Big Data and Leadership for Innovation- An Aggregator Model

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ABSTRACT

The emergence of Web 3.0 and Big Data have changed the business landscape and made speed as a key differentiator for sustenance of competitive advantage of enterprises, particularly businesses. Given the complexity of managing the new Web in an enterprise, implications on CEOs' focus on management are not discussed in literature.

This paper studies the role of Big Data in innovation and investigates how CEOs can leverage on the new IT tool(s). It introduces the *Nayar-Lanvin Model for Leadership of Innovation* as a way to manage the new leadership role required for innovating enterprises in the new era of Big Data and its effect on competitive advantages.

Key Words: Big Data, Semantic Analytics, Leadership Framework, Innovation

INTRODUCTION

This paper examines leadership of innovation in the context of finding new competitive advantages in a Big Data driven world. Rapidly evolving IT has given us for real time data analytics leads to availability of multiple new opportunities in the market space that, unless taken up rapidly, can disempower existent businesses rapidly. Speed is thus the essence and hence the Big Data driven world requires a leadership role that aggregates available potential opportunities, sifts through these, aggregates resources and (internal and external) talents, in order to actualize the sifted opportunities.

I. T. IS KEY TO NEW INNOVATION

IT is the key to new innovation (Mann 2012). The widespread use of IT in the 1990s spurred a new industry built not only on stand-alone applications but also on the internet which rapidly became commonly available as a tool for interconnectivity between people. Web 1.0 (document exchange; lacking participation) has limitations and this led to Web 2.0 which boosted collaborative innovation.

Web 2.0: Web 2.0 covers a range of technologies, most commonly, social networks, blogs, wikis, podcasts, information tagging and prediction markets. The phenomenal use of Web 2.0 (mostly, Social Networks) gives enterprises access to vast amounts of data, giving rise to a lot of opportunity for services innovation.

Web 3.0: Web 3.0 or Semantic Web ties each data item on the web to other data items of like kind, regardless of their location. It is a major step up in the evolution of the Web, with significant features broadly classified under two key functionalities: greater interoperability, and computers deriving meaning. These features enable users to search for contextually appropriate content instead of character strings. Thus, Web 3.0 browsers will make searching

easier and intuitive – operating on cross-application data and allowing intelligent questions. This is useful both for innovators and for end users. End users will be able to type-in complex search questions – equivalent of conditional searching in programing – instead of using the results of one search to feed the next search. With repeated use, Web 3.0 enabled browsers will, like personal assistants, 'learn' what users want, and need less structured queries.

WHAT IS BIG DATA?

Big Data is the very large volume of structured and unstructured data generated by social networks, smart devices and the 'Internet of Everything' (or M2M, machine to machine network connection). Two definitions commonly used are, the data centric "data that cannot be fit into a relational database", and the user centric "subjective state a company finds itself in when its human and technical infrastructure cannot keep pace with its data needs" (Aziza 2013)

Every interaction of a person on the internet adds a little more information about the user's publically known profile. This makes it easier for marketers to target products to individual requirements rather than to demographic approximations. If big data is ubiquitous, an individual's profile is easily available and takes the guessing out of meeting strangers, and every individual becomes less unknown or unpredictable. The Economist Intelligence Unit says that more companies in US have a Chief Data Officer, to make use of the massive volumes of data available to them from the Web. Thus social media captures comments, likes and suggestions from customers and potential demographics that can be studied in order for the company to make appropriate strategic choices (Giles 2012).

Big data, accompanied by cross-database correlation and analysis, enables services to be personalized to the extent of individually tailored solutions in, say, health care, and marketing. Other service functions, transport for instance, could, in the reverse, dispatch dynamically their services based on where traffic is accurately predicted to congregate.

Today businesses can measure their activities and customer relationships with unprecedented precision. The arrival of smart devices and Web 2.0 has led to an explosion of data on the Web. This is particularly evident in the digital economy, where clickstream data give precisely targeted and real-time insights into consumer behavior. CISCO's Chief Technology and Strategy Officer, Padmasree Warrior predicts three vectors of differentiation – data differential with more and more devices and sensors churning out that data over the 'internet of things'; experiential differential driven by customer-pushed needs; and a velocity differential that is driving the shift to cloud computing ('Saas') with IT as a service, not a data centers investment with delivery time constraints. Although IT companies of the future will have to solve these three problems, what is important here is not the data, but the analytics that will be applied to make the business process a better process (Warrior 2013).

The browser will gravitate towards being the database of the future. Big data, super intelligent content and knowledge management services are clearly the medium term future. Innovative applications based on Big Data will help service providers foster closer ties with customers, partners and employees. With Web 3.0, elaborate and complex virtual worlds where social interaction drives business operations can be realized through the Internet (Laurent 2013).

Role of Big Data: The following paragraphs examine the various applications of Big Data today: *Big Data and Marketing:* Big data alters marketing strategies and customer relations marketing (CRM).

The main enabler is data – mostly structured data.

More accurate and timely the information available, more realistic is its usage for service innovation. A shift from reactive to predictive and proactive care will follow, and change the face of healthcare. Big Data from Web 2.0 and semantic data analytics will make available patient centric data so large that individualized care can be tailored to fit exact needs (Rometty 2013). Emerging technologies are poised to personalize consumer experience radically via On-demand Marketing (Dahlström and Edelman 2012)

Innovation of Operations: Companies that are measure their operations more carefully, taking these very large volumes of data and creating more analytical types of management practices, are dramatically outperforming their competitors.

The pervasive use of IT has made customers an unsolicited business partner, as purchases and searches are tracked to tweak everything from websites to delivery routes … Rather than model hypothetical market scenarios, businesses can now get an answer in real time. … IT reduces the 'hypothesis-to-experiment' cycle time. Such packages are even available off-the-shelf. These packages (covering pricing, inventory management, labour scheduling, and more) can be cost-effective and easier to install than internally applications.

Big Data and Retail Management

It is said that you can't manage what you don't measure. Because of big data, managers now know much more about their businesses, and directly translate that knowledge into improved decision making and performance. This is especially true for retail management, since so much of life-cyle of the retail industry is now digital. Once shopping moved online, of customer understanding has increased dramatically. Online retailers could not only know what is bought, they also know how customers navigated through the site; how much they were influenced by promotions, reviews, and page layouts; and similarities across individuals and groups.

Big Data and Analytics

Smart leaders see using big data as a management revolution. But as with any other major change in business, the challenges of becoming a big data–enabled organization can be enormous and require hands-on—or in some cases hands-off—leadership. Nevertheless, it's a transition that executives need to engage with today (McAfee and Brynjolfsson, HBR Oct 2012)

Is 'big data' the same as 'analytics'? Almost – but with three key differences:

Volume: As of 2012, about 2.5 exabytes of data are created each day, and is doubling every 40 months or so. Walmart collects 2.5 petabytes of data every hour from its customer transactions. A petabyte is one quadrillion bytes, or the equivalent of about 20 million filing cabinets' worth of text. An exabyte is 1,000 times that amount, or one billion gigabytes.

Velocity: Real-time or nearly real-time information makes it possible for a company to be much more agile than its competitors.

Variety: Big data takes the form of messages, updates, and images posted to social networks; readings from sensors; GPS signals from cell phones, and more.

Computerized Data Analytics is in early stages of development. However, most companies do not have a Big Data plan for themselves. High-performing companies will embed analytics directly into decision and operational processes, and take advantage of machine-learning and other technologies to generate insights in the millions per second rather than an “insight a week or month” (Davenport 2013).

Data is a competitive advantage. Hence, Database

management is a core competency of Web 2.0 companies (O'Reilly, 2005). As more and more devices are connected to the new platform, new innovative applications become possible. Creating of innovative services requires data on targeted audience. The winner will be the company that first reaches critical mass via user aggregation, and turns that aggregated data into a system service.

'Velocity for Insight' as a business necessity: After a period in which innovation was concentrated on the scale and breadth of data, technology providers have begun to focus on velocity. For the first time, business leaders can ask their databases specific ad hoc questions and receive immediate answers. But, greater speed costs more. Data showing a live search for lower-cost service options on the company's website might prompt instant ideas for new sales.

Service analytics are able to provide customers better service at restaurants. In new data driven restaurants, every item sold, tip received, and every moment of a restaurant experience is recorded, profiled, and analyzed. Startups like Slingshot build data solutions tailored toward the restaurant business (Kolb and Kolb 2013). This change is powered by transaction data. Orders are entered instantly into the computer system and trends and anomalies analyzed. This change to data driven business is an example of companies building analytics tools tailored to small business needs. Kolb and Kolb predict 5 developmental directions to watch, most of which predicted to happen within the next 3-5 years, while others are already happening:

1. New applications will crunch data in real time and tell users what is interesting by learning what they find interesting
2. Better visualization and presentation of graphics, leading to easier understanding, and faster decisions.
3. Self-service data intelligence using Data Discovery tools
4. Natural intuitive data interfaces (touch, voice, gestures) abstract away complexity, enabling finding valuable information without expertise. Apple's Siri and Microsoft's Kinect train people to use voice and body gestures respectively. These modes of input combined create interactive environments that let you explore the data and interact with it.
5. Collaborative: Data that needs to be evaluated is simply too big to look at efficiently. The new types of interfaces (as explained above) will alleviate that problem.

This new data centricity leads to more and more individual-customer-specific innovation giving more customer tailored services. This makes it more attractive to Asian innovation needs.

ASIAN INNOVATION

Big Data and Analytics could be the twin forces driving innovation in Asia – one provides information while the other sifts through it for precious insight. In Asia, applications are endless, given the heterogeneity: Asian companies tend to work on existing products adapting these to local community needs, driven by diversity of Asian marketplace, price sensitivity, and features its target customers need. Contextual search has a major role here.

Since cost and social factor alleviation are two major considerations in Asia, a major role will be played by the open and free access to governmental and research data. This is called Open Data.

Open Data

Governments and states hold gigabytes of data. This data is beginning to be used for making cities safer. City administrations like San Francisco lead Web 3.0 open-source government efforts, opening public information – train times, crime statistics, health-

code scores -- to software developers who then use this data to create innovative applications tailored to residents' needs (Kazan, C. 2010). For instance, with the data and the analytics, a department could receive a daily report of possible crimes including likelihood, location, and timeframe, all with ranges and calculated probability – and take action for crime prevention. This is just one way government could use data and analytics to make societies better, and the wealth of data available to the government is staggering. If cities start using data to its full potential Data Science teams can create transformative tools with this wealth of information. (Kolb, Jeremy 2013). Police in Maryland and Pennsylvania are taking an even more data science-driven approach, crunching databases of tens of thousands of crimes and looking for patterns. Software automates decisions once made by police officers and judges, and this move to data-based decision making has dramatically decreased the percentage of repeat offenders among parolees (Kolb and Kolb, 2013).

Governments are now putting large data sets on the Web in data.gov and data.gov.xx sites. The notion of Open Data, data made freely available, could be used for innovative applications based on interoperable databases used for social uplift and poverty alleviation. Food-policy experts believe that a crucial step toward that goal is to give farmers, scientists and entrepreneurs unhindered access to agricultural data which is generated at research centers worldwide (Patel, 2013). For instance, apps on farmers' phones could club information about that areas soil condition, matched with best seed and fertilizer information for that soil type and, further, with locational information of seed distribution centers. Making such “what if” scenarios a reality will require increasing amounts of free, accessible agricultural research data that is easy to use, not just by humans but also by machines. Much of the data has been collected by scientists at universities and research centers – like plant genomics, weather conditions, data sets on crops for certain soils, rainfall changes, signs of pests and diseases, and anticipated prices at local markets – and made purposefully inaccessible for security or privacy reasons.

Google's Ray Kurzweil, winner of the US National Medal of Technology and Innovation, predicts that, powered by Semantic Web, computers will have emotional intelligence by 2029. Google is making strides towards understanding complex natural language and with it the ability to move well beyond recognizing keywords and onto understanding the emotional and intelligent content of web pages and of users' search requests.

The challenges presented by Big Data will only continue to grow as companies generate more new information day-by-day, minute-by-minute.

NEW LEADERSHIP FRAMEWORK

Most leadership frameworks are built for the business and organisation models of the 20th century. However, with 'Velocity for Insight' becoming a business necessity, driven by Big Data and the emerging information driven world, leadership roles too need to change, so that businesses – and other organisations – can remain competitive in an age of transient competitive advantage.

INSEAD's Global Indices – A Country level model

INSEAD Business School, Paris, and the World Economic Forum jointly published The Global Innovation Index (GII), Global Information Technology Report (GITR) and the forthcoming Global Talent Index 2013. These can be seen as a framework of three indices that define the competitiveness of countries

(http://www.insead.edu/facultyresearch/centres/elab/).

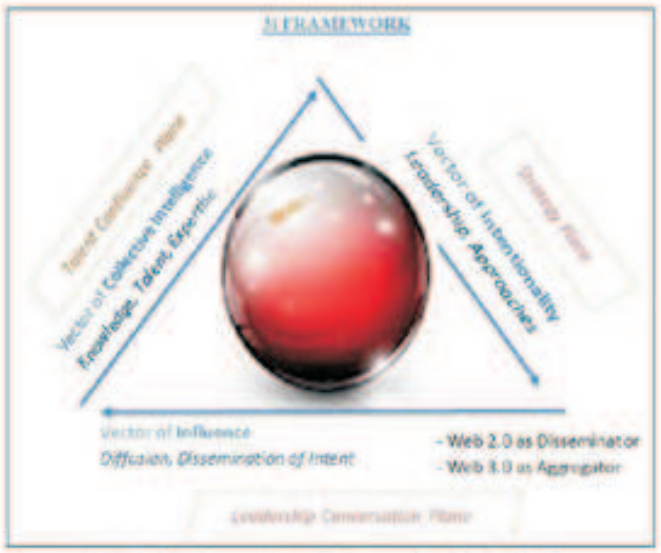

Fig 1: The Nayar-Lanvin Frameworks (above) for Innovation

These reports index countries on innovation parameters and list the effects of new trends and practices in innovation at the global level. Taken together, thus, it follows that leadership requires an Information Technology environment as well as human talent or skills.

While not explicitly a framework, the three vectors effectively constitute a framework for innovation leadership at a macro level.

Nayar-Lanvin frameworks for Enterprises

This section discusses the *3i (Intent-Influence-Intelligence) Framework for Sustaining Innovation* (Nayar 2013), and its extension: the *3A framework of leadership for innovation*. The 3i framework postulates intentionality (innovation strategy), influence (diffusion of leadership intentionality) and human skills or talent pools (which could include communities of practice, and open innovation) as necessary building blocks for sustainable innovation in enterprise. These vectors help ensure a culture of innovation by disseminating the leadership intent and strategies widely within the organisation, capitalizing on new ICT social networks and other Web 2.0 tools including Wikis and blogs. Emergent technologies like Web 3.0 based Semantic Innovation Management (Ning and O'Sullivan 2006) help aggregate the diffused innovation while Semantic Analytics help aggregate the structured and unstructured data generated by the Web 2.0 tools.

The significance of this framework is that it meets the necessity and sufficiency requirements for sustained innovation in any firm. Any one of these vectors is insufficient by itself to sustain innovation in the firm. For instance, if the enterprise has the right talent (the vector of collective intelligence) or pool of innovators, the pool will be able to produce innovation in their designated functional area, say new products development. However, this is a management of innovation; it does not inspire new service innovation or operations innovation which can change the firm into a firm of innovators. Next, in the presence of two of the three vectors, say intentionality (clarity on leadership intent and strategies) and, say, the right talent (the vector of collective intelligence); but with the absence of the dissemination of that intent and the associated strategies, innovation with remain flat or 2D, and will not be multidimensional.

This is indicative of a 'tall' organisation, with layers of hierarchy. Flat innovation occurs in firms that operate in the present – an existent strategy, for instance and is not sustainable.

1.1.1. Strengths and weakness of the 3i framework:

The strength of the framework is that it describes with sufficient simplicity a complex array of characteristics (like ontology, intentionality, engagement, social networks, Web 3.0 technology, and talent retention) into one simple framework.

The simplicity is also seen in the fact that the framework specifies vectors, rather than axes in the strict sense of the term, since an axis has an origin (zero value) and extends to infinity whereas a vector merely indicates direction or size, without defining a

gradation. Further, the cross-effect of the vectors can be studied. The area between any two axes defines the appropriate plane. The *talent confluence plane,* the plane between talent- and influence- vectors, thus describes the area where 2D / planar innovation happens, as described above. Similarly, the intersection of the vectors could be examined for identifying potential competitive advantages.

The weakness of the framework is that it does not cater to the implementation of the innovation strategy. This weakness is partially addressed in the detailed discussion of each vector and outside the scope of discussion here, and partially by the extended 3A framework of leadership for innovation (fig 2).

1.1.2. Comparisons with frameworks in literature

The 3i framework is consistent with the proposed by Prahalad's, the INSEAD's global indices, Bain's leadership model and, IDEO's model. The basic elements of Prahalad's opportunity gap management framework are paralleled in the 3i framework

- 'Strategic Intent' element is the same as the Intent vector of the 3i framework,
- 'Core Competencies' element matches 3i framework's Talent Vector.
- Fourth dimension ("energizing the whole organisation, and sharing mindset and motivation") matches exactly the 3i framework's Influence vector,
- "Creating new competitive space" is equivalent of 3i's resultant vector (innovation)

BIG DATA AND THE NEW LEADERSHIP MODEL IT ENTAILS

We now extend the 3i framework (for sustained innovation) to capture the leadership requirements.

As mentioned above, the weakness of the 3i framework is that it does not account for the implementation aspects of the 3i vectors. It details the required component vectors but does not prescribe how to seed and grow these vectors. Instead, the individual components of the vectors are treated as individual building blocks or Lego blocks.

Fig 2: Nayar-Lanvin Framework for Leadership

The emergence of Big data and the rapidly evolving IT capability to speed up real time data analytics has led to the availability of several opportunities in the market space, which unless taken up rapidly can disempower businesses rapidly. Speed is thus the essence and hence the Big Data driven world requires a leadership role that aggregates available potential opportunities, sifts through these, aggregates resources available as well as internal and external talents, in order to actualize the sifted opportunities.

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The 3i framework implies – among other things – that the leadership that drives the 3i vectors plays an aggregating role, aggregating opportunities that the external environment offers (see the External Influences side of the Total Innovation Management pyramid; Nayar, 2013) at the confluence of the Influence and Intentionality vectors, aggregating talent (team competencies of the TIM pyramid, including crowd sourcing and extended communities of practice) and aggregating resources (see the Management Platform of the TIM pyramid) including strategies and skill sets. Technology

elements help to aggregate the voices of all the elements of the supply chain, from suppliers' suppliers to customers' customers.

If efficiently done, listening to the network effectively, harnesses these voices and helps leadership aggregate opportunities. It bears mention that many industries miss these signals due to inattention, and miss emerging trends, leading to wrong strategy definition.

This framework is thus the framework of leadership for innovation, i.e. a leadership that causes agility to take advantages of rapid changes taking place in the external environment. While the skills-set (talent/ people/ intrinsic intelligence) needed may not be available within the organisation, IT collaboration (Open Innovation / crowd-sourcing) makes this available to an agile leader.

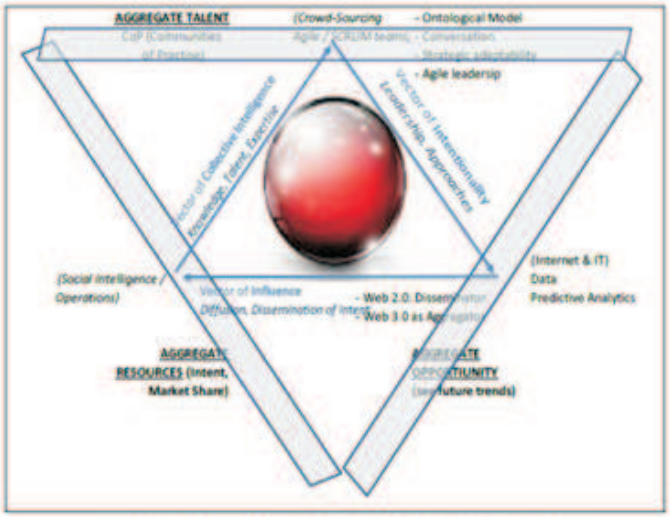

Fig 2: Nayar-Lanvin Framework for Leadership

The leadership must be, of course, capable of attracting and retaining such amorphous talent – this is the talent aggregation role.

The triple aggregator role of leadership will enable innovation to occur in an enterprise. This 3A framework is called the Nayar-Lanvin Framework for Leadership of Innovation, and is introduced here as a *de novo* concept. Further study needs to be done to test its strengths and weaknesses.

***The Future is Web 3.0*:**

Web 3.0 – also known as the Semantic Web since it manifests itself as a web of data, rather than a web of documents – is a quantum change on the method of linking data by a method of ontology of meaning. Functionally, it overcomes limitations of the conventional Web (now also known as Web 1.0) as well as of Web 2.0 which encompasses social networks, blogs, microblogs, and 'wikis'. The new Web tools aggregate the 'Wisdom of Crowds' for superior decision making and focus collective effort on prioritized outcomes (Cake 2011).

Conclusion

Leaders need to compare strengths and weaknesses of new frameworks they implement. Studies of national or regional innovation strategies measure the effectiveness of innovation systems, like INSEAD's Global Innovation Index, and the Nayar-Lanvin frameworks for leadership and innovation.

This paper addresses two common questions – how can innovation be made a sustained practice in an enterprise, and what role do specific parameters (such as leadership or emergent IT tools like Big Data) play in boosting innovation.

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