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EARLY 21ST CENTURY DEVELOPMENT PROCESSES: THE FIFTH GENERATION IS HERE

To make the point of this article it is useful to recap the relatively short history of industry efforts to significantly improve product development processes. By the mid-1980s, the cycle times in all functions, except R&D and product development, had been reduced from months to either weeks or days or hours. Meanwhile, R&D and product development cycle times were still in months or years. Product development effectiveness and efficiency was the Achilles Heel of industrial cycle time for line functions and that remains unchanged today.

In 1983, Don Reinertsen rang the first bell to alert companies to the potential of time-based competition through improved product development processes. In 1986, Bob Cooper offered a process structure that worked using phase and gate steps and Eric von Hippel outlined the concept of lead users. In June 1988, Don Clausing and John Hauser broke the first ground towards improved product definition and specification of products through their HBR article on QFD, and the Department of Defense published a report coining the word "concurrent engineering." In 1990, Business Week ran a cover story on concurrent engineering. By the early 1990s, leading-edge companies had been benefiting from one or more of these new techniques for several years and they then began to promote and market their development prowess externally to enhance branding and further competitive advantage.

During the 1990s, the fast followers and some of the slow followers pursued the leaders. Most of these companies benchmarked the leaders and went to conferences and seminars where leaders shared their knowledge. Many companies achieved the processes that the leaders had already been using for half a decade or more.

Meanwhile, leading companies had realized that it wasn't good enough to simply focus a process solely on development. They added a phase to the very end of their development process focused on launch and commercialization activities. They soon realized that one also needed to reap the benefits of the investment as soon as possible. The addition of this back-end phase then caused ripple changes in the preceding two or three phases prior to commercialization to improve launch preparedness.

Leading companies, perhaps first credited to Edith Wilson at HP in 1990, realized that the largest source of variation in development processes was constantly changing requirements. A great deal of resources was brought to bear across industry on product definition and the management science evolved. In 1994, John Hauser and Abbie Griffin described practices they called Voice-Of-The-Customer (VOC). Leading companies changed their fuzzy front-end practices. Too many simply relabeled existing practices using the buzz of VOC.

The point here is that, for almost fifteen years now the middle of the process has remained unchanged. Industry has been working on the front ends and back ends. In the repetitive, discrete, and job shop industries the Development Approval milestone is typically followed by Protoype which is followed by Validation which is followed by Pilot or Ramp-Up or Scale-Up. In the

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process and life sciences industries, Development Approval is followed by Pilot and then Validation and then Scale-Up. Most every industry, excluding software-only companies, focuses its attention on the first physical manifestation of development after the development project is approved.

What is about to happen will usher in the fifth generation of product development processes. There has been enough improvement in design, simulation, and testing software and in computer hardware processing power and storage ability, that physical milestones are about to be replaced by digital milestones in the next few years across all industries. We are about to enter the *Electronic Development Age*. Process and life sciences will have eProcesses and physical product companies will have eProtos.

Generation	Time Period	Product Development Process
1	BC – 1920	Master - Apprentice
2	1920 – 1975	Functional – Sequential
3	1975 – 1990	Matrixed – Sequential
4	1990 – 2005	Cross-Functional – Phased
5	2005 – 2020	Electronic – Phased
6	2020 – ????	Virtual – Simultaneous

For the next two decades, the physical milestones that currently follow Development Approval will begin to be replaced with "eProto" and "eTest or eValidation." This will then lead to a reduction in the number of physical milestones such as Alpha/Beta/Pilot/Scale or Proto/Pilot/Ramp. To get the bugs out most companies have three to four physical product milestones prior to launching. There will be a much greater percentage of first-pass and second-pass success, which, little by little, will result in several digital prototype milestones and fewer physical ones.

Then, just like the pattern of the 4th Generation (which is now ending) the reinvention of the development process will then lead to ripple effects in both the front-end and the back-end. Soon, digital models will become transparent over discontinuous systems and networks and they will be much easier to create quickly. Digital modeling will then become a significant activity in requirements gathering and validation, target costing, and supplier selection changing these 5th generation front-end processes. At the back-end, eProtos and eTest results will become the norm of potential customer consumption. Customers will make many decisions as products are nearing the end of the eProto cycle. Sales people will ship digital manifestations of products to customers and clients and will be able to begin their sales cycle shortly after "eTested eProtos" are available. The many months formerly consumed in the several rounds of building and breaking physical products will now be measured in weeks. Customer decision/buying time will greatly exceed physical pilot and scale-up time.

For the past 4-6 years, leading companies have been redesigning their processes and management review points to focus on eProtos and eTest. They continue to run using phases, but the development milestones themselves are preceded by the letter "e." Soon we will see these leading companies once again externally market their development prowess. We will then watch the front-end and back-end processes of these leaders as the "eRipple" makes its way from the middle of the process outward to both ends. The 4th and 5th generation processes are likely to be similar in their evolution, just like the 2nd and 3rd generation processes were. PD

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