatives that are strategically important for all the companies include: 1. dissolving functional structures or ignoring traditional organizational structures and focusing on cross-functional teams, 2. promoting employee involvement hroughout the organization, 3. realizing that a better environment is needed to allow change to occur, and 4. beating competitors to the marketplace as the key to survivability. Iva M. Wilson of Philips Display Components Co. would add the human element to concurrent or simultaneous engineering. Hal Edmondson of Hewlett-Packard feels that coupling product development and manufacturing and calling it product generation leads to large advances.

BEERCHECK, RICHARD C., *'MANUFACTURING TECHNOLOGY: MEETING THE GLOBAL CHALLENGE'*, MACHINE DESIGN AUGUST 23 1990 PP:64-69

The International Manufacturing Technology Conference's IMTS 90 trade show will exhibit a new generation of modular machines designed to boost productivity and quality. The push to get products to market faster has heightened the interest in the concept of concurrent or simultaneous engineering. The major benefit - dramatically shortened production cycles - would not be possible without an efficient means of transferring design data to the shop floor. To facilitate this transfer, software suppliers have devised closer interfaces between computer-aided design and computer-aided manufacturing, making the transfer of geometric data faster and easier. Today's machining centers have evolved into the most versatile and flexible of all metal-cutting machines. Individual modules can be integrated with similar machines into metal-cutting cells capable of performing nearly all the machining required on families of parts. The power of modern computer numerical controls is behind a trend toward combining operations on a single machine.

BECKERT, BEVERLY A., *'SDRC'S NEW CONCURRENT ENGINEERING TOOLS'*, CAE APRIL 1991 PP:22

Optimizing product concepts and manufacturing processes early in the design cycle is what concurrent engineering is all about, but to carry out concurrent engineering, it is necessary to have the right software: tools that are easy to use, cover a range of applications, and provide multilevel engineering data management. Structural Dynamics Research Corp. (SDRC) claims that the enhanced version of its I-DEAS software provides these capabilities and more. According to its developers, the new release builds upon previous functionality by: 1. extending variational geometry capabilities, 2. adding new modules, 3. improving the user interface, and 4. managing data at the design team and enterprise levels. SDRC's updated software now offers variational design for creating equations to define relationships between key product dimensions, establishing mating surfaces between parts in assemblies, and controlling the shape of sculptured surfaces. SDRC offers 2 modules: I-DEAS Data Manager and the Data Management and Control System.

BOGARD, TIM; HAWISCZACK, BOB; MONRO, TOM, *'CONCURRENT ENGINEERING ENVIRONMENTS'*, PRINTED CIRCUIT DESIGN, JUNE 1991, PP:30-37

Design engineering is now the critical factor in influencing product cost and quality as well as improving product development cycle time. As a result, designers are adopting tools and techniques that enhance their ability to evaluate cost and development criteria, such as manufacturability. While design for manufacturability (DFM) tools have proven their usefulness in several applications, an across-the-board implementation still evades designers. An understanding of the critical fit between the design system and design tools, particularly DFM tools, may provide the key to widespread fanout of DFM techniques. The effective implementation of DFM tools has been made possible by the development of integrated design processes. The key components of a generic model for an automated design process include: 1. standard design procedures, 2. specific design methodologies, and 3. integrated computer-aided engineering tools.

BURNETT, ROBERT W. , *' SUCCESS STORIES IN INSTRUMENTATION, COMMUNICATIONS-CASE HISTORY 2: CISCO SYSTEMS'*, IEEE SPECTRUM JULY 1991 PP: 33-34

Much of the dramatic growth that Cisco Systems Inc. has undergone is attributable to concurrent engineering (CE). Revenues for the maker of multimedia and multiprotocol internet working products - routers, bridges, terminal servers, and network managers for wide-area networks - jumped from $27 million in 1989, when CE was first adopted, to $70 million in 1990. Cisco had sales of more than $76 million in the first half of 1991. The genesis of CE at Cisco came in weekly review meetings that were set up in 1989 for engineering, manufacturing, and sales. Those meetings helped cut the cost of a multiport communications interface card providing up to 2 Ethernet connections and 2 serial connections. Cisco still has its weekly review meetings, but every new product is now guided by a team whose members come from many groups: hardware and software engineering, manufacturing, customer engineering, marketing, and business development.

BRAZIER, DAVID; LEONARD, MIKE, *'CONCURRENT ENGINEERING: PARTICIPATING IN BETTER DESIGNS'* MECHANICAL ENGINEERING JANUARY 1990 PP: 52-53

The concept of concurrent engineering techniques is beginning to dominate leading edge discussions of competitiveness in manufacturing. With the use of concurrent engineering methods, a number of manufacturers are speeding the product design cycle and are cutting costs at the same time. While computer-integrated manufacturing has helped bridge the gap between design and manufacturing, it has not tightened all the checks and balances within the product design cycle itself. Concurrent engineering, the simultaneous design of a product, and the process required to produce it involves participants from downstream functions, such as manufacturing, third-party suppliers, quality control, and customer support in the design engineering stage. The first step in the implementation of a concurrent engineering strategy is internal review. By implementing a common modeling technique that incorporates all design intelligence, such as features-based solids modeling, it becomes possible for all disciplines to work concurrently on any given model from a single database.

'CONCURRENT ENGINEERING, COMPETITIVE PRODUCT DEVELOPMENT' **IEEE SPECTRUM, JULY 1991**

In concurrent engineering the key ingredient is team work. People from different departments collabrate over the life of a product, to ensure it reflects the customer needs and desires, marketing, engineering and manufacturing works together to anticipate the problems and to eliminate them early on. QFD, Quality Loss Function, Signal to Noise Ratio, S.P.C., Fishbone Diagram, Continous Process Improvement, JIT delivery, TQM, are also discussed in this article.

CREESE, ROBERT C.; MOORE, L. TED, *'COST MODELING FOR CONCURRENT ENGINEERING'* COST ENGINEERING JUNE 1990 PP:23-27

Concurrent engineering is a philosophy for improving quality, reducing costs, and reducing the lead time from product conception to product development for new products and product modifications. It emphasizes management as well as engineering skills and requires multidirectional information flow. A major difficulty in the implementation of concurrent engineering is the failure of management to recognize that it must be implemented at the top levels first. The philosophy will be implemented differently for different companies because of the variations in leadership styles, products, processes, employee abilities, customer requirements, and supplier capabilities. Concurrent engineering has had a dramatic effect on the critical elements of the concurrent engineering process; it is essential that unnecessary costs be reduced significantly for products to be competitive in the international market.

DUFFY, JAMES; KELLY, JOHN, *'UNITED FRONT IS FASTER'*, MANAGEMENT TODAY(UK) NOVEMBER 1989 PP:131-139

Companies are finding that nothing succeeds like speed when they try to achieve a competitive advantage. Being first to market with a product or service generally ensures that a company obtains a 50% market share. Companies can gain speed simply by compressing the cycle, from concept to delivery, that they use to produce a product or service. Several UK manufacturers are using simultaneous engineering to improve their competitive positions in the area of product development. Simultaneous engineering can: 1. reduce the time lag between product development, marketing, and sales, 2. minimize development and product costs, 3. increase product quality, and 4. increase market share. In simultaneous engineering, all the disciplines involved in product design work together from the onset to bring a unique, quality product from concept to market in less time and at a competitive cost. This sometimes requires sacrificing short-term profits to gain longer term competitive advantage, however.

GARRET, RONALD W., *'EIGHT STEPS TO SIMULTANEOUS ENGINEERING'* MANUFACTURING ENGINEERING, NOVEMBER 1990 PP:41-47

Simultaneous engineering (SE) involves simultaneously designing a product and defining the best way to make it. Justification for an SE program comes from reducing direct labor costs, cycle time, inventory, scrap and rework, warranty, and engineering changes. To ensure success, companies need to: 1. provide a formal mechanism for manufacturing to work with marketing and design from the beginning, 2. design an employee participation program, which can boost morale and interpersonal communication throughout the company and thus create the environment necessary for SE to work, 3. involve both shop and office workers in the cost reduction program, 4. arrange workers properly, 5. recruit engineering generalists who are able to influence others and tolerate significant changes in their job responsibility, 6. train key employees in recognizing and solving problems and in improving interpersonal skills, 7. exploit computer-aided design (CAD), and 8. apply analytical tools.

GREENE, ALICE, H., *'CONCURRENT ENGINEERING: IMPROVING TIME TO MARKET'* PRODUCTION AND INVENTORY MANAGEMENT REVIEW AND APICS NEWS JULY 1990 PP: 22,25

There has been a strong movement toward breaking down barriers within manufacturing organizations and between suppliers and customers. One part of the movement is concurrent engineering, an approach that involves manufacturing operations and other departmental functions through the enterprise in the design of a product. The formula for concurrent or simultaneous engineering is the early involvement and simultaneous ownership of the product design and process by all functions of the enterprise, including marketing, design engineering, manufacturing or process engineering, manufacturing planning, production, customer service, logistics, and suppliers. Data sharing between multiple organizations, departments, and heterogeneous systems is a major factor in supporting concurrent engineering NCR is among the leading manufacturers that are addressing concurrent engineering. The firm is using some of the concurrent engineering concepts and working with solid models to address manufacturability of board design and to communicate with its suppliers.

GRETTENBERGER, JOHN, *'A QUALTY LIFE',* EXECUTIVE EXCELLENCE MARCH 1991 PP: 3-4

In 1990, Cadillac Motor Car became the first automobile maker to be named a Malcolm Baldrige National Quality Award winner. The award for dedication to quality products, processes, and customer satisfaction is fast becoming the most coveted prize in US business. It represents the most intensive and extensive internal assessment of approach to quality. The intensive self-examination required for participation and the feedback from the examiners make all participants better companies from a product standpoint, a customer satisfaction standpoint, and an employee involvement and planning standpoint. In 1985, Cadillac crafted a new way of doing business, determining that teamwork is critical to success. A simultaneous engineering process was begun, combining all disciplines in the product development process. This approach has increased teamwork by more than 600% and cut about a year off the time to develop a new car. While the cultural focus at Cadillac has been shifting, the products have been improving.

KREBS, MICHELLE, *'CADILLAC STARTS DOWN A NEW ROAD'*, <u>INDUSTRY WEEK</u> AUGUST 5, 1991 PP:18-23

In 1990, Roy S. Roberts became general manufacturing manager for General Motors Corp.'s (GM) Cadillac Motor Car Co. Much of the burden for manufacturing 2 of the most critical automobiles in Cadillac's recent history rests upon his shoulders. In the fall of 1991, Cadillac will introduce the 1992 Eldorado and Seville, which represent Cadillac's first attempt to compete with Japan's new luxury models. These cars mark the first start-to-finish products that employ all of the new systems, processes, and philosophies the GM division has instituted. A prototype of the Seville that traveled the 1991 automobile-show circuit won rave reviews for styling, and in early test drives, automotive magazines have praised the Seville's performance and handling. While Cadillac traditionally has scored high in customer-satisfaction surveys, it has been on the strength of service at the dealership. Cadillac used such new processes as simultaneous engineering in the development of the 2 cars. By 1995, Cadillac wants sales of 300,000 annually, or 3% of the US car market.

KOELSCH, JAMES R., *'SIMULTANEOUS ENGINEERING: MANUFACTURING'S SAVIOR?'*, <u>MANUFACTURING ENGINEERING</u> JUNE 1991 PP: 60-62

Today, shipping equipment on time is not enough. To cut overhead, US companies are pruning their in-house production and manufacturing engineering staffs and relying on builders to install the machinery and perhaps even maintain it. Frank J. Riley of Bodine Corp. is leading the Society of Manufacturing Engineers' Joint Industry Conference on SE Procurement Practices. His goal is to develop a model protocol for establishing contracts so simultaneous engineering (SE) can work in the US business culture. Stereolithography, a process from 3-D Systems Inc. for producing physical models directly from computer-aided design (CAD) data, has become a key enabling technology for SE in only a few years. It creates prototypes by curing a liquid plastic in 3 dimensions with a programmable laser. The US Air Force is tackling an ambitious project - automating SE in small shops.

KUO, WAY; HSU, J.P.,*'UPDATE: SIMULTANEOUS ENGINEERING DESIGN IN JAPAN'*, <u>INDUSTRIAL ENGINEERING</u> OCTOBER 1990 PP: 23-26

Concurrent engineering, or simultaneous design, is being recognized as the most effective and efficient approach to engineering design. Japan's Ministry of International Trade and Industry (MITI) is helping fund a 10-year project estimated to cost $1 billion. MITI is hoping that the US and Europe will pledge 40% of the research and development cost toward the establishment of a Joint

International Intelligent Manufacturing System Research Program. The remaining 60% will be borne by the Japanese government and its industries. Through the MITI initiatives, Japan hopes that modern concurrent engineering technology will be shared by others outside Japan for the improvement of human life. Four key areas the Japanese are addressing in regard to concurrent engineering are: 1. intelligent manufacturing systems, 2. intelligent computer-aided design, 3. the human/machine interface, and 4. maintenance.

KOCHAN, ANNA, *'SIMULTANEOUS ENGINEERING PUTS THE TEAM TO WORK'*, MULTINATIONAL BUSINESS (UK) SPRING 1991 PP;36-38

Responding to consumers' demands for more and better products, the manufacturing industry worldwide is in the process of revitalizing the way it manages new product development to ensure that the right product gets to the market quicker, at the right time, and at the right price. To achieve this, companies are adopting an approach variously known as simultaneous engineering, parallel engineering, or even concurrent engineering. Firms like Digital Equipment, General Motors, and Rolls Royce are already reporting that new product costs and the time taken to bring them to market have both been halved. Simultaneous engineering is a means of reducing product development time because it compresses the conventionally sequential development process so that many of the development stages take place simultaneously. Central to the methodology is a multidisciplinary team inwhich all those different specialists who work on the same product development project tackle it simultaneously, at all times having access tothe same information.

LARSON, ERIC, *'DESIGNINING BETTER THERMOPLASTIC PARTS'*, MACHINE DESIGN FEBRUARY 7, 1991 PP: 83-86

The concept of concurrent engineering - considering the manufacturing process in design - is gaining in popularity among many industries. To take advantage of the opportunities this concept presents, designs for injection-molded parts must take into account some basic factors that affect both function and manufacturing. To many designers, wall thickness is the primary design element of molded parts; it affects both how the parts operate and how they are made. In addition to being as thin as possible, thermoplastic part thickness must also be as uniform as possible. Redesigning the part for more uniform thickness will minimize sink marks and warpage, which often appear with differential, or multidirectional, shrinkage. Ways to increase rigidity and strength of a molded part without adding thickness include using corrugated surfaces and lipped edges and adding ribs.

MEADE, E. KIDDER, *'SIMULTANEOUS ENGINEERING IN ACTION'*, PRODUCTION OCTOBER 1989 PP:68-70

Lamb Technicon participated in simultaneous engineering projects long before the term became popular. Its experience includes over 30 major programs, primarily involving such large automotive power train components as cylinder blocks, cylinder heads, and transmission cases. A case study involved the development of an automobile engine cylinder head. The only initial design constraints were engine size, approximate envelope shape, and the usual functional requirements dictated by such factors as the type of engine and the fuel system. There are 2 fundamental principles behind the success of the simultaneous engineering procedure: 1. the uniting of the efforts of the product design engineers and the manufacturing engineers so that these 2 groups work as partners from the concept stage of product development, and 2. the preselection of suppliers so that their expertise can be brought to bear on program goals.

MCKNIGHT, SELDON W.; JACKSON, JERRY M.,*'SIMULTANEOUS ENGINEERING SAVES MANUFACTURERS LEAD TIME, COSTS AND FRUSTRATION'*, INDUSTRIAL ENGINEERING AUGUST 1989 PP:25-27

Simultaneous engineering is the concurrent development of project design functions, with open and interactive communication among all team members for the purpose of reducing lead time from concept to production launch. A leading example of simultaneous engineering is in the automotive industry, where it brings product, process, and facility personnel into the project at the outset of the design phase. Also included on the project team are equipment and part suppliers and representatives from marketing, sales, and distribution. Simultaneous engineering saves time from project concept to launch because all disciplines required are members of the same team agreeing on the design through each step of the progression. Industrial engineers, because of their orientation toward efficiency, will be well-suited for process engineering, particularly with the current emphasis on design-for-assembly.

MURRAY, J. CHARLES, *'ENGINEERS AND RESEARCHERS: TEAMWORK'* DESIGN NEWS , MARCH 7,1989 P: 66-69

This article presents how communication and simultanous engineering concepts implemented in Deere management in order to bring 9000 series to market more quickly.

PORTER, ANNE MILLEN, *'JIT II IS HERE'*, PURCHASING SEPTEMBER 12,1991 PP:60-67

Lance E. Dixon, director of purchasing and logistics for Bose Corp.(Framingham, Massachusetts), is the creator of JIT II, the ultimate in just-in-time (JIT) supplier partnering and concurrent engineering. In practice, the supplier representative sits in Bose's purchasing office, replacing the buyer and the salesperson. Bose empowers the representative to use its purchasing orders to place orders on himself. The representative can also practice concurrent engineering, attending any and all design engineering meetings involving his company product area, with full access to Bose's facilities, personnel, and data. Dixon had the foresight to realize that, for different kinds of transactions, Bose needs people with various skills. Candidates are rigorously interviewed by Bose staff. For Bose, JIT II means fewer purchasing personnel, more favorable pricing, and reduced inventory. For suppliers, it means elimination of the sales effort, increased volume, evergreen contracts, and efficient invoicing and payment administration.

REDDY, RAMANA; WOOD, RALPH T.; CLEETUS, K. JOSEPH, '*THE DARPA INITIATIVE: ENCOURAGING NEW INDUSTRIAL PRACTICES*', IEEE SPECTRUM JULY 1991 PP: 26-30

The Darpa Initiative in Concurrent Engineering (DICE) was established to encourage the practice of concurrent engineering in the US military and industrial base. The development, integration, and dissemination of technologies are part of DICE's mission. The Defense Advanced Research Projects Agency (Darpa) launched DICE in 1988 as a 5-year program. DICE is Conducted for Darpa by a consortium of more than a dozen industries, software companies, and universities. The consortium's overall goal is to develop an architecture for concurrent engineering in which the people working on a project can instantly communicate with each other and access, share, and store up-to-date information in a transparent way. The concurrent engineering services are being developed in conjunction with several pilot projects. West Virginia University's Concurrent Engineering Research Center operates a concurrent engineering testbed that is one of the principal vehicles for accomplishing DICE's mission.

ROSENBLATT, ALFRED, '*SUCCESS STORIES IN INSTRUMENTATION, COMMUNICATIONS-CASE HISTORY 4: ITEK OPTICAL SYSTEMS*', IEEE SPECTRUM JULY 1991 PP:36-37

Even companies that make one-of-a-kind items, such as ITEK Optical Systems, a maker of high-technology optical and electro-optical products, find value in concurrent engineering (CE). As part of a move Litton Systems Inc. made in its divisions about 3 years ago to create an atmosphere of change and to improve operations, ITEK, a division of Litton, adopted total quality management and CE. ITEK decided to try CE by focusing on the teamwork aspects of design by involving many disciplines in the early stages of the design process. Fausto E. Molinet, assistant director for total quality management at ITEK, says that a major team effort focused on the design-and-build documentation handed off to manufacturing. Once ITEK realized what the teams considering general business problems were accomplishing, it increased the number of those teams from 4 to 23. Molinet recommends that teams include at least 5 people.

ROSENBLATT, ALFRED, '*SUCCESS STORIES IN INSTRUMENTATION, COMMUNICATIONS- CASE HISTORY 3: RAYTHEON*', IEEE SPECTRUM JULY 1991 PP:34-36

Raytheon Inc. began to adopt concurrent engineering (CE) in the mid-1980s in its Government Group, producer of such systems as the Patriot air defense missile system. Raytheon's far-reaching CE environment now serves about 400 workstations at its Lexington, Massachusetts headquarters, and throughout New England. The firm's emerging CE environment is divided into 3 parts: 1.

system-level design, 2. module-level design, and 3. system management-level design. At the system level, a collection of programs being put under a common user interface performs analyses. For the module-level design, an integrated set of printed-circuit board design and analysis tools, under a common framework called RAPIDS (Raytheon automated placement and interconnect design system), is used. The System Management Environment, which is currently at the concept specification stage, monitors chedules and design goal budgets set by the concept environment.

SHINA, SAMMY G., *'NEW RULES FOR WORLD-CLASS COMPANIES'*, IEEE SPECTRUM, JULY 1991 PP: 23-26

Many companies in Japan, the US, and elsewhere compete successfully around the world because they have adopted a panoply of techniques for developing and manufacturing high-quality products that come under the heading of concurrent engineering (CE). CE can shorten the overall product-development process since the steps along the way are handled in parallel instead of in series, as is usual. In CE environments, new products are no longer the sole domain of the research and development department. From the start of CE, product development must involve all parts of an organization. As a result, effective teamwork depends on sharing ideas and goals beyond immediate assignments and departmental loyalties. The results of CE efforts can be gauged by comparing results gained with the new development process to those experienced with older products. The CE effort should combine computer-aided engineering and design and computer-integrated manufacturing with design for manufacturing.

ST. CHARLES, DAVID, *'DON'T TOSS IT OVER-BREAK DOWN THE WALLS'*, AUTOMATION, JUNE 1990 PP:68-69

Continuous improvement, a key precept of Japanese manufacturing, is slowly being adopted by some US firms. Some manufacturers have moved even further to embrace the emerging concept of concurrent or simultaneous engineering. Concurrent engineering is an overlapping process that involves marketing and sales, as well as manufacturing and quality engineers, in the design-engineering stage. The goals of concurrent engineering include: 1. to provide more effective product designs to meet customer needs and quality expectations, 2. to design products and the manufacturing process simultaneously, 3. to improve time to market, and 4. to simultaneously link producible designs to high-productivity processes. The building process of concurrent engineering results in a closed-loop cycle of ever-improving cost, quality, and timeliness.

STINSON, TERRY, *'TEAMWORK IN REAL ENGINEERING'*, MACHINE DESIGN MARCH 22 1990, PP:99-104

By applying the precepts of simultaneous engineering, the General Motors (GM) Chevrolet-Pontiac-Canada Group (CPC) recently produced a new sports car engine - the LT-5 - in 4 years rather than the usual 7 years. Goal-setting was of key importance in getting engineering squads from CPC, Lotus

Engineering, and Mercury Marine Division to work as a single team. CPC set the design criteria, Lotus was contracted to do the design work, and Mercury was contracted to manufacture the engine. Team members agreed that they would produce an engine with better perceived quality than the engines found in automobiles considered the most reliable by consumers. The LT-5 engine had to meet performance goals while also passing federal fuel-economy and emissions standards. As part of a team using simultaneous engineering, Mercury influenced designers to use existing equipment; the implementation of simultaneous engineering resulted in a simpler organizational structure. Trust and an aggressive time schedule were factors in the success of the LT-5 project.

TERESKO, JOHN, *'ENGINEERING: WHERE COMPETITIVE SUCCESS BEGINS'*, INDUSTRY WEEK NOVEMBER 19, 1990 PP:30-38

The steps to world-class manufacturing in the engineering context begin with an understanding of the benefits of designing the product and the process together and the need for quickly getting product concepts to market. The emphasis is not on technological solutions, but on how people integrate solutions. At General Motors' Saturn Corp. subsidiary, the conventional practice of dividing product development into separate tasks to be done sequentially is not followed. Instead, the organization uses simultaneous engineering so that projects are shaped by teams. Represented on these teams are finance, marketing, product design, manufacturing engineering, materials engineering, service, and suppliers. By getting everyone together at the engineering-concept stage, when 70% of a project's costs are committed, problems are solved before any implementation begins. At Hewlett-Packard Co.'s Singapore facility, the goal for world-class engineering is to destroy he barriers separating design engineers, production engineers, and manufacturing engineers. Functional goals are sacrificed for shared objectives.

TURINO, JON, *'MAKING IT WORK CALLS FOR INPUT FROM EVERYONE'*, JULY 1991 PP: 30-32

Organizations implementing concurrent engineering (CE) stand to reap rich rewards because the better designed, higher quality products brought to market in a shorter time by using CE mean higher profits. In addition, trouble-free product introductions often win market share away from competitors. Starting and sustaining CE takes dedication, discipline, and a sweeping cultural change. In the CE organization, expertise from all functions is integrated with the product design phase. Since it is difficult to get CE under way when the members of the product development team are not all in the same place and thus are unable to communicate fully, the members of the team should be located near each other. Getting closer to both customers and suppliers is another part of staying more competitive in the 1990s. This means having the marketing and sales people, as well as the product design team, closer to the customers.

WHEELER, ROY, *'SUCCESS STORIES IN INSTRUMENTATION, COMMUNICATIONS-CASE HISTORY 1: HEWLETT-PACKARD'*, IEEE SPECTRUM JULY 1991 PP:32-33

The experiences of Hewlett-Packard Co.'s (HP) Colorado Springs Division in getting started in concurrent engineering (CE) in 1980 illustrate that all an engineer needs to get started in CE is a pencil, paper, some intelligence, and a willingness to work with peers in other functional areas. If the budget permits, computer-aided tools may be added along the way. HP's CE development process evolved naturally out of the need for increased cooperation between the various functional areas of the business as HP focused on improving manufacturability and reliability. From idea to finished product, it took HP about 1/3 the time to complete the development of its 54600 oscilloscope than it would have without CE. In applying CE to small projects, it is often difficult to ensure that part-time team members are productive on other projects when the team does not require their services and that they are immediately available when their services are needed.

WOODRUFF, DAVID IN DETROIT; PHILIPS, STEPHEN IN CLEVELAND, *'A SMARTER WAY TO MANUFACTURE'* , BUSINESS WEEK, APRIL 30 , 1990 PP:110-117.

This article gives concurrent engineering examples from NCR, Westing House's electronic systems group. In Atlanta, NCR the specialists involved in design, software, hardware, purchasing, manufacturing, and field support all work side by side and compare notes -the overriding factor is getting products out on time. At Westinghouse's Electronic Systems Group, both design and manufacturing have been put under one manager, cross-functional teams are working together more smoothly and mediating their own disputes in a fraction of time , tems communicate electronically and make decisions themselves, this eliminates organizational approval process.

VASILASH, GARY S.; BERGSTROM, ROBIN P., *'CONCURRENT ENGINEERING: YES, THIS MAY HAVE A FAMILIAR RING'*, PRODUCTION MAY 1991 PP: 64-67

A conference titled "Managing Concurrent Engineering: A Full Spectrum Approach" was cosponsored by The Center for Operations Management, Education & Research at the University of Southern California and by Digital Equipment Corp. (DEC) to help people meet the challenges of effectively managing all aspects of the concurrent engineering process. One speaker at the conference, DEC's David Thorpe, said that the simple working relationship between people was the single biggest difficulty related to establishing a concurrent engineering program. Design-based Incrementalism and New Product Development and Renewal is a notion that Susan Walsh Sanderson and Vic Uzumeri of Rensselaer Polytechnic Institute, brought to the concurren engineering conference. In explaining DFX (Design for Excellence), Bill Sprague of NCR Corp. reported that NCR has had respectable success in its design for manufacturing (DFM) efforts.

VASILASH, GARY S., *'SIMULTANEOUS ENGINEERING WITHOUT THINKING ABOUT IT'*, <u>PRODUCTION</u> AUGUST 1991 PP:58-59

The employees of Ford Motor Co.'s Rawsonville Plant in Ypsilanti, Michigan, may have found the right way to perform simultaneous engineering (SE). After determining that they wanted a new type of alternator, the 3G, they set about optimizing the product and process. Teamwork abounds throughout the entire program, even among hourly United Automobile Workers employees. According to P. R. Nicastri, manager of the Alternator Engineering Department in the Electrical and Fuel Handling Division, quality is the operators' responsibility. Each employee receives 2 months of training - half on the plant floor, half in a classroom. Partnering is done with equipment suppliers as well. Ergonomics has been considered wherever manual intervention is required in the plant. Work currently under way to improve the 3G alternator line includes the addition of new overhead conveyors.

ZIEMKE, M. CARL; SPANN, MARY S., *'WARNING: DON'T BE HALF-HEARTED IN YOUR EFFORTS TO EMPLOY CONCURRENT ENGINEERING'*, <u>INDUSTRIAL ENGINEERING</u> FEBRUARY 1991 PP:45-49

Concurrent engineering, a modern organizational buzzword in the US, is a process in which a major new product or significantly different new model of an existing product line is designed, developed, manufactured, and marketed. The serial approach to the process often taken in many large US firms has several major disadvantages, such as a lengthened product development cycle. The failings only become apparent in comparison with approaches taken by foreign manufacturers, many of which are able to design and launch highly competitive products in less time. They typically form design and manufacturing teams around senior gurus and work as a united, interdepartmental group on major projects. Concurrent engineering stands a far greater chance of success if it is used as a tool, rather than a crutch, and is applied wholeheartedly.

ZIEMKE, M. CARL; MCCOLLUM, JAMES K., *'SIMULTANEOUS ENGINEERING: INNOVATION OR RESURRECTION?'*, <u>BUSINESS FORUM</u> WINTER 1990 PP:14-17

In contrast to the incremental system that US automobile makers have been using in product development, a simultaneous engineering system has all key personnel needed for product development and production working together as a team. This results in a major reduction in product development time. The development of the current simultaneous engineering management concept is a response to the lack of the kind of leadership provided in the past by such "industrial gurus" as Henry Ford and Walter Chrysler. In addition to understanding all of the main aspects of product development and production, these men had the leadership qualities needed to inspire teamwork between departments. Unfortunately, in today's specialized management of technology, few managers are able to develop the broad expertise necessary to provide balanced, integrated management. Even if simultaneous engineering can match the short model change schedules of the Japanese automakers, new US car models will remain inferior until US manufacturers overcome their fear of technical risks

2.PROJECT MANAGEMENT

DR. GAUTSCHI, *'A PROJECT PLAN FOR PROJECT MANAGEMENT'*, DESIGN NEWS, DECEMBER 18, 1989, P: 124

LACKMAN, MICHAEL, *'CONTROLLING THE PROJECT DEVELOPMENT CYCLE , PART 2-PROFILE OF A SUCCESFUL PROJECT MANAGER'*, JOURNAL OF SYSTEMS MANAGEMENT, FEBRUARY 1987 P:13-15

Project management skills neccesary to manage all aspects of a project: team building, understanding and working with a client, scheduling and planning, developing a product, managing financial and capital resources ,project monitoring and control.

3.TIME TO MARKET

LACY, JACK, *'INDUSTRY OVERVIEW'*, IMC JOURNAL JULY/AUGUST 1991 PP:4-5

It is estimated that well over 90% of all the world's information is recorded on paper. Growth projections for the document imaging industry indicate that the percentage will change in the future. Micrographics is the predominant approach to managing documents today. Electronic imaging accounts for only about 28% of current systems. Electronic image management is emerging as a critical capability for a growing range of organizations. It has been welcomed as a remarkably promising tool for processing document information quickly and efficiently. The value of improved customer service is clear in an era when customer satisfaction is the benchmark for business success. The value of speeding the internal flow of technical documentation is clear in a time when time-to-market determines success or failure.

INGELSBY, TOM, *'TIME WAITS FOR NO MAN(UFACTURER)'*, MANUFACTURING SYSTEMS. SUPPLEMENT JUNE 1991 PP:4-20

In US manufacturing, the traditional way has been linear and sequential. This involves development of a product, often in response to a perceived need, then testing and refinement. However, the fickle public, because of the time lag from market research to market exposure, often changes its demands. Concurrent engineering and manufacturing help assure that the end product gets out quicker and at a higher level of quality. Because of the importance of time to market in the highly dynamic technology areas in which it competes, Hewlett-Packard Co. developed Break-Even Time, a project-related metric that considers all cash flows resulting from a project. Time-based competitiveness requires a continued focus on quality processes with the added dimension of time. High-level decision making slows down the process. Processes must be tied together across functional disciplines, and information technologies must be implemented to provide critical benefits.

RUTTER, NANCY, *'HOW FIVE COMPANIES ARE BEATING THE RECESSION'* ELECTRONIC BUSINESS MARCH 4 1991 PP:26-31

Five electronics companies are proving that a well-run company, with the right product at the right time, can beat the economic odds, whatever they may be. In its 3rd year of operation, Conner Peripherals Inc. had a net income of $41 million on sales of $709 million. In the disk drive industry, Conner has been to the market first with reliable, flexible, and innovative products. Meanwhile, Borland International Inc.'s database product, called Paradox, and its spreadsheet program, called Quattro Pro, are stealing customers away from well-established companies. The technical integrated circuit breakthroughs offered by Altera Corp. and Xilinx Inc. have enabled designers to think out a circuit, design it, plug it in, and test it, thereby compressing the time to market from weeks to minutes. Stratus Computer Inc., which pioneered the technology of fault-tolerant online computing, apparently has done it better than its competitors. Sales in calendar 1990 were $403.9 million, up 18% from the previous year.

'SPEEDING PRODUCTS TO MARKET: WAITING TIME TO FIRST PRODUCT INTRODUCTION IN NEW FIRMS' **ADMINISTRATIVE SCIENCE QUARTERLY, MARCH 1990 PP: 177-207**

This paper examines the influence of organizational conditions-innovation, structure, resources, and organizational members- and enviromental circumstances-competitors, investors- on the speed with which new organizations develop their first products for market.

STOVICEK, DONALD R., *'RAPID PROTOTYPING SLICES TIME-TO-MARKET'*, AUTOMATION, SEPTEMBER 1991 PP:20-24

Rapid prototyping is a technology that enables manufacturers to quickly model their designs, thereby reducing product development cycles by weeks or months. Desktop manufacturing, which automates the prototyping process and substantially reduces the time to market, is rapidly becoming viewed as a powerfully competitive edge in the global marketplace. While shortening the time to market is an obvious objective of rapid prototyping, another worthy side effect is the opportunity to produce better designs through iteration. Rapid prototyping offers companies 2 basic paths: 1. the ability to save a considerable amount of time and money when making one or 2 prototype variations, and 2. the opportunity to create numerous revisions in the quest for the ultimate design, while minimizing last-minute revisions and maintaining the same schedule and budget originally needed for conventional means.

VERITY, JOHN W.; MCWILLIAMS, GARY, *'IS IT TIME TO JUNK THE WAY YOU USE COMPUTERS?'*, BUSINESS WEEK (INDUSTRIAL/TECHNOLOGY EDITION) JULY 22,1991 PP:66,69

In the computer industry, increasing attention is being given to the concept of reengineering. The idea is simple: instead of using computers and information systems to automate the way a business has always run, managers first reengineer the process, then apply computing power to the new system. The resulting productivity gains are the best that customers have seen from their computer investments in years. According to James F. Moore, president of Geo-Partners Research Inc., reengineering means reducing costs by 80%, improving time to market by 80%, or doubling sales. He noted that those metrics are driving managers to look at things in new ways. Computer manufacturers and systems integrators hope those measures will spur new sales. IBM, Digital Equipment Corp., Unisys, Wang Laboratories, Electronic Data Systems, and Andersen Consulting all are seizing on reengineering as a new marketing approach. Still, reengineering may not deliver the sales boost computer makers seek. This is because, in some cases, reengineering requires no new computer systems at all.

VESEY, JOSEPH T., *'THE NEW COMPETITORS: THINKING IN TERMS OF "SPEED-TO-MARKET"'*, <u>MANUFACTURING SYSTEMS</u> JUNE 1991 PP:16-24

The emphasis in manufacturing companies in the 1990s will be"time-to-market." The term is generally defined as the elapsed time between product definition and product availability. The new competitors are time-to-market "accelerators." Their focus is on speed: speed in engineering, in production, in sales response, and in customer service. One example of a company reducing time-to-market is the Developmental Operations program of the Ballistic Systems Division of Boeing Aerospace Corp. To become an accelerator, a useful starting point might be to eliminate some strategies that appear to be practical but that, in actuality, can be counterproductive.One key to success is the ability to remove the artificial barrier between the design engineers and manufacturing. Top management provides a vision of the future, a time-to-market goal that product developers continually strive to meet and exceed.

VESEY, JOSEPH T., *'THE NEW COMPETITORS: THEY THINK IN TERMS OF "SPEED-TO-MARKET"*, <u>ACADEMY OF MANAGEMENT EXECUTIVE</u> MAY 1991 PP:23-33

Time to market is becoming a highly competitive issue for manufacturing companies. In the 1990s, it may be the most critical factor for success across all markets. A new group of accelerating competitors is emerging that thinks in terms of speed to market. These business units are using shorter product life cycles and have a propensity for change that is winning market share and increasing profits. The success of speed-to-market companies depends on concurrent engineering, which gives manufacturing managers a say in designing the production and ensuring that flexibility and efficiency are available in the product phase of product development. Technological advances in information processing provide the tools necessary for concurrent engineering.

WHITING, RICK, *'CORE TEAMS TAKE THE FRONT LINES'*, <u>ELECTRONIC BUSINESS,</u> JUNE 17, 1991 PP:50-54

More electronics companies are entrusting the job of guiding new products through development to a core team - a cross-functional group of 8-10 employees from different segments of the corporation. By putting decision making into the hands of those doing the work, companies hope to better coordinate product development, improve product quality, and speed time to market. A core team becomes the single point of contact for all corporate functions involved in a development project. For example, the manufacturing team member serves as the core team's liaison with the manufacturing vice-president and the manufacturing engineers assigned to the project. The most difficult part of changing to a core team system is convincing functional managers to give up some of their authority. The basic core team is made up of a team leader, a program facilitator, and people from engineering, manufacturing, marketing, service, quality, and testing.

WHITING, RICK, *'PRODUCT DEVELOPMENT AS A PROCESS'*, ELECTRONIC BUSINESS JUNE 17 1991 PP:30-36

Product development is about to become a key competitive battleground in the electronics industry, where such advantages as shorter time to market and higher product quality will be won or lost. Manufacturers with the best product development processes can bring new products to market faster, leading to more market share, longer product life spans, and higher revenue. Being first to market means greater ability to set standards in the marketplace, gain patent protection, and build a company's reputation as an innovator. Potential gains from improving a company's development process run between 40% and 60%. A clear development process can bring improved product quality and lead to more predictable results. A product development process must be implemented across all functions and throughout all levels of a corporation. Enhanced product development is directly linked to corporate quality improvement efforts.

4. PRODUCT LIFE CYCLE

HAYES, H. ROBERTS; WHEELWRIGHT, G. STEVEN, *'THE DYNAMICS OF PROCESS-PRODUCT LIFE CYCLES'*, HARVARD BUSINESS REVIEW, MARCH-APRIL 1979 PP:127-136

In this article anew framework that can help a company to conduct a diagnosis of its strategic evolution, thinking creatively about possible future strategic directions, and explicitly involve both marketing and manufacturing in coordinating and implementing its competitive goals. the concepts outlined in this article are:

1) determining the appropriate mix of manufacturing facilities
2) reviewing investment decisions for plant
3) evaluating product and market oppurtunities in terms of company's manufacturing capabilities.
5) selecting an appropriate process and product structure for entry into a new market

MAC DOWALL, *'THE TECHNOLOGY INNOVATION SYSTEM IN JAPAN'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT,1984 PP: 165-172

This article sets out some characteristics of the innovation web in japan in order to give managers and public policy makers in western countries some ideas for improving their own innovation roles. Also mentioned that Japanese were not slavish imitators but careful evaluators and selectors of what had been done elsewhere, the article continues with the information on Japanese management style, government, universities, and the environment for innovation.

MCINTYRE, H. SHELBY, *'PERSPECTIVE , MARKET ADAPTATION AS A PROCESS IN THE PRODUCT LIFE CYCLE OF RADICAL INNOVATIONS AND HIGH TECHNOLOGY PRODUCTS'* JOURNAL OF PRODUCT INNOVATION MANAGEMENT, JUNE 1988, PP: 140-149

The market adaptation process appears to be particularly important during the growth stage when the market potential is itself growing due to the stimulation of an appropriate infrastructure without the market adaptation perspective , one can not fully understand the product life -cycle for radical innovations which, by definition, create significant departures from old patterns and ways of doing things.

MORE, A. ROGER, '*IMPROVING THE ORGANIZATIONAL ADAPTION RATE FOR HIGH-TECHNOLOGY INDUSTRIAL PRODUCTS*', PRODUCT INNOVATION MANAGEMENT , 1984 PP: 182-198

The development of new technology andits translation into profit-producing processes, products and services is a more successful process the more quickly buyers can be persuaded to accept the innovation. In this article some major characteristics have been identified, and related to the important stream of management research currently evolving in this area.

5. NEW PRODUCT DEVELOPMENT

ANONYMOUS, *'NEW PRODUCT DEVELOPMENT TO BE THE GROWTH STRATEGY OF THE 1990'S'* CORPORATE GROWTH REPORT SEPTEMBER 1990 PP:17

Recent studies have identified new product development as the key growth strategy for the 1990s. Recently, Strategic Compensation Associates conducted a study on companies' attitudes toward new product development. The study indicated that companies creating an internal culture for new product development with an effective reward system will be better prepared to compete in the marketplace of the 1990s. The study found that successful new product development companies: 1. use a decentralized organization model that pushes product development down into divisions or product management groups, which keeps their people close to the markets, and 2. support an interdisciplinary approach to new product development. Successful new product development companies build a strong culture around creativity and nurture a new product development ethic. Successful companies use both monetary and nonmonetary rewards to encourage new product development.

BARCZACK, GLORIA; WILEMON, DAVID, *'COMMMUNICATIONS PATTERNS OF NEW PRODUCT DEVELOPMENT TEAM LEADERS',* IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT MAY 1991 PP:101-109

New product development (NPD) teams can be considered information creating and processing systems. As such, they are dependent on effective intra-team and extra-team communication. The team leader plays an important role in this communication process by fostering communication within the team and acting as a liaison (boundary spanner) between the team and other groups - for example, manufacturing, customers, and vendors. A study was conducted that examined 2 types of NPD team leaders - operating and innovating. Specific attention was given to differences in the leader's communicationwith team members and with external groups. The results indicated that the communication patterns of team leaders are dependent on the type of team. Further, the findings revealed that degree of success differentiates the communication patterns of team leaders, particularly within operating types of teams.

BART, CRISTOPHER K., *'ORGANIZING FOR NEW PRODUCT DEVELOPMENT',* THE JOURNAL OF BUSINESS STRATEGY, JULY-AUGUST 1988.

As a method for producing new products, growth, and diversification, new venture units are an extremely useful and innovative approach. Naturally, as with any concept, there are administrative and interpersonal obstacles associated with their use; these however, have resulted in large measure from the way in which the concept has been implemented.

BELLO, DANIEL C.; BARCZAK, GLORIA J., '*USING INDUSTRIAL TRADE SHOWS TO IMPROVE NEW PRODUCT DEVELOPMENT*', JOURNAL OF BUSINESS AND INDUSTRIAL MARKETING SUMMER/FALL 1990 PP:43-56

Industrial firms can better manage the new product development (NPD) process by conducting research during trade shows. Industrial firms use trade shows as a major promotional medium and as a source of sales or sales leads. The relevant surroundings at a trade show for NPD research include the developing firm's exhibit booth and out-of-exhibit locations, such as conference and guest rooms at nearby hotels and other facilities. The trade show audience is positively predisposed toward exhibitors' NPD efforts since it came seeking information about industry trends and technological developments. Each type of show attracts a unique audience, so the NPD research that can be done during each show varies. For example, a national horizontal show would not be appropriate to screen ideas or evaluate prototypes if technical criteria used by nonmanagerial users and low-level influencers is needed. The regional-vertical show can be used to decide design features and specifications for prototypes.

BUGGIE, FREDERICK D.; SCHEUING, EBERHARD E.; VACCARO, VALERIE L. '*AN INNOVATIVE APPROACH TO NEW PRODUCT DEVELOPMENT*', REVIEW OF BUSINESS FALL 1990 PP:27-32, 46

Management can improve the odds of success of a new product by hiring outside consultants and using an effective system for managing the innovation process. One such system, the Strategic Innovation System (SIS), designed by Strategic Innovations International Inc., is a refinement of the traditional stages in the new product development effort. The SIS starts with the creation of a list of criteria for the ideal product before beginning the traditional idea generation process. The 2nd key difference of the SIS from the traditional approach is that, instead of utilizing consumers at the start of idea generation, it uses thought-leader type focus groups of experts. The idea generation and idea screening stages are considerably more detailed in the SIS approach. The main steps in the SIS are: 1. organization and target setting, 2. strategy development, 3. an innovation session, 4. a building session with the functional project team, 5. an evaluation meeting, 6. a 2nd cycle of sessions, 7. a qualification-business analysis, and 8. the development of a management action plan.

CHANG, ZEPH YUN; YONG, KIT CHIN, '*DIMENSIONS AND INDICES FOR PROJECT EVALUATION OF A PRODUCT DEVELOPMENT PROJECT*', INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT 1,2 1991 PP:155-167

New product development is regarded as an important strategy that can lead to a corporation's long term success; enormous amounts of resources are being invested in it annually. Corporations often emphasize their potential in product innovation in their annual reports to shareholders. Managing new product development and, in particular, performance evaluation of an on-going project is an important issue in many corporations. A quantitative approach for performance evaluation of a product development project in the consumer electronics industry is presented. The effectiveness of a project is measured and indicated through a series of performance indexes that show how well the performance standards set forth in the various dimensions are met. Four dimensions for performance evaluation of product development work are: 1. product cost, 2. development cost, 3. development schedule, and 4. product commonality. Measurement criteria for the dimensions and the corresponding performance indexes are given.

CHOU, CHIEN-FU; SHY,OZ, *'NEW PRODUCT DEVELOPMENT AND THE OPTIMAL DURATION OF PATENTS'*, SOUTHERN ECONOMIC JOURNAL, JANUARY 1991 PP: 811-821

A dynamic model that identifies 2 important welfare effects of the patent system - the effect on the incentive to innovate and that of the price distortion caused by the monopoly rights of patent holders - is developed and used to analyze the factors that determine the optimal duration of patents awarded to new product developers. It is argued that the possibility of a finite optimal patent life does not arise in the literature on product development because it considers only a constant returns to scale technology for developing new products. The optimality of an infinite patent life for his technology is confirmed. Moreover, it is shown that, if the cost of developing new products is increasing with the rate of instantaneous product development, then the optimal patent life for economies with a population growth less than the interest rate is finite. It is also shown that, for economies with population growth exceeding the interest rate, the optimal patent life may also be finite, provided that the degree of product substitution is sufficiently high.

COOPER, ROBERT G., *'THE NEW PRODUCT PROCESS: A DECISION GUIDE FOR MANAGEMENT'*, JOURNAL OF MARKETING MANAGEMENT, SPRING 1988, P: 238

This paper attempts to bridge the research vs. practice gap by giving some advice on putting findings into practice, implementing a systematic, step-wise new product process, improving the success rate of new products, focusing on the completeness, quality, and importance. There is clear need for project evaluation points, where GO/KILL/HOLD decisions are made on projects. By building in key activities-upfront and market oriented activities, the process promises a higher success rate for completed projects.

COOPER , G.ROBERT, *'DEFINING THE NEW PRODUCT STRATEGY'* IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, AUGUST 1987 PP: 184-193

This article looks first at what a product innovation strategy is, its role in the corporation, and why an innovation strategy is essential to an effective new product program. Next the article focuses on the development of a new product strategy, begining with objectives and moving to arena selection. A matrix approach to arena definition and selection is used. Emprical data from research by the author is employed in the model to prioritize new product arenas.

DE MEYER, ARNOUD; VAN HOOLAND, BART, *'THE CONTRIBUTION OF MANUFACTURING TO SHORTENING DESIGN CYCLE TIMES'*, R&D MANAGEMENT JULY 1990, PP:229-239

A review of key literature reveals 5 distinct ways to address the problem of shortening design cycle time without losing quality and increasing costs: 1. increasing resources of staff and money, 2. treating design as a total system involving suppliers, 3. encouraging free information flow and parallel development activities, 4. increasing manufacturing flexibility, and 5. automating the design process itself. These conclusions are checked against information from the European Manufacturing Futures Project database for the 1986-1988 period. Results do not concur with the literature. Unless backed up by top management commitment to innovation, more resources do not necessarily result in shorter design times. The value of special training of the workforce is not proven nor is the impact of automated design technologies. However, improved relations with suppliers speeds up design, and more manufacturing flexibility shows potential.

EBERT, RONALD J. ; MAJERUS, CLYDE D. ; RUDE E., DALE, *'PRODUCT DEVELOPMENT: ASSESSING THE CONSISTENCY OF ENGINEERING DESIGN POLICIES'*, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, MAY 1989

This paper describes how differentation can arise and foster inconsistent views which may be either healthy or dysfunctional. Having revealed these inconsistencies and voids in overall direction for a design project, Judgement Capturing then provides information for a group integrative exercise that leads toward better understanding of engineering design's role for a more unified product development effort.

FEIGENBAUM, ARMAND V., *'A GLOBAL VISION OF QUALITY'*, JOURNAL FOR QUALITY AND PARTICIPATION JULY/AUGUST 1991 PP:6-9

The rapidly growing national interest in The Malcolm Baldrige National Quality Award in the US and the increasing orientation toward world quality leadership in the major European nations are 2 examples of the Atlantic Rim nations' orientation to world quality leadership. The 1990s will be a staggeringly different and much more demanding era for business than what was experienced throughout the 1980s. Perhaps the most demanding task of managers and engineers will be to change a company's philosophy from "make it cheaper and quicker" to "make it better." New product development is one of the critical areas requiring excellence in work process emphasis. In the US, the beginning of the 1990s is showing great promise regarding the development of worldwide quality. US products and services are building their business growth on strategies that recognize that quality is the best competitive leverage for simultaneously achieving customer satisfaction, human resource effectiveness, and lower costs.

FRUMERMAN, ROBERT, *'HOW TO AVOID THE TECHNICAL TRAPS IN PRODUCT DEVELOPMENT'*, PLANNING REVIEW, NOVEMBER-DECEMBER 1988,
PP: 20-26

The six basic reasons how to avoid the technical traps in product development are stated
in this article.
1) a product is unable to function dependably for long periods without excessive maintanence or replacement.
2) failure to be economically competitive
3) efficiency is to low
4) scaling up from a small development model
5) unsuccessful translation of old technology to new applications
6) unexpected competition by a functional equivalent

GOLD, BELA, ' *INTEGRATING PRODUCT INNOVATION AND MARKET DEVELOPMENT TO STRENGTHEN LONG TERM PLANNING'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT, 1984, 2, PP:173-181

The steel industries of Europe and the U.S. are among the worst causalties of the industrial turmoil that has shaken the economic order during the past ten years, other heavy manufacturing industries can claim similar suffering. In this article, Bela Gold draws on his experience in studying the technology, productivity, and competitive structure of such industries. He suggests that traditional planning approaches will not have heavy industry to a winning track. A new long term approach, based on a n itegration of product innovation and market development, is needed to meet the changing pressures these industries facing.

HAWKINS, PETER; BARCLAY, IAN *'THE ENGINEERING AND MANUFACTURING MANAGERS OF THE 21ST CENTURY: PART II : CAREER DEVELOPMENT AND PROGRESSION'*, MANAGEMENT DECISION (UK) 1990 PP:48-54

One of the most significant changes in the industrial and manufacturing sectors is the move away from insular markets. This trend has been accompanied by substantial changes in the nature of engineering requirements needed to support new product development. The management function is one of the main routes for an engineer to progress in terms of status and money. In a survey of employers to determine the importance given to certain qualities in promoting engineering graduates to a management position, the overriding qualities were people-related skills, although a sound technical base was also required. In order to retain high-caliber graduates and successfully develop them into the engineering and manufacturing managers of the future, companies should: 1. use career development to attract and retain such graduates, 2. use a wide range of development methods, and 3. pay particular attention to the non-engineering aspects, especially business awareness and management development.

HIPPEL, VON ERIC, *'NEW PRODUCT IDEAS FROM "LEAD USERS"'*, RESEARCH AND TECHNOLOGY MANAGEMENT, MAY-JUNE 1989, PP: 24-55

Lead users are the users whose present strong needs will become general in a marketplce months or years in the future. Lead users often attempt to fill the need they perceive, they can provide new product concept and design data as well. This paper presents how lead users can be systematically identified, and how their perceptions and preferences can be incorporated into marketing research analyses of emerging needs for new products, processes and services.

JOHNSON, NILS O., *'A DYNAMIC MODEL OF COOPERATIVE PRODUCT DEVELOPMENT BETWEEN COMPANIES OF GREATLY DIFFERENT SIZES'*, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, NOVEMBER 1987

This article adresses that today cooperation between companies in product development often occurs. Reasons that why large companies choose small companies as product development partners. Small specialist companies, well established in the business can be utilized by the large company in an effort to overcome capacity shortage or market threats. some of the early development will be made by small company instead.

KENNARD, R. B., *'FROM EXPERIENCE:JAPANESE PRODUCT DEVELOPMENT PROCESS'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT SEPTEMBER 1991 PP:184-188

Japan's knack for converting technology into products that have worldwide value and customer appeal is unique. Many advantages arise from the cultural and business environments within which the Japanese company operates: a long-term perspective on growth and survival, customer focus, and cooperation at all levels. Product development becomes an arena where innovation and experimentation are encouraged and valued to the extent that new product development activity becomes a change agent for the company. TheJapanese approach is proving to be especially effective in a competitive world where a company's capability to adapt and innovate may determine not only how well it does financially, but whether it survives long term. The Japanese company focus is survival.

MARKEN, G.A. 'ANDY', *'MAXIMUM EXPOSURE FOR YOUR NEW PRODUCT'*, PUBLIC RELATIONS QUARTERLY , SPRING 1989 PP: 24-27

This article discusses that there are natural order of things when announcing a new product sales literature, sales presentation materials, key customer contacts, featue articles, news releases, sales staff/rep. trainnings, advertising, and how to maximize the impact of your product announcement.

MCDONOUGH, EDWARD F., III, *'AN INVESTIGATION OF THE RELATIONSHIP BETWEEN PROJECT PERFORMANCE AND CHARACTERISTICS OF PROJECT LEADERS'*, JOURNAL OF ENGINEERING AND TECHNOLOGY MANAGEMENT (NETHERLANDS) MAY 1990 PP:237-260

The relationships between project performance and the cognitive (problem-solving) style and career orientation (work-related values) of project leaders are examined with data collected through questionnaires and interviews with the leaders of 41 new product development projects in 13 UK companies. The measure of performance focused on the performance of the project. Split sample correlation analyses are conducted to test the hypotheses. Results indicate that the traits of effective project leaders differ considerably according to type of project. For new technology projects, the most effective type of project leader will have a masters or doctorate degree and an innovative cognitive style. In applications projects, younger project leaders who have been with the firm fewer years make the more effective leaders. For minor modifications projects, it is older, more experienced leaders who are more effective. Data imply that it may be advisable to place inexperienced leaders in applications projects and move them into minor modifications projects as they gain more experience.

MCGUINESS, NORMAN,*'NEW PRODUCT IDEA ACTIVITIES IN LARGE TECHNOLOGY BASED FIRMS'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT SEPTEMBER 1990 PP:173-185

An exploratory study examined how new product ideas are detected, become refined, and gain momentum in large technology-based organizations. A previous study in small high-technology firms had found that ideas progressed in a more patterned and systematic manner than was thought. Nine large firms with substantial research and development activities were interviewed during 1986 and 1987. The results showed that the 34 search processes traced can be categorized according to whether they were planned or unplanned in nature. The 9 ideas in the planned grouping were characterized by a top-down approach, whereby a problem or opportunity was assigned to a specific organizational group for further action. The 25 unplanned-category ideas were bottom-up in nature and initiated through voluntary individual efforts that sometimes went beyond the requirements of the job. The search processes passed through the following stages: 1. detection, 2. credibility seeking, and 3. intensive search. A problem definition stage preceding the detection stage was a significant additional step.

NORRGRENN, F.' *DESIGNING AND IMPLEMENTING THE SOFTWARE FACTORY-A CASE STUDY FROM TELECOMMUNICATIONS'*, R&D MANAGEMENT (UK) JULY 1990 PP: 263-273

A large information technology company in Sweden took action to eliminate defects from its software production business by introducing into software production the time- and specification-oriented culture of the factory. Software writing had usually been delegated to largely autonomous individuals in research and development (R&D). Procedures were poorly documented, cross-fertilization with other projects was minimal, and lead times were long. The solution was to differentiate and rationally define jobs within the design function. A flat managerial structure was set up overseeing a group of integrated teams each made up of a senior system designer and a junior designer leading 4 semiskilled technicians. A well-defined workflow organization was introduced, and quality circles were used. Review procedures were installed, leadership and interpersonal skill training was undertaken, and measures were taken to guarantee effective communication in all directions.

NISHIKAWA, TOHRU, '*NEW PRODUCT DEVELOPMENT: JAPANESE CONSUMER TASTES IN THE AREA OF ELECTRONICS AND HOME APPLIANCES*', JOURNAL OF ADVERTISING RESEARCH APRIL/MAY 1990 PP:27-90

The marketing philosophy of Japanese enterprises in the high-technology field is to discover ways to match technology with the traditional lifestyle and culture of the people of Japan. Here, the marketing policy of Japanese enterprises - especially with respect to product design - is clarified by examining 3 examples: 1. Japanese-language word processors with "handwriting" typefaces, 2. noiseless washing machines, and 3. high-tech "kotatsu," traditional Japanese heaters. A high value is placed on retaining the Japanese culture and in making technology serve this. For instance, the Japanese-language word processor was equipped with handwritten characters of script in order to maintain the special character of the Japanese language. The success of the noiseless washing machine was brought about by understanding the special characteristics of the living environment in Japan. The traditional charcoal fire heater, the kotatsu, was introduced as an electrical appliance.

PATEL, R. MIKE ; PATEL, M. SARLA, '*MARKETING CONSIDERATIONS FOR NEW INDUSTRIAL PRODUCTS*' SUMMER 1982.

The purpose of this study is to survey some of the important aspects of marketing new industrial products.

PELL, M. ROGER, '*IS EVERYONE SINGING FROM THE SAME SONGBOOK?*' BANK MARKETING, JUNE 1989 PP: 42-45

Practical suggestions for developing a product manual and training guide for your institution. Together product manual and the training guide are powerful tools to realize observable, positive behavioral changes on the part of both staff and management.

RABINO , SAMUEL; MOSKOWITZ, HOWARD *'DETECTING BUYER PREFERENCES TO GUIDE PRODUCT DEVELOPMENT AND ADVERTISING'* JOURNAL OF PRODUCT INNOVATION MANAGEMENT, 1984, 2, PP: 140-150

This article describes one approach by which a relatively set of test products is evaluated by consumers in order to identify the most accptable combination of product attributes. Identification of this combination provides the product developer with guidelines as to which test product should be selected for subsequent introduction. The focus is on the discovery of discernible attributes of a product in a fragmented category to support the advertising claim.

SANCHEZ, ANGEL MARTINEZ; ELOLA, LUIS NAVARRO, *'PRODUCT INNOVATION MANAGEMENT IN SPAIN'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT MARCH 1991, PP:49-56

Managing directors and technical directors of 56 industrial firms in Spain were interviewed in 1986 to analyze the new product development process. The type of innovation carried out by the firms was basically incremental - improvements on existing products and new products in an existing family. The most frequently prescribed methods, such as market research, sales testing, and prelaunch analysis, were used by less than 1/2 the firms studied. Comparing this with Cooper and Kleinschmidt (1986) showed that there was a similar pattern in Canada. The most frequent type of financial analysis used was, in almost 75% of firms, costs and sales forecasts for the new product. The 2nd most common type was pay-back-period analysis. The vast majority of firms performed new product lab tests during development. Analysis revealed the existence of a relatively systematic, but informal, process of new product development.

SCHOENFELD, GERALD, *'TREAT OLD PRODUCTS LIKE NEW'*, MARKETING NEWS, PP:15-16

This article highlights some new ideas to refresh that old brand, e.g.: new distribution, new uses, a new way to think about it, a new ingredient, a new premium, and a new guarantee.

THOMAS, J. ROBERT, *'ESTIMATING MARKET GROWTH FOR NEW PRODUCTS: AN ANOLOGICAL DIFFUSION MODEL APPROACH'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT, 1985,2 , PP: 45-55

In this article proffessor Robert Thomas suggests some steps toward the development of models that incorporate the attractive features of diffusion models. His approach is to use, in a systematic way, the sales histories of products that can be considered to have analogous features from a buyer's point of view. He illustrates the approach by forecasting the sales of a new service.

WYCKHAM, ROBERT G.; WEDLEY, WILLIAM C., *'FACTORS RELATED TO VENTURE FEASIBLITY ANALYSIS AND BUSINESS PLANPREPERATION'*, JOURNAL OF SMALL BUSINESS MGMT OCTOBER 1990 PP:48-59

The graduates of the New Enterprise Program (NEP) at Simon Fraser University in Canada and their ventures are investigated. The NEP is a market-responsive program aimed at current and aspiring entrepreneurs, research and development professionals, and corporate managers of new product development. NEP participants indicated that the program assisted them in determining the financial feasibility of their proposed new ventures. In large proportion, they prepared and used the business plans the program is designed to assist them with. Feasible projects were associated with participants: 1. whose ventures were for themselves rather than their employers, 2. who had more managerial experience, and 3. who were employed by a large firm when they entered the program. Business plans were less likely to have been completed by participants examining a venture for an employer. Participants working for a small business were more likely to write a business plan.

WALSH, WILLIAM J., *'GET THE WHOLE ORGANIZATION BHIND NEW PRODUCT DEVELOPMENT'*, RESEARCH AND TECHNOLOGY MANAGEMENT NOVEMBER/DECEMBER 1990, PP:32-36

It is generally conceded that approximately 9 out of 10 new product developments end up as failures. This outcome remains despite the enormous efforts most US companies have expended over the last 10 years to improve new product quality and shorten development times. After examining some new product failures, it is found that the disappointing outcomes were organizationally induced. Techniques for fostering an organizationallydriven team in the environment of a large company are built around 4 basic concepts: 1. a holistic philosophy of new product development, 2. date making and date keeping, 3. individualized commitment based on education and training, and 4. program control by means of a new product integration manager. Eaton Controls Operations' organizationally driven approach combines interdepartmental teams, quality function deployment, and a new management position. These 3 managerial tools provide the discipline and foster the dedicated unity required for successful innovation. These tools should be especially helpful in the large, multifaceted business that operates around a group of independent functional departments.

6. RESEARCH AND DEVELOPMENT

CICERO, DANIEL; FRURMAN, ROBERT; BAETERS, CHARLES, '*R&D PROGRAMS WITH MULTIPLE RELATED PROJECTS-I*' RESEARCH MANAGEMENT, SEPTEMBER-OCTOBER 1987, PP: 31-35

This article presents a methodology for the managing the development of a product or process where many technological gaps must be bridged.

CLIFFORD, MARK, '*SAMSUNG'S SPRINGBOARD*', FAR EASTERN ECONOMIC REVIEW (HONG KONG) FEBRUARY 14 1991 PP:62

Samsung Electronics (Republic of Korea) has successfully specialized in manufacturing computer memory chips, but the shift from development of existing designs to true innovation, essential for any technology company aspiring to a leading-edge position, may test corporate philosophy as well as ingenuity. The company is tackling the goal at several levels, but it is discovering that catching up with the leaders is not easy. In the early days of its electronic business, Samsung received help from abroad, notably from Japan's Sharp. However, Japanese and US companies worry that technology transfers to firms like Samsung will produce a new competitor. Korean companies dislike joint ventures. Before it can approach such relationships as an equal, Samsung will have to demonstrate its credentials in technology. As an initial step, it has significantly increased its spending on research and development. Research expenditures in 1990 amounted to more than 12% of semiconductor sales revenues, or about $209 million.

CLINCH, GREG, '*EMPLOYEE COMPENSATION AND FIRMS'* RESEARCH AND DEVELOPMENT ACTIVITY', JOURNAL OF ACCOUNTING RESEARCH SPRING 1991 PP:59-78

The relation between compensation practices and research and development (R&D) activity is examined using a sample of 200 public companies. The implications of the results for motivation-, information-, and tax-based explanations of compensation design are analyzed. Only in the motivation- and tax-based settings are unambiguous inferences available. If a motivation-based perspective is adopted, the empirical results indicate that the relation between R&D and the relative informativeness of stock-based versus accounting-based performance measures is negative for small firms, with inconclusive results for large firms. High R&D in small firms is associated with lower relative informativeness of stock prices versus accounting earnings. In an information-based framework, the large number of Factors contributing to contract design make inferences difficult, so empirical results are best interpreted as descriptive. The results do not appear to be tax driven.

CORDTZ, DAN, *'CORPORATE R&D: A SPECIAL REPORT'*, <u>FINANCIAL WORLD</u> OCTOBER 1, 1991, PP:32-37

Over the past decade, corporate financial support for research has been impressively steady. After a slowdown in the early 1970s, business spending for research and development (R&D) has risen by about 7% a year even after inflation. Where foreign competitors have outstripped corporate America is in the task of turning new knowledge into new or improved products that can attract buyers. This is not the responsibility of scientists, but of managers - ultimately top management. However, many top managers are not familiar with technology and find it difficult to evaluate and incorporate technological factors in their strategic planning. This may be changing. During the past decade, a growing number of companies have grasped the need for change in the management and use of R&D. While some firms are tightening the links between R&D and other departments, others are establishing closer ties between R&D and their customers. One of the keys to making better use of R&D is to recognize that it is not the only important source of innovation.

GONNORY, RALPH E., *'MOVING IBM'S TECHNOLOGY FROM RESEARCH TO DEVELOPMENT'* <u>RESEARCH AND TECHNOLOGY MANAGEMENT,</u> NOVEMBER-DECEMBER 1989, PP: 27-32

IBM uses a mechanism called joint programs fosters the transfer of technology from research to development by forming, continuing joint efforts in which teams of research and development people agree on plans and work together to achieve them. How these joint programs came into being, how they work, and their advantages is the subject of this article.

GRAVES, SAMUEL B., *'DYNAMICS OF INNOVATION'* <u>A CASE STUDY, FOR PRESENTATION AT THE TIMS/ORSA JOINT NATIONAL MEETING DALLAS, THE AMERICAN UNIVERSITY, WASHINGTON, D.C.,</u> NOVEMBER 28, 1984.

This paper presents the technological S-curve as a model of the dynamic innovation process. The model is compared to data which summarize the dynamics of innovation in the commercial aircraft producing industry. Time series are presented which describe growth in technical performance and trends in R&D intensity.

HENDRY, JOHN, *'BARRIERS TO EXCELLENCE AND THE POLITICS OF INNOVATION'*, <u>JOURNAL OF GENERAL MANAGEMENT (UK)</u> WINTER 1989 PP:20-31

Research into technological innovation has produced 2 main methods of achieving innovation success. These methods focus on either organizational structures that combine marketing and research and development (R&D) or corporate culture and its manifestations. The methods are connected, as is shown by an analysis that views new product development as a political process. Barriers to the implementation of the requirements for successful technological innovation can be overcome through: 1. group development programs, 2. strong social and recreational programs, 3. common training programs for marketing and R&D recruits, 4. a centralized personnel function and central recruitment, 5. job rotation or similar programs, 6. common status and reward systems, 7. use of the design function to coordinate R&D and marketing, and 8. specific training and organizational development that changes the nature of the functions themselves, especially the marketing function.

KLIMSTRA, PAUL D. ; POTTS, JOSEPH, *'MANAGING THE R&D PROJECTS'* RESEARCH AND TECHNOLOGY MANAGEMENT, MAY-JUNE 1988, PP: 23-39

Tis article suggests that the focus of project management must be upon such invisible processes as the generation, organization and dissemination of information.

KROGH, LESTER C.; PRAGER, JULIANNE H.; SORENSEN, DAVID P.; TOMLINSON, JOHN D., *'HOW 3M EVALUATES ITS R&D PROGRAMS'*, RESEARCH AND TECHNOLOGY MANAGEMENT, NOVEMBER -DECEMBER 1988, PP: 10-14

This article discusses about 3M 's technical audit system and how major resaerch programs assesed . Advantages and disadvantages of 3M's technical audit process.

KORNEL, AMIEL, *'INVESTING R&D PROWESS'*, COMPUTERWORLD, SUPPLEMENT AUGUST 13 1991 PP:28-29

Japan has clearly set its sights on achieving innovative preeminence.In a 1989 survey conducted by Japan's Science and Technology Agency, 2/3 ofJapanese managers surveyed cited strengthened research and development (R&D) as their primary goal. Japanese capital investment in manufacturing plants, equipment, and research has risen 150% since 1985. This research and monetary power is finding its way into many information systems (IS)-related areas. Improving the interface between human and machine is arguably the most pressing area of Japanese research. Voice recognition and touch-panel technologies are high priorities. At the chip level, researchers are experimenting with new levels of component density. Artificial intelligence is also a major focus. Just one example is a neural network project initiated by Hitachi Ltd. in 1989. Most communications-related R&D in Japan is carried out in the laboratories of Nippon Telegraph & Telephone Corp., which spends more money than any other company in the world on investments in new equipment and research.

LEINFUSS, EMILY, *'R&D WITHOUT THE FEE'*, DATAMATION(INTERNATIONAL EDITION) MAY 1 1990 PP:93-95

New relationships between universities and companies are changing the way schools compete in the technology race and the way business benefits from the rich resources of educational institutions. The result is a new symbiotic relationship, where education and enterprise stand to mutually prosper. As a result of this relationship, students receive hands-on understanding of real industrial challenges without having to sacrifice the learning environment of school. The schools also benefit by receiving monetary grants or hardware and software donations from high-technology suppliers. Another important factor that is driving universities to form alliances with companies is that they gain access to practical information about a particular industry. Finally, a popular belief that US manufacturing practices have fallen behind those of world class competitors has spurred the alliance. Companies that need expertise in specialized programming canprofit from academic expertise.

LICHTENBERG, FRANK R. ; SIEGEL, DONALD, '*THE IMPACT OF R&D INVESTMENT ON PRODUCTIVITY-NEW EVIDENCE USING LINKED R&D-LRD DATA*', <u>ECONOMIC INQUIRY</u> APRIL 1991 PP:203-209

In order to study the relationship between research and development (R&D) and productivity for the period 1972-1985, the Longitudinal Research Database (LRD) file was linked to the National Science Foundation/Census firm-level AnnualSurvey of Industrial R&D.These data allow for significantimprovements in measurement and model specification, yielding more precise estimates of the returns to R&D. The analysis finds that R&D investment was a significant determinant of productivity growth during the years 1972-1985. The R&D-productivity connection was strong throughout the 1970s, when there was a pervasive slowdown in productivity growth. The results suggest that the rate of return to R&D was higher in the latter stages of the decade and especially in the 1980s. This may explain why manufacturing firms are devoting a larger percentage of their own funds to R&D projects in the 1980s. It appears that profitable research opportunities were plentiful during the 1970s and in recent years. Concern about a recent decline in the impact of R&D on technological progress does not appear to be well founded.

LEFEBVRE, LOUIS A.; HARVEY, JEAN; LEFEBVRE, ELISABETH,'*TECHNOLOGICAL EXPERIENCE AND THE TECHNOLOGY ADOPTION DECISIONS IN SMALL MANUFACTURING FIRMS*', <u>R & D MANAGEMENT</u> JULY 1991 PP:241-249

Survey data from 144 small manufacturing firms in Quebec were used to investigate changes in the factors bearing on technology adoption decisions in such firms. It was hypothesized that, as a firm's experience with technoloy increases and its technological capabilities grow, the decision process is modified such that more weight is put on those factors that are more closely related to the true potential of the technology. It was found that the more innovative firms have an outward orientation dominated by clients and suppliers and pay more attention to the added flexibility brought about by new technology. In addition, functional groups within the company play a more important role in the decision-making process.

MEINHART, WAYNE A.; PEDERSON, JOHN A. , *'MEASURING THE PERFORMANCE OF R&D PROFFESSIONALS'*, RESEARCH AND TECHNOLOGY MANAGEMENT, JULY-AUGUST 1989, PP: 19-21

This paper presents a study of 20 large research oriented firms appraise the performance of research proffessionals shows that the process is conducted with care but there are inconsistencies in the instruments utilized. It is found that an instrument employed only for research proffessionals and sterssing special characteristics of their job, can be a key element in enhancing the effectiveness of research management.

ODIOSO, RAYMOND C., *'AN R&D EXECUTIVE LOOKS AT MARKETING'* RESEARCH MANAGEMENT, SEPTEMBER -OCTOBER 1987, PP: 20-25

Author gives hints about nine laws how can technical managers can be more effective in dealing with their counterparts in marketing. 1) marketing interest is the reciprocal of the feasibility, 2) imitate don't innovate, 3) label life is always less than product manager life, 4) marketing time table is always less than the time required, 5) advertising costs are 1000 times the R&D costs, 6) iventories available are always less or greater than inventoriesrequired,
7) you never know what is going to sell untill you try to sell it, 8) best is the enemy of good, 9) the success of a project is inversely proportional to topmamanagement attention.

RAJASEKARA, JAY R., *'OUTLINE OF A QUALITY PLAN FOR INDUSTRIAL RESEARCH AND DEVELOPMENT PROJECTS'*, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT AUGUST 1990 PP:191-197

As companies pay more attention to improving quality in manufacturing, there is an increasing concern that companies should also pay more attention to research and development (R&D), particularly when the R&D projects in a company are directly geared to manufacturing. For project quality to be improved, the project must first be identified and associated with the relevant customers as the project progresses through various stages. It can be very costly for a company if it does not identify quality correctly the first time. An analysis for quality issues associated with projects in an industrial research laboratory is provided. Through the application of a planning and decision-making tool called the analytic hierarchy process (AHP), a quality plan is constructed and activities of industrial research projects are placed under a common umbrella to identify the most important quality aspects of customers. Tables.

ROBERTS, KARLENE H. ; ROSSEAU, DENISE M. , *'RESEARCH IN NEARLY FAILURE FREE , HIGH RELIABILITY ORGANIZATIONS: HAVING THE BUBBLE'*, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, MAY 1989, PP: 132-141

High reliability organizations such as nuclear power plants, air traffic control centers, and aircraft carriers pose special challenges to organizational researchers. Problem formulation, data collection, and interpretation of the researcher-organization relationship. Methods for conducting research in these organizations are explicated along with the consequences of failing to bring organizational knowledge to high-reliability work units.

SCHNEIDERMAN, HOWARD A., *'MANAGING R&D: A PERSPECTIVE FROM THE TOP'*, SLOAN MANAGEMENT REVIEW SUMMER 1991 PP:53-58

Although most technology-dependent companies recognize research and development (R&D) as a necessary business expense, their executives usually do not understand it well. Yet R&D fuels these companies' earnings growth.Inexperience and poor decisions in R&D can quickly become expensive. Monsanto Co. is technology-driven and global. It has had to address such issues as the duration and costs of R&D projects, improving productivity, and integrating R&D into the rest of the company. How much is spent on R&D depends upon the business. A company's R&D expenditures also depend on how much its competition is spending, how long the company is likely to remain in a particular business, and whether the busines demands technological leadership. A product will not be commercially successful unless everyone involved in research, development, manufacturing, and marketing works smoothly together. A project needs many informed supporters in the ranks if it is to endure tough technical or regulatory problems or periods of tight funding.

SLEVIN, DENNIS P. ; PINTO, JEFFREY K. , *'CRITICAL SUCCESS FACTORS IN R&D PROJECTS'* ,RESEARCH AND TECHNOLOGY MANAGEMENT, JANUARY-FEBRUARY 1989 PP: 31-35

This paper gives a clearer understanding of ten factors are critical to and predictive of success, but they come into play at different stages of product life cycle. The 159 R&D projects sampled, include examples of new product development and introduction, computer software, and hardware development, food drug and soft goods R&D, and equipment and appliance development. These factors are ; project mission, top managementsupport, project schedule/plans, client consultation, personal and technical tasks, client acceptance, monitoring and feedback, communication, trouble-shooting. The four additional factors are ; characteristics of the project, team leader, power and politics, environmental events, and urgency.

SOUDER, WILLIAM E., '*THE VALIDITY OF SUBJECTIVE PROBABILITY OF SUCCESS FORECASTS BY R&D PROJECT MANAGERS'* IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT', FEBRUARY 1989, PP: 35-47

The results of an experiment conducted at the research laboratories of monsanto company supports the hypothesis that R&D planning and control models, that are based on subjective probability estimates may reliably be used by management to aid in early identification of eventually failing projects, as well as to aid in project selection and project funding.

SZAKONYI, ROBERT, '*CRITICAL ISSUES IN LONG-RANGE PLANNING'* , RESEARCH AND TECHNOLOGY MANAGEMENT, MAY-JUNE 1989, PP: 28-32

This article discusses the seven critical issues in long term planning. These issues are: 1) The effect of poor long-range business planning on development and use of technology 2) The importance of long-range technology planning 3) The fact that planning also involves control 4) The diffuculty of nurturing an alternative perspective to conventional wisdom 5) The importance of getting members to understand that planning is useless without implementation 6) The importance of appreciating the value of a home-span analyitical framework 7) The diffuculties in getting company members to learn how to plan

WILKINSON, ALAN, '*DEVELOPING AN EXPERT SYSTEM ON PROJECT EVALUATION-PART I : STRUCTURING THE EXPERTISE'* ,R & D MANAGEMENT JANUARY 1991 PP:19-29

Interim results are reported from research on the development of an expert system originally intended to be advisory to managers at all levels of research and development on the selection of projects. While diversity had been anticipated, when the experts were consulted, agreement about how projects were selected was totally absent. The objectives were shifted from project selection to project evaluation and to an attempt to classify projects such that projects in one class might have similar criteria for evaluation. It seemed necessary to construct a model that would reflect a totally dynamic system but would enable the segregation of projects into zones that might have similar criteria of success. How the model evolved is described, along with a test by questionnaire against actual projects by a number of companies. The model has been the basis of a prototype expert system.

VAN DER MEER, JACQUES B. H., '*R&D BASED STRATEGIES IN THE SEMICONDUCTOR AND DRUG INDUSTRIES; RATIONALE, ORGANIZATION AND ACTIONS'* , RESEARCH AND DEVELOPMENT MANAGEMENT, APRIL 1988, PP:111-121.

In this paper author surveyed the factors that determine the success or failure of corporate innovations in the European semi-conductor and pharmaceutical industries. Success factors; concentrating innovation projects and related R&D into fairly restricted channels; minimizing diversification; working to explicit but not too detailed top management guidelines for innovation activity; defining clear and realistic goals; minimizing red-tape and formality and being willing to revise plans frequently; ensuring a close relationship between R&D, marketing and, manufacturing, but allowing R&D to maintain a long range perspective; providing a stimulating supportive and well-supervised working environment.

TERESKO, JOHN, '*ANDY GROVE'S VISION FOR INTEL*', INDUSTRY WEEK DECEMBER 4 1989 PP:27-28

Going into its 2nd 20 years, Intel Corp. faces challenges, not only conventional issues of competitiveness, but also of succession and continuity of vision. Robert N. Noyce, cofounder of Intel, is currently dividing his time between being Intel's vice-chairman and the chief executive officer (CEO) of Sematech, the semiconductor industry's manufacturing technology consortium. Cofounder Gordon E. Moore is currently chairman. Andy Grove, who was one of the original 3 as head of research and development (R&D), has been president and CEO since 1987. He plans to step down in 1992. So far, the declining influence of the founding fathers has not taken a toll. The company's net revenues grew almost 51% in 1988, the 2nd consecutive year of 50% or more growth. Net income reached a record $453 million. Intel attributes such performance to the high-technology 3Rs - R&D, risk-taking, and responsiveness. Of all the challenges confronting Grove, helping to select a successor may be the toughest. Grove does not plan to leave the company entirely; instead, he will likely become vice-chairman.

7.GLOBAL ISSUES IN RESEARCH AND DEVELOPMENT

HLADIK, KAREN J.; LINDEN, LAWRENCE , *'IS AN INTERNATIONAL JOINT VENTURE IN R&D FOR YOU?'*, <u>RESEARCH AND TECHNOLOGY MANAGEMENT.</u> JULY-AUGUST 1989, PP: 11-13

This study indicates that perspective alliance seekers face a high failure rate, and these pitfalls to avoid are: 1) risks of sharing proprietary know-how, 2) the issues of control and product design , dissimilarities between potential partners, 3) integration and communications with the rest of the parent company, 4) antitrust regulations and patent protection.

MERRIFIELD, BRUCE, *'STRATEGIC ALLIENCES IN THE GLOBAL MARKETPLACE'*, <u>RESEARCH AND TECHNOLOGY MANAGEMENT,</u> JANUARY-FEBRUARY 1989, PP: 15-20

These alliances are : 1) multiplying the world market potential for a new product process or service at less cost to each partner 2) avoiding wasteful redundant activity, pool limited resources and skills, and shorten development times 3) providing more rapid access to advancing technology 4) reducing risks involved in continual development of leading-edge technologies now required for survival 5) allow increased specialization among allied firms.

PERRINO, ALBERT C.; TIPPING, JAMES W. , ' *GLOBAL MANAGEMENT OF TECHNOLOGY* ' <u>RESEARCH AND TECHNOLOGY MANAGEMENT</u>, MAY-JUNE 1989, PP: 12-19

This article presents an approach to formulating R&D deployment strategy for a global technology network emerges from a study of 16 multinationals in the U.S. , Europe, and Japan. The important factors are overcoming national boundaries, attaining world scale advantages, capturing and integrating critical inputs worldwide.

8.DESIGN AND R&D INTERFACE

BAK, DAVID J., SENIOR EDITOR, *'LESSONS FROM A TECHNICAL GIANT'* DESIGN NEWS, JULY 23 1990, PP: 105-111

This paper is about GE and an explanation of why GE prospered in the 80's while other industrial giants floundered. The following keys to success help explain why GE is among U.S. 's technical pace setters. Working together-the corporation between central R&D lab. and operations, sharing personel and ideas, teamwork, targeted research-should be aimed horizantally where an infrastructure already exists, Technical alliances- cooperation with other companies.

R&D AND MANUFACTURING INTERFACE
ALSTER, NORM, *'WHAT FLEXIBLE WORKERS CAN DO?'*, FORTUNE, FEBRUARY 13, 1989.

This paper indicates that training employees in several jobs can help companies respond to the market faster, and increases efficiency, quality, productivity and job satisfaction. examples from Mariott corp., Motorola, USAA, General Motors in this perspective.

RUDOLPH, STEPHEN, *'SOMETIMES THE BEST SOLUTION IS IN SOMEONE ELSE'S LAB'* BUSINESS MONTH, OCTOBER 1989, PP:91

Manufacturer's are turning to 'global sourcing' to find new technologies 1) increasing the sophistication of products and the scarcity of engineering resources are making it prohibitively expensive for manufacturers to develop all relevant technologies in house.It's the only way they can maximize their R&D investments and successfully position their companies with the global economy.

SWAMIDASS, M. PAUL,*'PLANNING FOR MANUFACTURING TECHNOLOGY'*, LONG RANGE PLANNING, OCTOBER 1987, PP: 125-133

Compared to Japanese manufacturers, generally many U.S. and European manufacturers have fallen behind in the modernization of their process technology. Some of the reasons cited for this problem are; 1) lack of experience with modern technology 2) the inadequate understanding of new technologies 3) the lack of skills to evaluate intangible and non financial aspects of 'process technology' 4) the lack of top management support for, or understanding of advanced manufacturing technologies 5) the absence of 'process champions' 6) the treatment of modernization decisions as no more than capital budgeting decisions 7) the exclusive use of present value criteria which could result in uncompetitive facilities. The primary solution to the problem lies in the use of a foolproof systematic planning process that would prevent executives from overlooking modernization decisions as when they are due.

9.MANUFACTURING AND DESIGN INTERFACE

'BUSINESS STRATEGY AND MARKETING'

Seven principles which Philip L. Smith presents in this article are: 1) overall corporate vision, 2) direction for research is both a top-down and a bottom -up process, 3) interaction between research, business planning and marketing must be forced, recognize that different businesses have different levels of technical intensity, look beyond your own walls for new ideas with a reseach budget, there has to be enough flexibility to permit some amount of scientific doubling, chck your research spending periodically

'CONQUERING COMPLEXITY: HOW WINNERS LEVERAGE SIMPLER DESIGN', **ELECTRONIC BUSINESS, FEBRUARY 6, 1989, PP: 62-64**

The issues that discussed in this article are : keeping product design features to a minimum in any one product release, maximizing reusability, maximizing productivity, managing complexity along product and process dimensions simultaneously. Complexity of product design can impose sustantial hidden costs. These costs can be uncovered.

DE MEYER, ARNOUD; VAN HOOLAND, BART, INSEAD, 77305 FONTAINBLEAU CEDEX, FRANCE, ***'THE CONTRIBUTION OF MANUFACTURING TO SHORTENING DESIGN CYCLE TIMES'***
R&D MANAGEMENT, MARCH 20, 1990, PP: 229-237

Shortening design cycle times, keeping quality and resources constant has become an important target for management effort. Shorter product life cycles, reduction of slack in the development process and the increased demand for production variations and modifications have forced companies to examine the duration of the development process. In this paper the data gathered through the european manufacturing futures survey were used to verify a few results of a short literature review on the role of resource availability, human resource policy, vendor relationships, integration of information systems, design process technologies and manufacturing lead time reduction.

10. R&D AND MARKETING INTERFACE

BAKER, KENNETH G.; HOZIER, GEORGE C.; ROGERS, ROBERT D., '*SUPPLY-SIDE MARKETING : RISKS AND BENEFITS*', RESEARCH MANAGEMENT, SEPTEMBER-OCTOBER 1987

Supply-side marketing concept is a variation of technology transfer theme, but, instead of representing a transition from a production to a sales orientation, the transition is from a production to a sales orientation, the transition is from a sales to a marketing orientation. The focus is on the need to sell newly developed technologies modified by a concern for the establishment of markets. Supply-side marketing focus on the concept of creating the demand. The benefits of this common effort is a more timely and cost efficient. Introduction of innovative technologies into the marketplace with the resulting competitive advantages for the organization, and more rapid feedback of change in customer needs back to the technology developers.

BROCKHOFF, KLAUS; CHAKRABARTI, ALOK K., '*R&D /MARKETING LINKAGE AND INNOVATION STRATEGY: SOME WEST GERMAN EXPERIENCE*', IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, VOL. 35, NUMBER 3, AUGUST 1988, PP: 167-174

In this article the Marketing/ R&D interface surveyed in 31 West German companies. Study has also involved with intraunit interface problem. In addition to interunit interface problem, (Horwitch 1987 and Thietart) and project level interface problem (Souder and Chakbarti 1978). The survey was the perceptions about the success rate of innovation in these business units. Study identified four different types of innovation strategies using different combinations of technology-defensive imitator, process developer, agressive specialist, agressive innovator- and marketing strategy -defensive imitator, market defender, market penetrator, innovative marketer- and suggested a relationship between strategy choice and risk perception. Risk avoiders has least agressiveness in two dimensions -marketing, technology. Risk balancers who are agressive in only one dimension. Innovators are the ones who are agressive in both dimensions. As a conclusion firms are better equipped for dealing with technological dynamism of the industry through agressive marketing strategies.

CLIPSON, COLIN, '*A BUSINESS AND DESIGN EDUCATIONAL EXPERIMENT AT THE UNIVERSITY OF MICHIGAN*', JOURNAL OF PRODUCT INNOVATION MANAGEMENT JUNE 1990 PP: 135-141

Although successful new product development practices generally require the joint efforts of professionals from various areas, these professionals often are trained as specialists with little exposure to other functional viewpoints. At the University of Michigan, an educational initiative was designed to bring together selected technical, business, and design students to develop product recommendations for sponsoring firms. The experiment focused on the establishment of effective planning and management procedures, coupled with coordinated specialized skills carefully introduced through a business plan and strategy. The design of communications and information flow between disciplines solving the problems was a critical part of the experiment. The student teams quickly ascertained a need to overcome language and cultural barriers in order to successfully complete the project.

FUSHAN, PETER, '*TAKE THREE STEPS TO BEST PRODUCT POSITIONING STRATEGY*', MAY 22 1989, PP:30

Chilton refers to best product positioning as; a need gap inquiry to determine what features or product characteristics are important to consumers; a competitive assessment to determine the strengths and weaknesses of the product within the competitive environment; a strategic action plan based on information gained from the first two steps.

GUPTA, ASHOK K.; ROGERS, EVERETT M., '*INTERNAL MARKETING: INTEGRATING R&D AND MARKETING WITHIN THE ORGANIZATION*', JOURNAL OF SERVICES MARKETING SPRING 1991 PP:55-68

Many studies have concluded that one of the most significant causes for new product failure is a lack of integration of research and development (R&D) and marketing early in the innovation process. The idea of integrating R&D and marketing for successful new product development is a new idea for many firms. Rogers' (1983) innovation diffusion model suggests that the rate of adoption of an innovation or a new idea depends on several elements, among them relative advantage, compatibility, and complexity. When marketing and R&D people are asked to integrate their efforts, they must know what is expected of them, what their roles will be, which activities will need to be done jointly and which separately, how their performance will be evaluated and by whom, and what kind of training they will need to undergo. Personality differences exist between R&D and marketing personnel, suggesting a need to develop training programs and implement human resource management That promotes integration.

GUPTA, ASHOK K. ; DAVID WILEMON, '*WHY R&D RESISTS USING MARKETING INFORMATION*', PP: 36-41

R&D managers want objective information which helps in designing products without stifling creativity. They want accurate information with supporting data which exhibits understanding of real customer needs, technology, and competition at a time when the product will be introduced in the market. They also would like managers to develop some understanding of technology and various design tradeoffs involved during the product development. These are the findings of the research that was disscussed in this paper. It is also suggested that a great deal of improvement is needed in the quality of marketing information.

GUPTA, ASHOK K.; WILEMON DAVID, *'IMPROVING R&D/MARKETING RELATIONS: R&D'S PERSPECTIVE'*, R&D MANAGEMENT(UK) OCTOBER 1990 PP:277-290

Successful product innovation hinges on close research and development (R&D)/marketing relationships, especially in technology-based organizations. However, there is evidence that linkage problems are common, and when they are not overcome, failure is the usual result. R&D's perspective on what R&D, marketing, and senior management can do to improve their relationship with marketing is presented. The recommendations are based on suggestions from R&D directors involved in new product development efforts in 83 technology-based companies. Also presented is how the need for integration has changed over time and where it is going in the future. The new realities of the marketplace, characterized by increased emphasis on new products, a need for faster product development, greater competition, increased product complexity, increased customer sophistication, and a greater reliance on strategic alliances with external organizations, have necessitated an even more harmonious and productive R&D/marketing interface. Personnel, time, and money were often perceived as key resources by the R&D directors.

HEGARTY, W. HARVEY; HOFFMAN, RICHARD C., *'PRODUCT/MARKET INNOVATIONS: A STUDY OF TOP MANAGEMENT INVOLVEMENT'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT SEPTEMBER 1990 PP:186-199

A study investigated the influence of top managers on new product development and market innovations and the extent to which the strategic management activities of these managers are associated with such influence. Data were gathered from 362 top managers at 96 manufacturing business units located in 8 European countries and the US. Ten variables were assessed to explore the propositions examined in the research. Top managers were found to have varying degrees of influence in product and market innovations. The degree of influence varied by the manager's functional specialty and somewhat by the type of innovation. The top managers exercising the greatest influence on the innovation decision were those whose functional specialty was most closely aligned with product and market innovations. The findings lso point to the top manager's role as "strategist" in the innovation process because the use of the strategic management activities of scanning and forecasting was found to be positively related to the top manager's influence on various types of innovations.

HISE, RICHARD T.; O'NEAL, LARRY; PARASURAMAN; MCNEAL, JAMES U., *'MARKETING/R&D INTERACTION IN NEW PRODUCT DEVELOPMENT: IMPLICATIONS FOR NEW PRODUCT SUCCESS RATES'*, JOURNAL OF PRODUCT INNOVATION MANAGEMENT JUNE 1990 PP:142-155

In order to assess the variables that are associated with new product success, the responses of 252 large manufacturing companies regarding their new product development procedures were analyzed. The results suggest that marketing has a high level of involvement in new product development practices. This involvement seems to be greater for the design and evaluative stages than for the input stage. Greater levels of involvement by marketing appear to exist for consumer products than for industrial products. When marketing and research and development (R&D) demonstrate high levels of joint effort in determining the final design of new products, new consumer and industrial products are each more likely to have higher levels of success than when low levels of cooperation occur. In regard to specific aspects of new product development, marketing is clearly more likely than R&D to be mainly responsible for the original idea that led to the creation of the most recent new product.

LINK, ALBERT N.; ZMUD, ROBERT W., '*ADDITIONAL EVIDENCE ON THE R&D/MARKETING INTERFACE'* , IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, FEBRUARY 1986, PP: 43-44

This paper investigates factors associated with interfirm differences in the R&D/ marketing interface. The analysis suggests that relationships can be improved through organizational change but some aspects of disharmony may be inherent given the strategic mission of the R&D group.

LUCAS, GEORGE H., JR.; BUSH, ALAN J., '*THE R&D INTERFACE: DO PERSONALITY FACTORS HAVE AN IMPACT ?*', JOURNAL OF PRODUCT INNOVATION MANAGEMENT DECEMBER 1988

A study was undertaken to investigate the personality traits of managers in the areas of marketing and research and development (R&D) and to assess the influence of personality traits on the success and perceived satisfaction of participants in the marketing-R&D interface. The study was based on data from 234 responses to questionnaires forwarded to the top-ranking marketing and R&D managers of the 1,000 largest US companies. Study results suggest these guidelines for enhancing marketing-R&D interface and integration: 1. Marketing personnel should temper their assertiveness when dealing with R&D counterparts. 2. Marketing personnel should understand that R&D personnel generally are more emotional and timid. 3. Marketing personnel should strive to be less opinionated. 4. The value of cooperative work must be stressed. 5. Guidance from industrial psychologists can be useful in formulating constructive approaches that enhance cooperation.

MOENAERT, RUDY K.; SOUDER, WILLIAM E., '*AN INFORMATION TRANSFER MODEL FOR INTEGRATING MARKETING AND R&D PERSONNEL IN NEW DEVELOPMENT PROJECTS*', JOURNAL OF PRODUCT INNOVATION MANAGEMENT JUNE 1990 PP:91-107

Marketing and research and development (R&D) personnel are key actors in the development of new product innovations. Interdependence between the 2 functions necessitates integration. Task specification, structural design, and climate orientation are the major integration mechanisms advocated in the literature. A nomological network is developed that interrelates the integration mechanisms, interfunctional information transfer, uncertainty reduction, and new product innovation. A causal framework is proposed that describes the determinants of successful information transfer between marketing and R&D in the development of technologically new products.

Innovation success is expected to be a function of the uncertainty reduced by marketing, the uncertainty reduced by R&D, and the convergence between these 2 types of uncertainty reductions. The transfer of information between marketing and R&D functions stimulates each of these 3 elements.

PECHTER, KERRY, *'PHANTOMS OF THE MARKETPLACE'* , ACROSS THE BOARD, JULY/AUGUST 1989, PP:11-15

Measurements and analysises how consumers respond when a product they want is not available. This will cause loss of market share of the company.

SOWREY, TREVOR, *'IDEA GENERATION: IDENTIFYING THE MOST USEFUL TECHNIQUES'*, EUROPEAN JOURNAL OF MARKETING (UK) 1990 PP:20-29

The effectiveness of a new product development program depends on the quality of ideas that are produced. However, in spite of its importance, many companies do not pay sufficient attention to the idea generation stage in their development programs. One factor that may have led to this situation is the fact that the topic of idea generation has not been featured in the marketing literature as much as the other stages in the development process. Not only have the techniques for idea generation been inadequately described, but few research studies have been attempted to evaluate the techniques. Four such studies are examined in order to guide managers in their choice of techniques for their own idea generation systems. A comprehensive study of sources and techniques used to generate ideas for new products revealed that there appears to be a strong relationship between the number of techniques used by a company and the number of successful products developed by that company.

WAGNER, JACK, *'NEW PRODUCTS ARE NOT THE ONLY WAY TO GROW'*, MARKETING NEWS MAY 14 1990 PP:17

New product development is not the only alternative for companies that wish to grow. Another option is new market development, which requires finding new trade customers for existing technology or existing product lines. There are fewer risks involved in this process because of the familiarity with production capabilities and technology. Locating consumer segments in a market may not be difficult because of the vast amount of available information. However, the process involved with business/industrial products involves making assumptions and working to prove or disprove them, looking within the company for support, holding a brainstorming session with all departments involved to create some good preliminary ideas, and looking at the company's strengths and weaknesses. Once it has been determined what the company is comfortable manufacturing, or for which products it is seeking new markets, the company can proceed by: 1.looking at previous research, 2. participating in trade shows, and 3. being alert to subcontract opportunities.

11. MARKETING AND MANUFACTURING INTERFACE

CARRIE GOTLIEB, '*INTEL'S PLAN FOR STAYING ON TOP*', FORTUNE

The american semiconductor industry's weakness in manufacturing became apparent four years ago, when the Japanese took over the DRAM business and caused severe hemorrhaging in EPROM's by selling competing products below cost the gain market share, This article discusses about INTEL's manufacturing techniques and what they have learned from Japanese.

FISHER, ANNE B., ' *WHAT CONSUMERS WANT IN THE 1990'S* ' FORTUNE, JANUARY 29, 1990, PP: 108-112

This article discusses that the nineties will be a far less cynical decade than the eighties. Cost still will be the concern but family, community, earth will be valued and considered as well.

GILMORE, BARRY J.; COY, JONES A.; WRIGHT, PETER, 'INDIRECT VS. DIRECT COMPETITION : EVIDENCE FROM SELECT INDUSTRIES', INDUSTRIAL MANAGEMENT, MARCH-APRIL 1989, PP: 6-7

In this article select cases has been used to demonstrate how smaller companies could compete effectively, in industries that may be dominated by huge corporations.

KLEIN, EASY, '*MAKING INNOVATION PAY*', D&B REPORTS, JANUARY-FEBRUARY 1989, PP: 18-19, 44.

This article dicusses that innovation does not always have to be a gigantic leap into the unknown, it should be based at least in part on the company's track record. The whole point is to leran from experience.

KLEINER, ART, '*COMPUTERS*", PRODUCT MARKETING, PP:104-110

As people get used to having computers around, the focus of marketing could shift to software and accesories for performing particular tasks.

MUNRO, H. ; NOORI, H. , '*MEASURING COMMITMENT TO NEW MANUFACTURING TECHNOLOGY, INTEGRATING TECHNOLOGICAL PUSH AND MARKETING PULL CONCEPTS*' , IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, MAY 1988

Manufacturing automation is becoming an increasingly important strategic factor in North American companies. This paper characterizes the notion of push-pull integration in the context of manufacturing technology acquisition. The study concludes that both the technology-push and integrative perspectives yielded more commitment to technology adaption than did the market-pull approach.

PAYTON, T. H., '*TOWARDS COMPATIBLE OBJECTIVES-- THE PRODUCTION MARKETING INTERFACE*', MARKETING INTELLEGENCE & PLANNING (UK) 1986 PP:14-25

Two problems occur when one tries to classify objectives: clarifying often unstated or imprecise objectives, and showing their relationship to each other. Intention, directionality, and result are the 3 basic categories of objectives. The marketing objective must be the focal point when settingthe production objectives. The only time this should not occur is when the marketing objective calls for operating levels that are outside the capability of production resources. The marketing/production interface should start at the top of the planning hierarchy. At this stage, the fundamental issues of market opportunities, market needs, company capabilities, resource acquisition, and allocation are resolved. Internal consistency in planning must begin at this stage, too, by identifying divisional dependencies and influences. An understanding and recognition of how marketing influences and depends on the production function must begin during the planning process

PITTA, JULIA, '*CHALLENGE AND RESPONSE*', FORBES, APRIL 16, 1990.

This article discusses about the need for an industrial policy to protect the U. S. high-technology industry. Grove' s prediction is Japanese firms, having taken an important piece of the market for electronic components, will eventually take over the U.S. computer market as well.

ST. JOHN, CARON H., '*MARKETING AND MANUFACTURING AGREEMENT ON GOALS AND PLANNED ACTIONS*', HUMAN RELATIONS MARCH 1991 PP:211-229

A company's competitive strategy is implemented through the day-to-day actions taken and decisions made at the operating level of the firm. A study was conducted to determine: 1. the areas of disagreement between marketing and manufacturing groups within the same firm, 2. the level of support provided by marketing and manufacturing groups for the postures traditionally associated with their departments, and 3. the effect of written strategic plans and management by objectives (MBO) linked to performance appraisal on the common strategic vision. In the areas of disagreement, it was found that differences were firm-specific rather than representative of fundamental differences between marketing and manufacturing groups. Agreement between groups was significantly higher in those firmswhere marketing and manufacturing managers perceived that written strategic plans and MBO linked to performance appraisal were relied on frequently.

'THE SAGE OF SILICON VALLEY', BUSINESS QUARTERLY, PP: 9-15

Managerial experience of Andrew Grove .

WOHL, AMY, *'USER-DRIVEN, OR JUST DRIVING USERS CRAZY ?'* COMPUTERWORLD, NOVEMBER 13, 1989.

The article discusses that users want products to support their specific problems in a highly focused and useful way. But on the other hand vendors can't make money building thousands of individually designed, customer-specific products. Conclusion is products are only useful when they solve user problems.

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