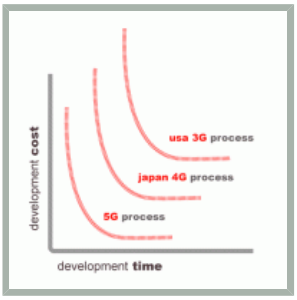
five generations of innovation



characteristics

author:	Rothwell, Roy R.
country:	United Kingdom
period:	1994
type:	model
role:	consultant, change agent and manager
activity:	analyse, design and reflect
topic:	org. design & development and innovation & risk
abstr. level:	environment
perspective:	living
status:	under review
module:	innovation
comments:	1

related models

corporate innovation indicators

description:

The British sociologist, Roy Rothwell, an academic primarily at the University of Sussex, was widely regarded as one of the pioneers in Industrial innovation with his significant contributions to the understanding of innovation management.

Rothwell's five generations (5G) of innovation provides an historic overview of industrial innovation management in the Western world between the 1950's and 1990. Each of the five innovation management 'generations' arose from different and distinct business environments. Rothwell observed that more effective innovation processes lead to a decrease in market time and a reduction in product development cost. His desk research focused on technological innovation at multinationals and high-tech start-ups. The model is to be used when defining a corporate innovation management strategy.

Rothwell created his 5G framework by combining Niosi's 4G innovation model with his own analyses of successful innovation management practises. The five generations of innovation management is a descriptive model of how (manufacturing) companies structure their innovation processes over time.

Rothwell identified five generations of innovation management over a period of forty years that begins in the 1950's. He found that each new generation was, in fact, a response to a significant change in the market such as economic growth, industrial expansion, more intense competition, inflation, stagflation, economic recovery, unemployment and resource constraints. A change in generation requires a company to update their strategic focus, overhaul the current innovation process and develop new market niches.

The five generations are:

1. TECHNOLOGY PUSH

From 1950 to the mid-1960's, fast economic growth led to a 'black hole demand' that allowed a strong 'technology push' and industrial expansion in the Western world and in Japan. Companies focused predominantly on scientific breakthroughs -- "the more R&D in, the more new products out." This was nicknamed the 'strategy of hope' -- "Hire good people, give them the best affordable facilities, then leave them alone." Research & Development was considered as corporate overhead and relegated to an 'ivory tower' position. Innovation occurred at the fast growing multinationals isolated from universities.

2. MARKET PULL

The mid 1960's to early 1970 were characterized by a 'market shares battle' that induced companies to shift their development focus to a 'need pull'. The central focus became responding to the market's needs. Cost-benefit analyses were made for individual research projects including systematic allocation and management of resources. Stronger connections were initiated between R&D and operating units by including product engineers in scientist run research teams in order to decrease time to market.

3. COUPLING OF R&D AND MARKETING

From the mid 1970's to the mid-1980's, 'rationalization efforts' arose under the pressure of inflation and stagflation. The strategic focus was on corporate consolidation and resulted in 'product portfolios'. Companies moved away from individual R&D projects. Marketing and R&D became more tightly coupled through structured innovation processes. Operational cost reduction was a central driver behind this 'coupling model'.

4. INTEGRATED BUSINESS PROCESSES

When the Western economy recovered from the early 1980's to the mid-90's, the central theme became a 'time-based struggle'. The focus was on integrated processes and products to develop 'total concepts'. Typical of this fourth generation was the 'parallel and integrated nature' of development processes. Externally, strong supplier linkages were established as well as close coupling with leading customers.

5. SYSTEM INTEGRATION & NETWORKING

Finally, from the 1990's onwards, resource constraints became central. As a result, the focus was on 'systems integration and networking' in order to guarantee 'flexibility' and 'speed of development'. Business processes were automated through enterprise resource planning and manufacturing information systems. Externally, the focus was on 'business ecosystems'. Advanced strategic partnerships were setup as well as collaborative marketing and research arrangements such as 'open innovation'. Added value for products was to be found in quality and other non-price factors.

assets:

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pros:

- The model is best used for decreasing development costs and increasing the speed of development. It provides a versatile checklist of innovation management activities that enables them to be assessed and optimized. The model can be applied as a situational intervention tool in which the current problem situation can be matched with an historical market situation. The recommended actions that belong to a given generation can then be applied to the organisation.
- There is wide consensus on the definition of the five generations given that a broad range of academic articles was integrated into this one model. A rare exception is an article from the Delft University of Technology (Berkhout et al.) that reframed the 4th and 5th generation into a Cyclic Innovation Model and defined a 6th generation to build upon the core model.

cons:

- The model is a too simple a representation of a complex reality. Processes belonging to distinct generations can occur concurrently □ generations are not mutually exclusive; causality between the market and the innovation process is ambiguous and create the perception that 5G is □hot□ and other generations are □passé□.
- The fifth generation is predictive and open-ended. This last generation started in 1990, but does not have a end-date. Rothwell published his article in 1994. The long list of twenty-four 5G characteristics is inductive. The fifth generation is not clearly defined at an operational level in contrast to the other four generations.
- The theoretical background of the 5G model is the extension of a three generation model developed in 1991 by three consultants at Arthur D. Little. This 3G model was used to categorise a series of organizational interventions by which R&D could be used as a strategic, competitive weapon. This initial model focused on the optimization of research projects. At 4G, this is optimized □deeper□; business processes are managed in parallel and integrated. The 5G model developed from the 4G process added a stronger focus on technologies that enable innovation. It is not unlikely that a 6th generation model will appear.

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