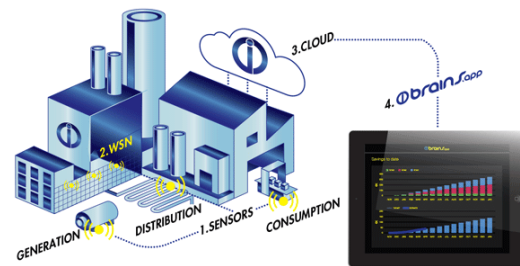


## EXECUTIVE SUMMARY

Konux is a IIOT firm serving industrial assets to live longer and decrease machine downtime. The key question I solved was whether Konux should go components or full stack and how should Konux's product and service look like? From the empirical and other research, I found out that Konux should emphasize on the value chain and capture the maximum value creating portion. Also, the other less value creating portions should be served but by cooperation with other firms. To be successful, they must position themselves in a low-price position which they can get by product bundling and economies of scale and using network effects efficiently. To do this, they must remove the barrier adopting technology slowly and speed up the adoption of IIOT by arranging finance, cooperating and removing their fear of security and meeting up low price demand. The best way for them would be to make a common platform to gather all types of sensor data into one and make that platform a standard like Microsoft Windows. Also, they should differentiate themselves by customization, excellent customer service, branding, low price and credible solution to the clients. All these would be a success factor for Konux if implemented successfully which research and academics have already proven.

## INTRODUCTION

IIOT is being deemed to be the next best disruption in the technology. Konux has entered the market in the right time. But they need very good strategy and careful planning to be successful and leader in this arena. Konux provides currently the sensor solution, data integration and analytics platform and also the predictive analytics to decrease the maintenance cost. For this, they need heavy investment in technology and top on that, they need quality human resource to provide the service. After that comes which service they should provide i.e. full stack or component? I tried to touch this question for Konux as I think if they can fix this area, later other strategy like growth strategy and other strategy can be modeled based on this analysis. So, their first question should be what product in which market and how I will serve?



To understand this, we need to know what value does Konux offering? Is it sensor, platform, analytics? Not these-but the cost reduction and improved profitability of the business. To provide this value, they have to determine how to best serve this value to the customers. In this report, I have discussed in depth on this with the help of research, case studies and many more.

I have analyzed the complements, value chain, differentiation factors, product bundling, network effect, second degree and third degree price discrimination and many more to understand Konux's position and sorted out the best option for them to craft a strategy in the IIOT market.

## DEFINITIONS OF TERMS

**IIOT:** The IIoT is part of a larger concept known as the Internet of Things (IoT). The IoT is a network of intelligent computers, devices, and objects that collect and share huge amounts of data.

**Sensors:** A device that reads the physical status of a machine and sends data to the cloud for further processing.

**Product Bundling:** Product bundling is offering several products for sale as one combined product. It is a common feature in many imperfectly competitive product markets. Industries engaged in the practice include telecommunications, financial services, health care, and information.

**Network Effect:** A network effect is the effect that one user of a good or service has on the value of that product to other people.

**Price Discrimination:** The action of selling the same product at different prices to different buyers, in order to maximize sales and profits.

## METHODS

In this consultancy report, most help was taken from the secondary sources i.e. data published online, university websites, different published books and articles. Major focus was to relate the concepts of the course videos to the task I was given.

To accomplish this, I searched for individual research report on the topics and analyzed and synthesized the results to formulate recommendations for the client party “Konux”.

## RESULT AND SYNTHESIS

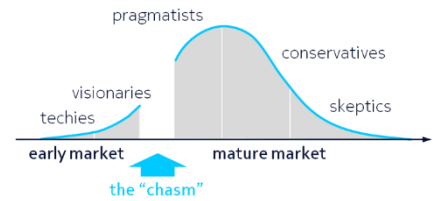
First Question: Components or full stack? How should KONUX’ product and service solution for the industrial “Internet of Things” look like?

Konux is offering value to the firms in the form of cost reduction, improved asset life that saves money to the organization and reduced downtime which improves the revenue. To do this they are providing sensors to get data from the assets, storing those data in the cloud like IBM Bluemix or google cloud, pulling data from the cloud at their Andromeda platform and applying machine learning techniques like regression, classification, neural network to find the pattern and outliers and trend and predicting the asset malfunction and prescribing to the firm of the analysis. Is it sensors or analytics or platform or the visualization? The value the customers are getting is the reduced cost of maintenance, improved asset life thus again saving money for the company and reduced downtime thus improving productivity. So, the value customers getting is saving cost of a certain amount. So, Konux should offer the full stack service including sensor supply, cloud service to store the sensor data, analytic platform to analyze those data and use bundle price to lower the cost as the customers only value is cost saving.

Strategy guru, Michael Porter, in his Harvard Business Review paper with Heppelmann (2014), discusses how IOT is the 3rd wave of IT driven competitive strategy to be adopted by firms, after computer-aided automation of industrial processes in 60s and 70s (Porter & Millar, 1985) and Internet strategy driven digital business transformation of 90s (Porter M. E., 2001). While IT was mainly an enabler in the previous two waves, for IOT Information technology is likely to be an integral part of the product offering itself – ranging from sensors with embedded software, data aggregation and analytical platforms with meaningful actions and insights. But to try and enable the whole stack alone will be time and money consuming.

From <https://www.ama.org/publications/eNewsletters/Marketing-News-Weekly/Pages/75-percent-business-execs-dont-have-industrial-iiot-strategy.aspx>,

The survey, which received 173 responses from C-Suite, senior executives and managers across industries in North America, found that 82% of business executives believe successful adoption of IIoT is critical to the future of their company. However, only 25% have a clear adoption strategy. We can illustrate this in the following diagram:



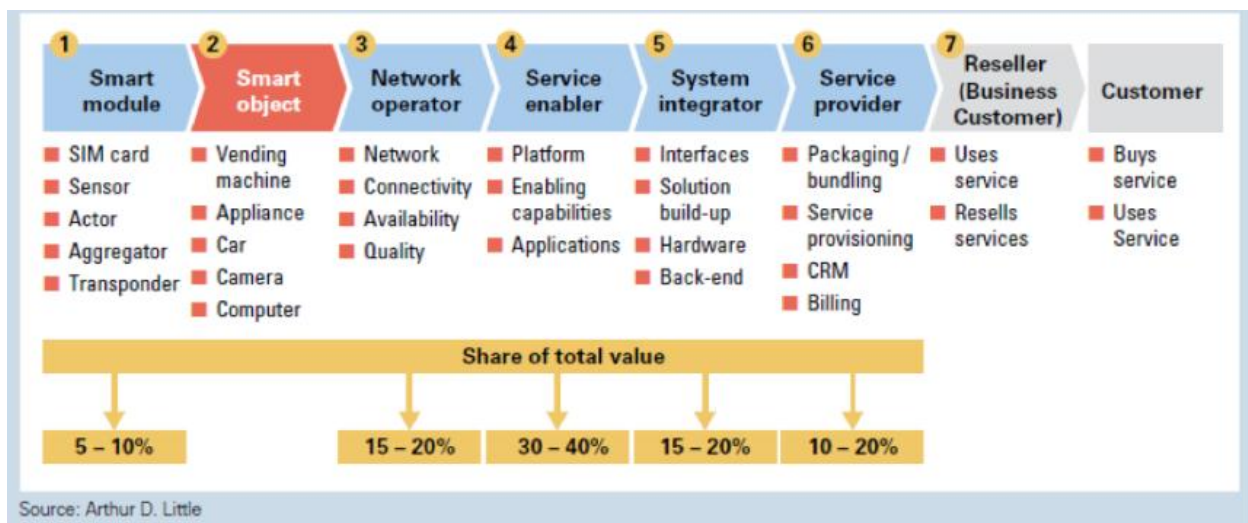
One reason for low adoption may be due to 37% of business executives expressing concern about security and 33% about privacy of IIoT. About 35% of the survey respondents say they are also concerned about the skills of their technology staff while 34% are apprehensive about the use of their legacy system and about data quality. Even with concerns, 77% of survey respondents cite IIoT as something that can spur growth. Approximately 75% say they believe agility is a benefit of proper IIoT adoption.

From the Illinois university Urbana Champaign, we came to know that (In their case study on the value chain management specialization) the sensor market is trend is changing trends and purchase behaviors, the market is shifting to less expensive, low power multi-function sensor systems, with redundancy being a key focus, products and/or services should be offered in the future and, perhaps, which should be discontinued. Initially, Konux could outsource much of its production but subsequently started to invest in its manufacturing capability in hope of becoming more competitive in the market. After a few years, they will finally be able to bring production in-house. This will allow them to maintain more control over development cycles and product quality.

The sensor market is very much in the growth phase. In 2013, the global market for sensors was valued at \$68 billion. It was predicted to have a compound annual growth rate of 9.8% from 2011–2017. The market is shifting to less expensive multi-function sensor systems, with redundancy and wireless capability being key focal areas. Additionally, the market is driven by new applications and continuous product development. The product development time to market is approximated at 2.0 years. Konux must successfully navigate this change if it is to have

another successful 15 years in the industry. The success factors could be customization capabilities, technical innovation, brand recognition, operational efficiency, and customer care.

So, to answer the question Konux should offer components or full stack, we should consider the value chain of IIOT analytics firm's value chain and how much value does each step captures. An IOT value chain analysis by Arthur D. Little, in 2011, is most useful in trying to analyze the same and still holds good. Following is the diagram:



From the above diagram, we can see that Network operator, Service enabler and System integrator capture the 60%-80% of the value chain. So, Konux should go full stack but mainly capture the Network operator, Service enabler and System integrator but outsource the less value capturing services. Here **cooperation** is vital to be being successful in this regard. We can explain this with the help of game theory sequential games. Let's see the following analysis.

From “**The Internet and Network Economics by Nicholas Economides**”, in network markets, and more generally in markets with network externalities, when firms and consumers interact in more than period, history matters. Both consumers and firms make production and consumption decisions based on sizes of installed base and on expectations of its increases over time. The same underlying technology and consumer preferences and distribution can lead to different industrial structures depending on the way things start. Thus, strategic advantages, such as first-mover advantages, can have long-run effects.

		Player 1	
Player 2		New technology(N)	Old technology(O)
	New technology(N)	(a,b)	(c,d)
	Old technology(O)	(e,f)	(g,h)

Network externalities for both technologies mean that  $a > c$ ,  $e; b > d$ ,  $f; g > c$ ,  $e; h > d$ ,  $f$ . If both firms are worse off when they are not coordinated, both the “new technology” (i.e. (N, N)) and the “old technology” (i.e. (O, O)) will arise as equilibria. Clearly, one of the equilibria can be inefficient. If the (O, O) equilibrium is inefficient and is adopted, Farrell and Saloner (1985) call the situation excess inertia. Similarly, if the (N, N) equilibrium is inefficient and it is adopted, the situation is called excess momentum. So, cooperation within the firms is important in this situation. Konux should cooperate with other firms and make strategic alliance with some firms to make its strong foot hold.

Further digging hints at cooperation among the competitors (Lv, Zhang, & Yue, 2012) as a model to maximize profits in the value chain. It may be down to working together for standardizing technology or legitimizing the business model for wider adoption, cost of which can be shared in the business network with each company contributing with their core competencies ( Bengtsson & Kock, 2000). We are seeing that already with backers of Lora Alliance, LTE-M, SIGFOX etc. slowly forming, with organizations identifying themselves with emerging coterries, often multiple.

Investment services provider Raymond James (2014), discusses similar value chain, but they argue due to lack of standardization they see IOT as a series of verticals instead of one market, matching Xu et. al’s theoretical research cited above. Lack of commonality in application software and requirements of different verticals have meant vertical focused solution.

Hence, an IOT aspirant organization needs to consciously align with one/more emerging value chain as a best fit and identify the right verticals to mature.

When the Mobile revolution happened in 90s, it had a clear value proposition “Phone without a wire”. Standards came later, but it captured the consumer imagination from early days. However,

with IOT, which is pegged as the next big disruptive wave since Mobile, e.g. something like “Machines can talk” is way too vague.

IOT, should provide an augmented service on top of a core, which simply can't have an astronomical charge e.g. It is nice to have a smart meter to drive energy efficiency, but I won't be ready to pay say £10 for it if my average monthly energy bill is say £60!

Hence due to low ARPU for IOT, to be profitable for the eco-system, massively streamlined systems across the value chain are needed along with platform positioning.

**PLATFORM:** In their book, Platform Revolution (W.W. Norton & Co., 2016), authors Geoffrey G. Parker, Marshall Van Alstyne, and Sangeet Paul Choudary (<http://sloanreview.mit.edu/article/platform-strategy-and-the-internet-of-things>) wrote that the platform model is the basis of some of the most successful companies operating today, from Google and Amazon to Uber and eBay. “No matter who you are or what you do for a living, it's highly likely that platforms have already changed your life as an employee, a business leader, a professional, a consumer, or a citizen — and are poised to produce even greater changes in your daily life in the years to come,” they write.

The platform business model uses technology to connect people, organizations, and resources in an interactive ecosystem. As defined in Platform Revolution, “A platform is a business based on enabling value-creating interactions between external producers and consumers. The platform provides an open, participatory infrastructure for these interactions and sets governance conditions for them. The platform's overarching purpose: to consummate matches among users and facilitate the exchange of goods, services, or social currency, thereby enabling value creation for all participants.”

On October 13, 2016, Van Alstyne, the Everett Lord Distinguished Faculty Scholar at Boston University, participated in a webinar about platform strategy hosted by MIT Sloan Management Review and made possible with sponsorship support from Xively. The presentation focused on the crucial role of the emerging Internet of Things as a component of platform strategy. The



webinar was moderated by Steven Paul, a contributing editor at MIT SMR, and highlighted on Twitter at the hashtag #MITSMRevent. Among Van Alstyne's key points:

Architecturally, the IoT redefines how devices communicate and offers significant economies of scale. Before the Internet of Things, each participant in a network had his or her own device, with each device having a full stack of the functions that they use. In this architecture, "each device has to communicate with each of the other devices," said Van Alstyne. The Internet of Things presents a competing architecture view, which "might be to put everything into a single box," he said. "Here you get economies of scale. Everyone has access to all of the functions, and you save and economize on some of the connectivity and communications that take place." There is a downside to going completely in this direction, he said: "While this model scales beautifully, it makes making changes more difficult." Folding IoT onto a platform strategy is a more architecturally ideal solution.

#### WHICH MARKET TO SERVE:

As they are railway industry specialized, they should go vertical and work on this niche market to solidify their position and differentiate themselves from others. They should not target any specific geography. Rather they should target the biggest rail industries. The following diagram shows the major rail industries created from the data available from the Wikipedia.

Sheet 1



Map based on Longitude (generated) and Latitude (generated). Color shows sum of Railway length(km). Size shows sum of Railway length(km). The marks are labeled by Country. Details are shown for Country.



From this figure and Railway-technology.com, we can see that the United States has the world's longest railway network, followed by China and India largest railway networks in the world based on total operating length. Other countries in the top 10 list are Russia, Canada, Germany, Australia, Argentina, France, Brazil. After strong footprint in this specialization, they should go for the other sectors as the followings:

**IIoT Market, by Vertical:**

- Manufacturing
- Utilities
- Oil and Gas
- Metals and Mining
- Retail
- Healthcare
- Transportation
- Agriculture

**IIoT Market, by Device and Technology:**

- Sensors
- RFID
- Industrial Robotics
- 3D Printing
- Distributed Control System (DCS)
- Condition Monitoring
- Smart Meters
- GPS/GNSS
- Autonomous Haulage System (AHS)
- iBeacons
- Camera Systems
- Yield Monitors
- Guidance and Steering
- Flow and Application Control Devices
- Networking Technologies (Wired and Wireless)

**IIoT Market, by Software:**

- Product Lifecycle Management (PLM) Systems
- Manufacturing Execution System (MES)
- SCADA Systems
- Outage Management System
- Distribution Management System
- Retail Management Software
- Remote Patient Monitoring Systems
- Traffic Management System
- Farm Management System

So, Konux could create **complements** ---Sensors, Cloud, Platform, Analysis algorithm, Delivering report, customization.

- Product differentiation ---Programmable Logic Controllers (PLCs) and Remote Terminal Units (RTUs): These are hardware components that interface with the machines and control them. They are responsible for interfacing with sensors in the machines. All parameters that require monitoring are available here. PLCs and RTUs are your interface to the machine world.
- Data Acquisition Systems: These are centralized systems that collect data from PLCs and RTUs. The connectivity could be wired (Modbus, TCP) or wireless. OPC (OLE for Process Control) is a recommended way to connect to your hardware.
- Supervisory Systems: Systems that allow supervisors to monitor their machines. These systems do real-time condition monitoring, raise alarms when thresholds are breached and ensure that your machinery works optimally.

They can create any complementary products from above and build a bundle price.

## PRODUCT POSITIONING

Konux should position itself in the low price high value position to be successful in this arena as suggested by research. To ensure low price they should apply bundle price, second and third degree price discrimination, economies of scale. To deliver high value, network effects will appropriate as evidenced from the previous discussions and research.

**DIFFERENTIATION:** The differentiation factors would be:

1. Low Price
2. Branding
3. Customization
4. Rapid innovation
5. Knowledge gathered from the data.
6. Customer service

**Pricing Decision:** To ensure low price, Konux should go bundling i.e. second degree price discrimination, third degree price discrimination and economies of scale.

**Bundling-(From the sample given in the course).**

Bundling in the Cell Phone Application Market “Our analysis shows that there are several examples in different software and technology markets that show that bundling was successful in these markets in the past. Therefore, I consider it likely that bundling is beneficial for the Konux product lines as well. Both theoretical and empirical studies in adjacent market segments (the office software market had a similar market maturity as the mobile app market today) have important positive implications for Konux’s future strategy: § Bundling helps to exploit consumer surplus and delivers additional value provided by software items included to the bundle, which would not be purchased by the customer if no bundle existed. § As described in the analytical part of this report, bundling can be regarded as a strategy similar to second-degree price discrimination. This was empirically proved. § By bundling separated app items our company would be likely to increase demand elasticity: Customers would be less sensitive to price changes compared to the case of unbundled products. 3 § Research suggests that bundling combinations consisting of specifically-designed products have the highest potential to boost revenue when bundled. This condition is fulfilled for Konux’s products, as we have no overlap in app functionalities between photo and video editing apps. § Bundling was proved to reduce the effort needed to address heterogeneity of customer preferences from the firm’s perspective. Hence our app would be likely to address more customers at once in a bundled combination as in an unbundled offer. Consequently, customer segmentation could be simplified by this reduction in consumer heterogeneity. As we have seen in the past and for existing successful bundles the way how such a bundle is shaped in detail decides strongly on its success. The classical software bundling example are the office suite bundles as they were shipped in the 1990s. The success of office software bundles was not only based on the fact that software items were sold in bundle combinations but also due to the fact that lots of the market volume we know nowadays was yet to be generated. Moreover, office software growth was a process that was majorly driven by operating software diffusion which took place at the same time (although it had started some years before office software sales were skyrocketing). Hence, taking market and competition

figures into account is absolutely important to map a strategy which is based on the relevant details to ensure strategic potential...”

### **THIRD DEGREE PRICE DISCRIMINATION:**

From Carroll, Kathleen and Coates, Dennis, Teaching price discrimination: some clarification. Southern Economic Journal, 1999. 66(2): p.466., Third-degree price discrimination is based on characteristics of the consumer or group of consumers. A consumer somehow indicates that he or she has a particular characteristic, and is charged a particular price as a result. Unlike first-degree price discrimination, consumers are dealt with as groups, rather than individuals. Unlike second-degree price discrimination, willingness to pay is connected with a characteristic of the consumer, rather than the product. As Konux must serve different country, they have to take help of this discrimination to be successful.

**ECONOMIES OF SCALE:** Konux should take advantage of economies of scale in course of time by fully producing all sensors in their own, building a common platform for IIOT data and analytics solution when they will be at mature stage. In that time, they can take the full advantage of second degree price discrimination like discount, bundling, coupon etc. to hold its position in the market.

### **NETWORK EFFECTS**

(<http://mattturck.com/the-power-of-data-network-effects/>) The concept of network effect (in general) is by now well understood: a flywheel type situation where a good or service becomes more valuable when more people use it. Data network effects occur when your product, generally powered by machine learning, becomes smarter as it gets more data from your users.

The more data they contribute, the smarter your product becomes (which can mean anything from core performance improvements to predictions, recommendations, personalization, etc.); the smarter your product is, the better it serves your users and the more likely they are to come back often and contribute more data – and so on and so forth. O

Google is a classic example of data network effect at play: the more people search, the more data they provide, enabling Google to constantly refine and improve its core performance, as well as personalize the user experience. Waze, now a Google company, is another great example, essentially a contributory database built on data network effects.

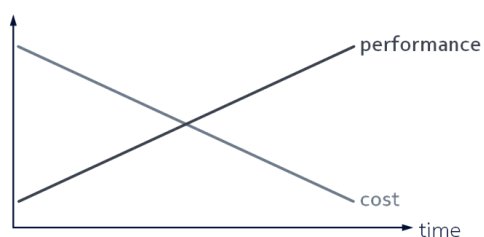
- Internet of Things: Data network effects are particularly relevant to the long term defensibility of Internet of Things companies, including Helium (enterprise IoT) and Kinsa (health/consumer IoT) in my portfolio. Hardware will often get copied and sometimes will get commoditized. However, if you think of each device as a node in a network that contributes data, IoT companies have an opportunity to build insights/learnings from each customer that will be increasingly harder to replicate – the real value gets built at the software and data level;

- Learning from someone else's data

- What if you don't own the data? This is a problem that applies across both consumer and enterprise businesses, regulated or not. Data privacy issues deserve an entirely different post, but the best practice here is to build privacy into the core DNA of the product from the onset. Disclosure, consent, user controls are essential.

- In an enterprise context, the problem appears early and often. A typical scenario: a small enterprise software startup with great technology approaches a large corporation, promises to process and analyze large amounts of customer data, and by the same token hopes to fine tune its algorithms for the benefit of this customer (but, eventually, all other customers – to build the data network effect). The large corporation is very protective of its data, everything needs to be done on premise (and not in the cloud), and the security department will block anything it does not understand.

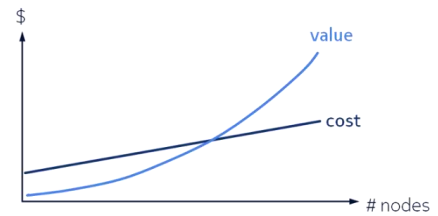
From <https://blog.networks.nokia.com/iot/2016/03/21/moores-law-metcalfes-law-iot/>, Big data



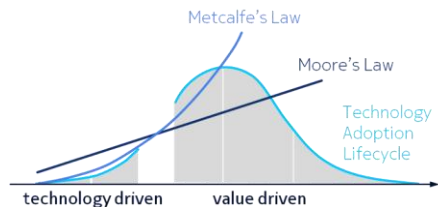
analytics for continuous machine learning, which is where Metcalfe's law will really kick in because more data means better decisions. With time performance

increases but cost reduces. The value delivered surpasses more that the cost to provide the value.

Moore's law refers to an observation made by Intel co-founder Gordon Moore in 1965. He noticed that the number of transistors per square inch on integrated circuits had doubled every year since their invention. Moore's law predicts that this trend will continue into the foreseeable future.



Several years after Moore's famous observation, another technology pioneer, 3Com co-founder Bob Metcalfe, stated that the value of a network grows with the square of the number of network nodes (or devices, or applications, or users, ...), while the costs follow a more or less linear function. Take for example a wireless network: if you have only 2 mobile devices, they're only able to communicate with each other. However, if you have billions of connected devices and applications, opportunities rise dramatically.



To explain their rather slow take-up, we have to take a look at the technology adoption lifecycle, and more specifically at the "chasm theory" that was developed by another Moore. In his book "Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers," management consultant Geoffrey A. Moore writes about the gap that product marketers have to bridge for the take up of new technology by early enthusiasts and mass market adoption. By combining the three preceding charts and admittedly visually cheating with axes, scales, and representations, I have come to the observation that the chasm is actually the point where the shift from a technology driven model to a value and customer experience driven business needs to take place. If this doesn't happen, any new product or technology introduction is doomed to fail.

#### RECOMMENDATION:

1. No one firm can offer IIOT end-to-end – Konux needs a partnership based ecosystem or Cooperation.

2. There are competing value chains and one has to align with the one that fits best.
3. Cooperation is much needed to ensure healthy growth.
4. Value chains will most likely mature in verticals – identify the one(s) right for Konux.
5. ARPU is going to be low- so align with eco-system where you can scale, unless of course you can spin an innovative business model to charge a premium.
6. Low price and network effect is the key to success.
7. Use product bundling and third degree price discrimination wisely.
8. Building a common platform, going niche in vertical first then growing horizontally would be best.

#### **CONCLUSION:**

Konux is a new start up going through a lot of reforms and need right strategy and craftiness to fight in this sector. Many other firms like IBM, GE has tapped into this market and to fight with them Konux have to brand themselves, build a platform, capture the market as early as possible, grow vertically first and then horizontally, and use network effect nicely. Also, they should concentrate more on the possible partnership to grow faster, then in house production to grasp the control of the market and use new updated technology which have a development life of to years. The core competency of Konux should be the more data they get, more insight on the data and keep it to their advantage to be ahead of the competition.