

Riding the Wave of Big Data: Towards a Rapid Systematic Innovation Framework

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No longer business as usual...

China factory orders shrink, but both world and domestic demand are down

China needs growth to employ millions, but both world and domestic demand are down

生存，中国制造业的艰难选择

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Innovation - Key to SMEs Competitiveness

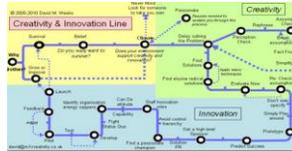


Barriers to SMEs Product Innovation

Researchers point out new products have a remarkably high failure rate, at around 50%, and this performance has not changed much over the past 20 years. This is because many challenges involves in product innovation such as:



Creativity or new idea



Long and complex process

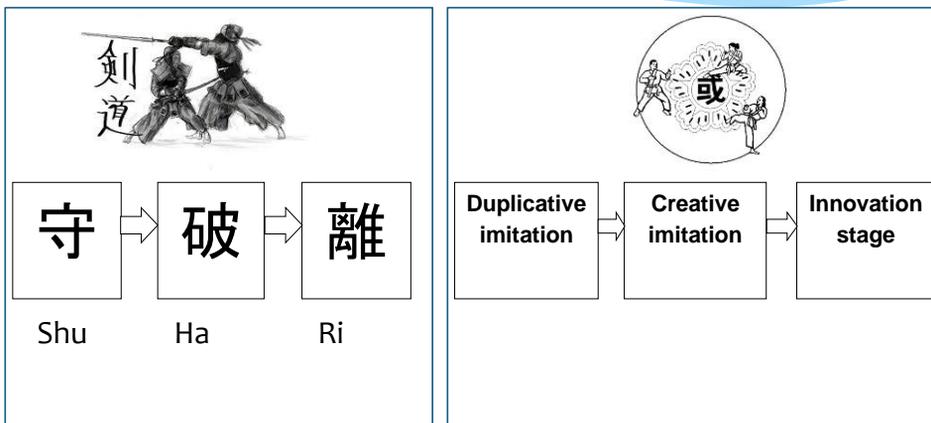


Time to market/volume



Huge resources and time consuming

Japanese and Korean PI stages are quite similar



Chinese SMEs Take a Different Path...



Adoption



Adjustment



Alteration



How could SMEs overcome the innovation challenges?



Chinese style innovation
(Big Data, Accelerated)



World leading innovation

How to harvest big data to achieve rapid innovation?



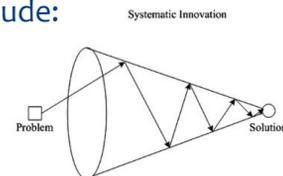
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Systematic Innovation Models



- * According to Sheu and Lee (2011), systematic innovation is a methodical approach to innovation, where optimal solutions are converged from wider possibilities by analysing situations and resources systematically.
- * Conventional processes from literature include:
 - * TRIZ
 - * Mann's (2004) Framework
 - * Sheu and Lee's (2011) Framework



Systematic analysis: robust, quickly convergent to optimal solution
Source:

Sheu, D. D., & Lee, H. K. (2011). A proposed process for systematic innovation. *International Journal of Production Research*, 49(3), 847-868.

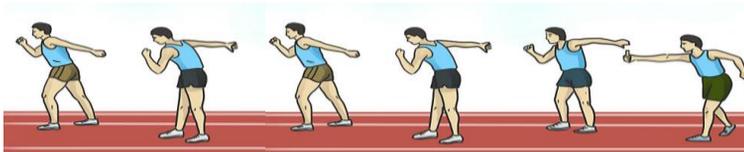
Structured Innovation Approach

- * Two common types of conventionally structured innovation process:
 - * Phased Program Planning (PPP) (Takeuchi and Nonaka, 1986) / Phased Review Process (Cooper, 1994)
 - * Stage-Gate Process, which was developed in 1980s and has been widely applied since then (Cooper, 1990; Cooper, 1994; Cooper, 2008; Cooper, 2011), evolving into modified versions:
 - * Stage-Gate Process (Cooper, 1990)
 - * Third-Generation Stage-Gate Process (Cooper, 1994)
 - * Portfolio Life Cycle Process (Hughes and Chafin, 1996)
 - * Next-Generation Stage-Gate Process (Cooper, 2008)



Phased Programme Planning (PPP)

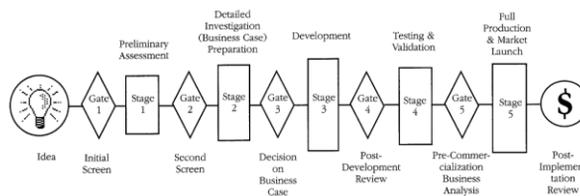
- * Endorsed by NASA, PPP was exemplified in the 60s as a sequential development approach for new products (Takeuchi and Nonaka, 1986; Cooper, 1994)
- * Under PPP, NPD process was designed like a relay race (Takeuchi and Nonaka, 1986; Cooper, 1994)
- * Project activities were run not in parallel but in sequence, with hand-off points between each phase



Adapted from Takeuchi and Nonaka (1986)

Cooper's (1990) Stage-Gate Process

- * Cooper (1990) proposes a stage-gate system which recognizes that innovation is a process which can be managed
- * A stage-gate process is conceptual framework which acts as a roadmap to help ensure the effectiveness and efficiency in new product development projects, from idea generation to product launch and beyond.
- * A typical stage-gate process has five stages and five gates, with activities running in parallel for time compression. Each stage requires cross-functional team efforts, with clear governance process and accountability installed while each gate acts as a go/kill decision point by management.

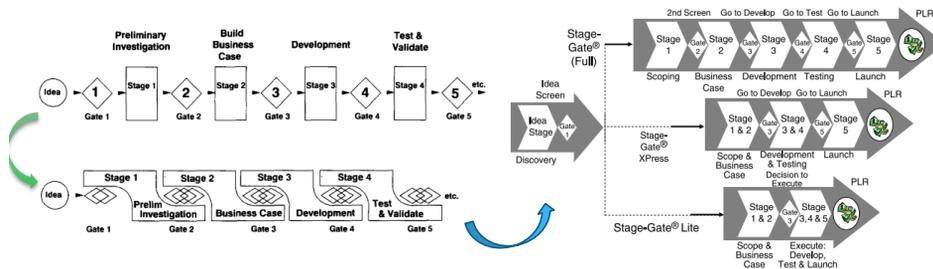


Source:

Cooper, R. G. (1990). Stage-gate systems: a new tool for managing new products. *Business horizons*, 33(3), 44-54.

Cooper's (1990) Stage-Gate Process Upgrade

- * Cooper's (1990) stage-gate process has evolved over time.
- * Third-generation stage-gate process is more flexible and adaptable with overlapping stages, has conditional decision gates, builds in project prioritization function and focuses on resources allocation (Cooper, 1994)
- * Next-generation stage-gate processes merge different stages together in different ways to scale down the system for smaller projects (Cooper, 2008)



Source:

Cooper, R. G. (1990). Stage-gate systems: a new tool for managing new products. *Business horizons*, 33(3), 44-54.

Cooper, R. G. (1994). Perspective third-generation new product processes. *Journal of Product Innovation Management*, 11(1), 3-14.

Competition with Time

- * Today's market is fast-paced and competitive, it is necessary to speed up new product development (Takeuchi and Nonaka, 1986; Schilling and Hill, 1998)
- * Fast new product development cycle time and time based competition has become the norm (Rosenau, 1988; Rosenau, 1990; Smith and Reinertsen, 1991; Uttal, 1987; cited in Page, 1993)
- * Shorter product life cycles put pressure on an increased rate of new product innovation (Guveritz, 1983; Rosenau, 1988; cited in Griffin, 1997a)
- * Although there have been efforts to shorten NPD processes through improvement of the previous models (Cooper, 2008), the conventional NPD process remains long – Griffin (1997b) reported that new product development cycle times can range from 0.25 – 72 months, depending on product type and complexity



Before



After

Achieving Cost-effectiveness

- * Despite the fact that up-front activities are essential to NPD (Cooper, 2008) and much resources and effort are placed in the up-front activities under conventional NPD approaches, Urban and Hauser (1993) found that the new product success rates were low and showed little improvement over time (Wind and Mahajan, 1997).
- * Estimates of new product failure rates ranges 37%-80% (Urban et al, 1987; cited in Shah, 2010)
- * These figures show that the current NPD approach is not too cost-effective, especially to SMEs, which are normally in lack of financial resources and technical expertise (Rothwell, 1983; Rothwell, 1984; Rothwell, 1988; cited in Freel, 2000)
- * To ensure high success, firms should leverage on disruptive strategy, which has a rate of 33% estimated success (Christensen, 2002); however, there is a void in literature with a lack of frameworks of disruptive innovation process



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Big Data

“Big Data is the next frontier for innovation, competition, and productivity” – McKinsey, 2011; 2013

One of the best advantages of big data is in developing new products and services (Davenport, 2014). With big data, firms can gain a better understanding of their products, customers and markets, and this is crucial to innovation.



So, what collects big data?



Games Boxes and GPS Systems Internet Service Providers



HDTV's and Blu-Ray Players with built-in Internet connectivity Movie Rental Sites



.....

Big data is pushing the traditional operations and product innovation to a higher level...



Drive incremental revenue

- ✓ Predict customer behavior across all channels
- ✓ Sharpen product competitive advantages
- ✓ Increase innovation of next generation product



Improve operational effectiveness

- ✓ Machines/sensors: predict failures, network attacks
- ✓ Financial risk management: reduce fraud, increase security
- ✓ Reduce downtime



Reduce data warehouse cost

- ✓ Integrate new data sources without increased database cost
- ✓ Provide online access to 'dark data'

Big data is the game changer

Examples of using big data to facilitate new product development



Volume - Dell initiated to develop a database that includes 1.5 million records related with sales and advertisements to develop new products; and Tesco generates more than 1.5 billion new items of data every month to improve operations efficiency and better understand their customers.

Variety - Tata Motors analyses 4 million text messages every month, spanning everything from product complaints to reminders about service appointments to announcements to develop better engine models.



Velocity - Twitter and produces over 120 million contents per day, and firms are now capable of gathering users' feedback in near real time to track changes in customer behaviour and rapidly communicate this to the R&D team (Davenport 2006; Manyika et al., 2011).

Case 1: Precision Angle and Levelling Instrument

- * Traditional Spirit Levels and conventional single-axis pendulum-based electronic Inclinometers are mechanical products that have been existing in the market for a long time
- * As a highly commoditized product with simple technology, this innovation is neglected in the market and are sold at a low price.
- * Rapid innovation on traditional levelling instruments has been catalysed with advanced 2-axis MEMS Technology; the improved innovation can make accurate measurement despite nonlinearity and temperature variation in the environment.
- * Because of the enhanced performance of the digital precision angle and levelling instrument, it has been widely used in different industries, eg. aerospace, automotive, civil engineering, hardware and DIY, manufacturing, medical technology, offshore and shipbuilding, photo and videography, precision engineering, railway maintenance and operations, research and education, and semiconductor industry (jsbtech.com).



A spirit level's vial



Mechanical spirit level clinometer with micrometer adjustment

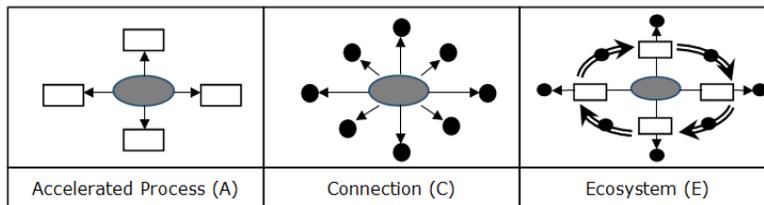


Digi-pas 2-Axis ultra precision inclinometer

Source: <http://www.jsbtech.com/precision-measurement.php>

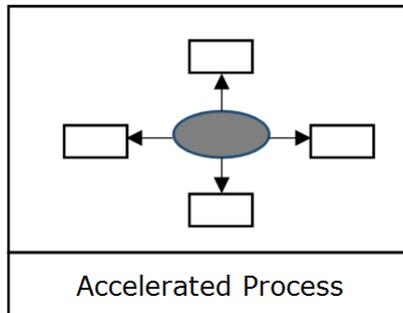
Rapid Innovation Framework

A framework to assist firms in product innovation through utilising big data to shorten the time lead to market, improve customers' product adoption and reduce costs.



It is termed the ACE framework because it is based on the principles of Accelerated Process (A); Customer Connection (C); and Ecosystem (E).

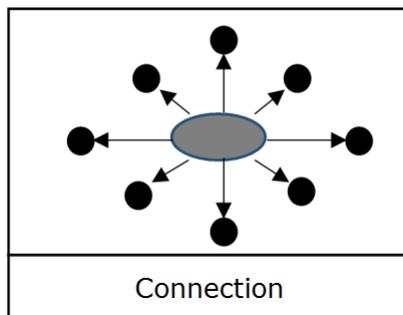
Accelerated process can result in a quicker realization of profit, and there will be a lower risk that the competitive situation or market has changed before the new product can be launched.



In order to achieve the accelerated process, the most important elements are:

- Autonomy Management
- Cross-functional teams work in parallel
- Divides project into small elements
- Big data supported communication and development

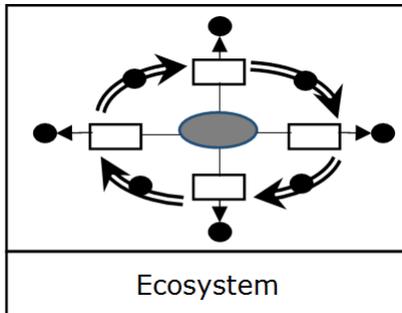
In addition to being able to develop new products rapidly, product innovation has to be close to the market to stay abreast of the evolving needs for functionality, which in turn are driven by quickly evolving customers' taste.



In order to achieve the customer connection, the most important elements :

- Using big data to understand customers and market
- Keeps close to customers
- Updates the latest product information quickly
- Interact with customers and gathers useful feedback

Ecosystem is an innovation and market testing environment in order to develop new products at dramatically fast speed and lower costs.



In order to achieve the innovation ecosystem, the most important elements are:

- Builds strong networks with partners and customers
- Launches the new product quickly
- Gathers feedback quickly from customers and partners
- Redevelop the product to meet the needs which triggers further improvements

Case 2: Electronic luggage combination lock

- * Mechanical lock and digit-dial lock have been in the market for decades, they do not pose the maximum convenience to users who may accidentally lose the key of the lock or forget the password of the lock.
- * But surely there is a market demand for luggage lock as travellers do value the lock-up function that combination locks provide to protect their properties while travelling.
- * Targeted innovation on luggage lock is applied through the use of proximity access security and smart identification technologies, deploying advanced near-field communication and biometric fingerprint authentication sensors to enhance security performance.
- * The new electronic combination lock supersedes the traditional mechanical lock or digit-dial lock by eliminating the chance to rummage for keys, to misdial the digital wheels, or to forget the password of the combination lock, ensuring a hassle-free user experience and peace of mind. Also, the RFID tag embedded helps to conceal users' personal information, providing much higher level of privacy (egeetouch.com)



Digit-dial luggage lock



eGeetouch digital combination lock

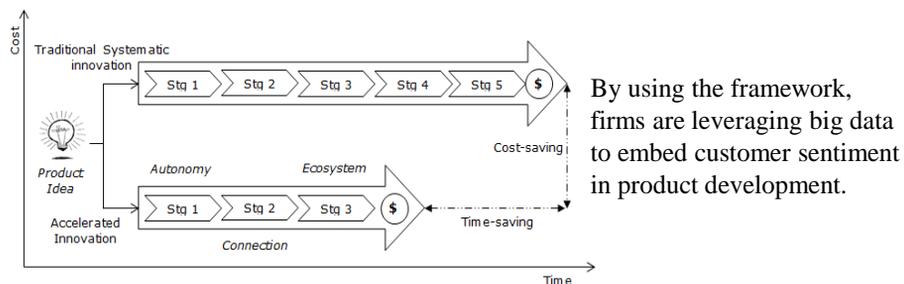
Source: <http://www.egeetouch.com/about/r-and-d-capabilities/>

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Conclusion

Compared with traditional innovation approaches, accelerated innovation gives particular emphasis to efficiency and cost saving.



By using the framework, firms are leveraging big data to embed customer sentiment in product development.

This enables firms to move away from product-focused innovation and turn their attention to innovation around their customers and partners.

Further Works

- * Product innovation – end of life products
- * Rapid product ramp-up capabilities
- * Amazon & Ebay for fast worldwide market penetration
- * Social media – inputs for rapid product upgrades etc.
- * Wider applications in other industries
- * IP protection

Thank You