

Cloud Computing for Managing Apparel and Garment Supply Chains - an Empirical study of Implementation Frame Work

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Abstract

With operating efficiencies already quite high, members of the apparel and manufacturing supply chain need to look at strategies other than reducing labor costs to improve margins. The key area is collaboration with supply chain partners. Collaboration offers an opportunity to reduce costs in the supply chain in the areas of product development, inventory holding, and manufacturing through better capacity utilization, lower reject rates, fewer charge-backs and profitability. Apparel and garment industry is highly fickle and are characterized by short life cycles, unpredictable demand, whimsical consumers, multiple trading partners, difficulties in doing cross-border trade and stagnating economic conditions. Information Technology enabled collaboration should be the key area for tackling the hurdles in this regard. Cloud computing as an IT enabled option for model for delivering on-demand, self-service computing resources with ubiquitous network access, location-independent resource pooling, and rapid elasticity. In order to make the supply chain efficient, collaboration among partners is becoming a necessity. Retailers should prefer to form partnerships with suppliers who have gone ahead and implemented processes and systems which facilitate collaboration. In this paper, an empirical study of adaptability of Cloud computing model for apparel and garment manufacturers to achieve

collaboration among the supply chain partners to manage the Supply Chain is presented.

Key words: Cloud Computing, SCM, Collaboration, cloud computing framework.

1. Cloud Computing:

Definitions of **Cloud computing** on the Web:

Definition 1. Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on-demand, like electricity[1]

Definition2. Computing in which services and storage are provided over the Internet [1]

Definition3. On-demand self-service Internet infrastructure where you pay-as-you-go and use only what you need, all managed by a browser, application or API. Cloud computing is broken up into multiple segments including: Cloud Infrastructure, Cloud Platforms and Cloud Applications. [2]

Definition4. A new generation of computing that utilizes distant servers for data storage and management, allowing the device to use smaller and more efficient chips that consume less energy than standard computers. [3]

It is a style of computing where massively scalable IT-related capabilities are provided “as a service” using Internet technologies to multiple customers. Cloud Computing, a key differentiating element of a successful information technology (IT) is its ability to become a true, valuable, and economical contributor. It implies a service oriented architecture, reduced information technology overhead for the end-user, greater flexibility, reduced total cost of ownership, on-demand services and many other things.

While there is no arguing about the staying power of the cloud model and the benefits it can bring to any organization, mainstream adoption depends on several key variables falling into alignment that will provide users the reliability, desired outcomes, and levels of trust necessary to truly usher in a “cloud revolution.” Until recently, early adopters of cloud computing in the public and private sectors were the catalyst for helping drive technological innovation and increased adoption of cloud-based strategies, moving us closer to this inevitable reality. Today, driven in large part by the financial crisis gripping the global economy, more and more organizations are turning toward cloud computing as a low-cost means of delivering quick-time-to-market solutions for mission-critical operations and services. The benefits of cloud computing are hard to dispute:

1. Reduced implementation and maintenance costs
2. Increased mobility for a global workforce
3. Flexible and scalable infrastructures
4. Quick time to market
5. IT department transformation (focus on innovation vs. maintenance and implementation)
6. “Greening” of the data center
7. Increased availability of high-performance applications to small/medium-sized businesses

Rapid experimentation by early cloud providers has created four distinct layers of services:

Infrastructure As a Service provider (IaaS), Includes raw utilities such as compute power

and electronic storage resources, as services over the network.

As a Platform as a Service (PaaS), includes tools and environments to build and operate cloud applications and services;

As a Software as a Service (SaaS), enables on-demand use of software over the internet and private networks; and

As a Business as a Service (BaaS), includes application functionality coupled with physical and human resources required to perform a broader set of business activities – typically a major module of activity in a broader business process (e.g., a call center module, as part of the customer service process), or in some cases the complete business process itself (e.g., fully cloud-based supply chain management).

These models of computing are being driven by the confluence of several changes in the business environment and IT landscape. From the business perspective, the trend towards consumer-driven innovation and partnership ecosystems is accelerating software development timeframes. Simultaneously, from the IT perspective, several trends focused on increasing the efficiency of software distribution and hardware utilization have converged to enable a cloud computing model, notably early adoption of Software as a Service, proliferation of Hardware Virtualization, and the advent of Utility Computing.

Cloud Computing is more than a technology. It is more than a platform. It is more than just a hosting provider. It is more than just an application hosted as a service. It is more than providing storage services on the Internet. It is a combination of all the above. In today’s economic environment as Enterprises try to balance out and optimize their IT budgets, Cloud computing can be an effective strategy to reduce the IT operations and management costs and free up critical resources and budget for discretionary innovative projects. Typically, Enterprises have a 80/20 split between regular ongoing IT operations cost which includes hardware, software licensing costs, development, data center maintenance etc Vs new investment for solving critical business needs which is critical for businesses to survive in these challenging times. Cloud Computing can have a significant

impact in this by reducing the footprint of IT operations by taking out the upfront capital investments needed for hardware and software licensing. It enables a Use what you Need and Pay for what you Use cost model. This will enable businesses to invest on innovative solutions that will help them address key customer challenges instead of worrying about operational details. Even though IT budgets are being slashed, enterprises cannot afford to

stop investing in IT because IT is what helps them gain and maintain a competitive advantage. The Cloud offerings will help enterprises to continue to invest in IT without having to take up big budget and long term IT projects. Investment in IT changes from being a Capital Expenditure to Operating Expenditure. Enterprises can become agile and harness the power of Information Technology to drive unprecedented customer value.

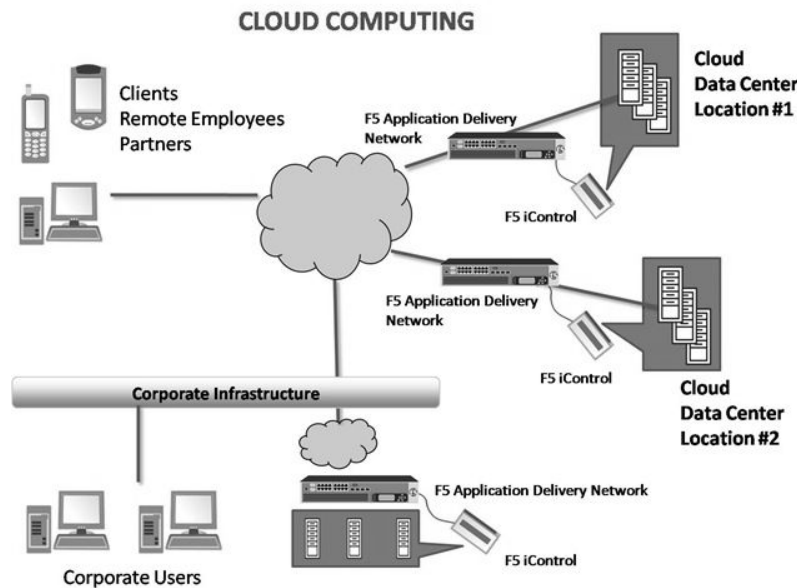


Fig.1. Cloud Computing model.

2. What technologies constitute cloud computing?

Cloud Computing is a paradigm that is composed several Strata of Services. These include services like Infrastructure as a Service, Storage as a Service, Platform as a Service and Software as a Service. Different Cloud Providers have developed various access models to these services. The access to these Services are based on standard Internet Protocols like HTTP, SOAP, REST, XML and the infrastructure is based on widely used technologies including Virtualization, hosting. Cloud Computing is the maturation and coming together of several prior computing concepts like Grid Computing, ASP, Server Hosting, Utility Computing and Virtualization.

3. Supply chain of Apparel / Clothing/ Garment sector

The textiles and clothing sectors can be seen as a supply chain consisting of a number of discrete activities. Increasingly the supply chain from sourcing of raw materials via design and production to distribution and marketing is being organized as an integrated production network where the production is sliced into specialized activities and each activity is located where it can contribute the most to the value of the end product. When the location decision of each activity is being made, costs, quality, reliability of delivery, access to quality inputs and transport and transaction costs are important variables.

Apparel and Garment manufacturing industry environment is characterized by:

- Entire demand for a given season/style order must be fulfilled by one lot

- Demand and pricing for seasonal and/or fashion items is uncertain and time-sensitive
- Multi-tier, disaggregated suppliers, due to specialization/cost structures/quota constraints, erode loyalty and make supply chains fragile and dynamic
- Moderately high set up or changeover costs, so cost is lot size dependent
- Distributed, global suppliers; most with little infrastructure
- Plans based on rules of thumb for production and transit lead times, cumulative rollups/padding very inaccurate—low confidence in on-time delivery creates buy and sell side date padding
- Delays in determining status and no easy mechanism to notify downstream suppliers or participants
- Lack of documented accountability and genealogy of communications
- Externally imposed finite capacity, e.g. time-dependent quotas, with no visibility over other competitor's shipments for same quota category
- Supply chain cycle time is 2-3X total season cycle times and 6-9X profit season cycle times for many styles. Consequently, consumer demand for popular styles is frequently not satisfied and margin opportunities are lost

4. Apparel/Manufacturing industry - Adaptability to Cloud Computing:

4.1 Supply Chain Management;

Supply chain management is collaborative process and project management to meet the needs of the end customer efficiently and effectively. One of the key requirements of successful management of supply chains is Collaboration. It should be noted, in general, that there are three flows that occur in supply chains:

- **Material flows**, which represent physical product flows from suppliers to customers as well as the reverse

flows for product returns, servicing, and recycling;

- **Information flows**, which represent order transmission and order tracking, and which coordinate the physical flows; and
- **Financial flows**, which represent credit terms, payment schedules, and consignment and title ownership arrangements.

These flows are supported by three pillars: *Processes*, which embed the firm's capabilities in logistics, new product development, and knowledge management; *Organizational structures*, which encompass a range of relationships from total vertical integration to networked companies as well as management approaches, and performance measurement and reward schemes; and *Enabling technologies*, which include both process and information technologies for every organization's supply chain. However, in service organizations there is usually no flow of materials, but rather a flow of documents containing the valuable information for decision making. Regardless of the type of organization, it is necessary to coordinate all the above flows among all parties involved in the supply chain using appropriate and adequate

4.2 SCM in Textile/Apparel/Garment Industry:

The supply chain in the textile and clothing sector is illustrated by Figure 1. The dotted lines represent the flow of information, while the solid lines represent the flow of goods. The direction of the arrows indicates a demand-pull-driven system. The information flow starts with the customer and forms the basis of what is being produced and when. It is also worth noticing that information flows directly from the retailers to the textile plants in many cases. The textile sector produces for the clothing sector and for household use. In the former case there is direct communication between retailers and textile mills when decisions are made on patterns, colors and material. In the second case textile mills often

deliver household appliances directly to the retailers. The Indian Textile industry adds 14% to the industrial production and 8% to the GDP of India. It provides employment to 38 million people and thus, is the second largest employment provider after agriculture. The

Indian Apparel & Textile Industry is one of the largest sources of foreign exchange flow into the country with the apparel exports accounting for almost 21% of the total exports of the country.

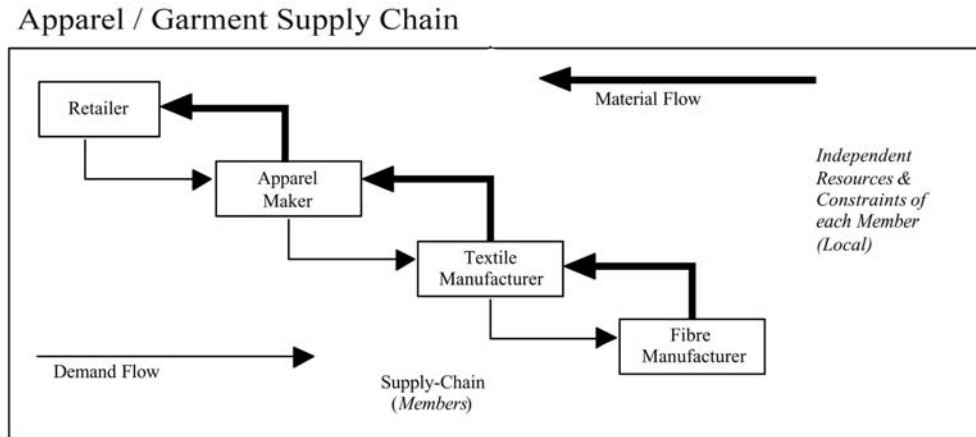


Fig2. Apparel/Garment manufacturing Supply Chain.

5. Discussion on Adaptability:

The clothing sector is both a labor-intensive, low wage industry and a dynamic, innovative sector, depending on which market segments one focuses upon. In the high-quality fashion market, the industry is characterized by modern technology, relatively skilled designers and a high degree of flexibility. The competitive advantage of firms in this market segment is related to the ability to produce designs that capture tastes and preferences, and even better – influence such tastes and preferences – in addition to cost effectiveness. The core functions of firms servicing this market segment are largely located in developed countries and often in limited geographical areas or clusters within these countries. In the low to middle priced market,

the role of the retailer has become increasingly prominent in the organization of the supply chain. The retail market has become more concentrated, leaving more market power to multinational retailers. These have market power not only in the consumer market, but perhaps more importantly they have considerable buying power. In addition, high-volume discount chains have developed their own brands and source their clothing directly from the suppliers, whether foreign or local.

6. Typical Cloud Platform Provider's Services and offerings:

1. Hosting
2. Storage
3. Platform
4. Application Services
5. Tools

Who are the key Cloud Platform Providers?

There are several large providers that offer different services as Cloud Offerings.

Company	Offering	Hosting	Storage	Platform	App Svcs	Tools
Rackspace	Mosso	●	●			
IBM	Public & Private Cloud	●	●			
Google	Google AppEngine	●	●	●	●	
Amazon	Amazon Web Services	●	●	●	●	
Microsoft	Azure Services	●	●	●	●	●
Salesforce.com	Force.com	●	●	●	●	●

Table1. Key Cloud Platform Providers.

7. Adaption of Cloud Computing - Does this mean the end of IT departments in Apparel and Garment Enterprises?

Cloud Computing won't make IT redundant; IT won't be defined as the way we know it today. Instead of the CIO's core focus being the infrastructure and keeping it running, Cloud will truly empower the CIO to focus on Information management. IT departments will have to focus on developing solutions and supporting business functions' rapid use information to react and develop new offerings, instead of managing servers and infrastructure. Information Technologists Enterprises will need to build architecture roadmaps and develop information strategy that IT can step up to handle. In essence, IT as we know will change to more business focused than being infrastructure focused.

Cloud Computing will also allow CIOs to focus on translating the business metrics end-to-end and map that to technology metrics - meaning translating business goals into application and architecture goals. CIOs can have revenue goals instead of cost management goals. ROI of the application portfolio will become a key metric, and this is an area in which Cloud Computing will have a direct and pronounced impact.

7.1 What is a Cloud Maturity Model?

Cloud Computing is in its infancy today and it will take 5-10 years for this to be

a reality - meaning, significant adoption in the Enterprises even for critical Line of Business applications. So we have developed a maturity model for how Cloud Computing will be adoption in different phases. Today the adoption has started with small and departmental applications experimenting with Cloud Services. In the next phase this will move to a Hybrid model, where the Cloud Services will integrate with Data Center applications or services for infrastructure capabilities like Security. This will mature to integrating with other Data Center based business applications. And in the final phase of model, Line of Business applications will migrate to the cloud tipping the adoption of Cloud platforms. From a client perspective as well, the application models will mature from today where they are only Web based applications to a combination of Web and rich client applications and finally reaching the state where Rich, Internet, Mobile or any other future applications types are all first class application models.

7.2 Is Cloud Computing Enterprise Ready?

As highlighted in the Cloud Maturity Model, Enterprises will start with small new departmental level applications or web applications that need to scale over time for Cloud adoption. These will also include a class of applications that are already external focused. The key requirements of these applications are abilities of rapid application

development and the elastic nature of the Cloud. There are hurdles that need to be scaled for the successful adoption of Cloud at a level where it can be declared mainstream. At the base level, it is winning the mindshare and driving businesses to even experiment in this area. Issues like lack of Control, Security and Data Privacy, Service Level Agreements, Compliance, Data Loss and new application model costs/adoption are some of the requirements that need to be addressed. While it might seem that these are large and hairy issues, Cloud Providers are working to address these in collaboration with the eco-system. And there are already some shining examples of Cloud adoption within the Enterprise that can help set the tone for the future.

8. IT and Apparel/Garment Industry:

The value of information has been well established over the past 20 years. Businesses have long recognized that flawless information flow and knowledge processing streamline business objectives and execution plans, thereby enhancing overall business performance. As businesses entered the era of Information Technology (IT), they began to utilize advanced technologies, such as ERP and CRM systems, to automate information flow and business processes within the company. While up until 5-10 years ago the focus of information dissemination was internal, such a strategy was not a panacea in the growing global marketplace; globalization has forced businesses to work closely with suppliers and other business partners—many of them located in other countries or continents—to serve customers around the world.

Lee et al. (1997) observed that information across different stages of supply chains tends to be distorted, and such distortion leads to poor inventory and production decisions, a phenomenon known as the bullwhip effect.³ Naturally, the need for more data transactions and frequent technology upgrades evolved, and companies started using Business-to-Business (B2B) solutions to automate information exchange between trading partners and collaborators in their business networks. Adoption of such

B2B solutions had a positive impact on companies' performance, as is evident from a study which was published in early 2007. Although some companies were successful in implementing the B2B infrastructure themselves, others found in-house implementation too difficult to manage and principally burdensome for those trying to concentrate on their core competencies. To overcome this problem, some companies started handing over portions of their noncore IT capabilities to external service. Advancement in IT and acceleration of globalization has created another problem for business communities: supporting inter-operation of various data formats and communication protocols used by different trading partners. Business communities understand the importance of standard communication protocols and unified data format which not only automate and speed up information transactions, but also enrich the quality of information flow.

9. Functional Framework for Cloud Computing Adoption.

9.1 Business Priorities

First of all, companies in India should prepare the business objectives and priorities for adopting Cloud Computing for supply chain management. Majority of the companies are focusing on the priorities most effective and useful aspects of supply chain parameters for attaining maximum benefit from the implementation of Cloud Computing for SCM. The most common priorities are supply chain collaboration to attain collaboration among the supply chain partners. Information sharing capabilities and prospective information reliability is the next priority for some companies where collaboration information is vast and confidential. In addition to this Indian companies are aiming at cost reduction and saving in all aspects of operation of supply chains. And in the light of globalization forces of emerging economy, Indian companies are focusing at achieving greater customer satisfaction through faster deliveries.

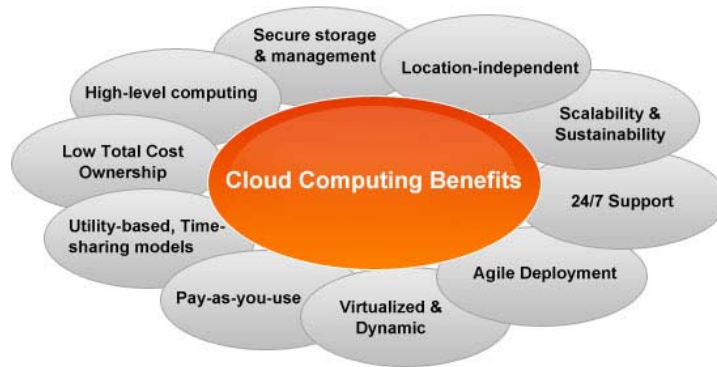
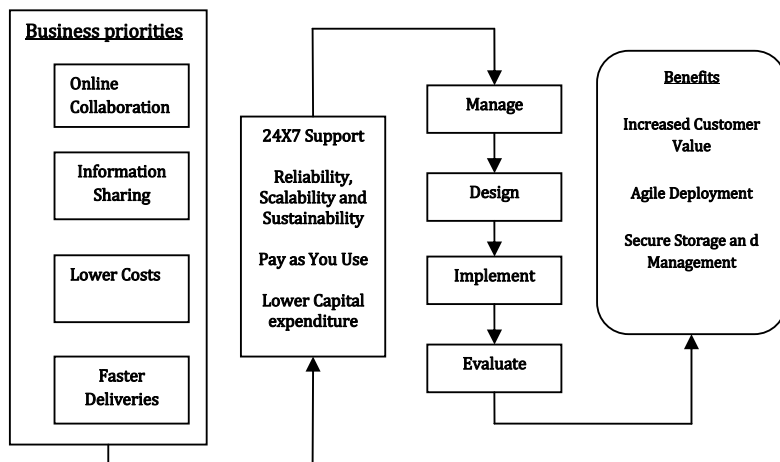


Fig3. Benefits of Cloud Computing.

9.2 Cloud Computing Adaption Framework:

The textiles and apparel sector has long been characterized by an elevated degree of complexity, which is an inevitable part of the framework in which firms have to operate. This complexity can partly be traced to behavioral patterns influencing the final purchaser’s buying and consumption models, which cause considerable difficulty in forecasting demand when defining apparel

collections, and partly also to the short life cycle of a typical garment. The entire sector is affected by these complex interactions, which have repercussions on the strategies adopted by firms seeking to defend a competitive position, as it can be difficult to create and maintain a sustainable competitive edge in an environment where, among other things, an elevated number of production alternatives can be found.



Fig(3) Cloud Computing adoption frame work.

This framework is further complicated by the process of modernization of the distribution network that has taken place in recent years. With regard to industrial organization, in fact, in the Indian context a striking feature is the considerable number of

textile and apparel firms, most of which are fairly small, often bound by local aggregations corresponding to the model of the industrial district. Also, as regards the structure of distribution, independent and traditional retailing maintains the largest market share, in

contrast to the typical model in the other European countries, where one finds an increasing predominance of large distribution chains and specialized chains. The frame work suggested here is to be implemented with a strategic approach through the following modules viz., Selection, Manage, Design, Implement and Evaluate.

9.2.1 Selection

Selection is based on risk minimization in the following aspects to avoid risk in the following phases or steps of Cloud Computing enablement/adoption.

- Selection of appropriate Cloud Computing infrastructure and architecture,
- Selection of right tools matching organizational business priorities
- Implementation strategies and organization transformation,
- Meeting current and future needs of Cloud Computing,
- Immediate updates and technological renovations,
- Investment decisions and returns on investments (ROI),
- Disruptions and visibility constraints and obstacles,
- Documentation and ownership,
- Education and training to the personnel including the partners, and
- Overall after performance of the firm.

Businesses have to prepare efficient internal systems using Cloud Computing infrastructure to respond quickly to customer's requests, questions, and comments. The operational excellence model for Cloud Computing assisted SCM is that which delivers the highest customer satisfaction on an e-business infrastructure for an emerging economic situation that has the following characteristics; User-friendly, Functional, Reliable, Cost effectiveness, adequacy and Performance. The cost effectiveness is very

important character for adaptability in emerging economic perspective.

The principles, practices, and methods required to raise employee awareness about basic information security and train individuals with information security roles to increase their knowledge, skills, and abilities.

9.2.2 Manage

- Identify business priorities and requirements and establish enterprise-wide policy for the IT adoption strategy for management of Supply Chain.
- Acquire and manage necessary resources, including financial resources, to support the Cloud Computing adoption
- Set operational performance measures for impact of Cloud Computing modules in business operations and metrics like profitability, ROI etc.,
- Ensure the organization complies with Cloud Computing enablement environment
- Ensure that appropriate changes and improvement actions are implemented as required to adopt Cloud Computing.

9.2.3 Design

- Develop the implementation strategies and policies for Cloud Computing enablement
- Develop administration change management procedures to ensure Cloud environment
- policies and controls remain effective following a change
- Define the goals and objectives of the Cloud Computing in the Supply Chain operations like collaboration, Information Sharing etc.,
- Establish a tracking and reporting strategy for Cloud Computing enablement
- Establish a change management process to ensure transformation of business environment
- Develop a collaboration strategies with the supply chain partners

9.2.4 Implement

- Perform a needs assessment to determine risks and identify critical needs based on mission requirements
- Develop new—or identify existing—improvement opportunities that are appropriate and timely
- Communicate management’s commitment, and the importance of the Cloud Computing enablement and implementation to the workforce.
- Ensure that Cloud Computing systems operations and maintenance enables day-to-day business functions
- Collaborate with technical support, incident management, and engineering teams to develop, implement, control, and manage new Cloud Computing enabled SCM administration technologies

9.2.5 Evaluate

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- Assess and evaluate the Cloud Computing security awareness and training program for compliance with corporate policies, regulations, and laws (statutes), and measure program and employee performance against objectives
- Review Cloud Computing security awareness and training program materials and recommend improvements
- Assess the awareness and training program to ensure that it meets not only the organization’s stakeholder needs, but that it is effective and covers current Cloud Computing security issues and legal requirements
- Ensure that information security personnel are receiving the appropriate level and type of training
- Collect, analyze, and report performance measures.

10 Benefits

Benefits from Cloud Computing frame work implementation
• High Level computing
• Improved Information Sharing capabilities
• Enhanced Operating Effectiveness
• Increased Customer Responsiveness
• Decreased Supply chain complexity
• 24X7 Support,
• Pay as you Use
• Improved Visibility and coordination
• Improved ROI
• Reduced stock-outs
• Optimized inventory
• Improved Sales

Table2. Benefits of Cloud Computing frame work implementation

Conclusions:

Depending on the business need, an organization can choose to move certain aspects to their IT requirements to the Cloud Computing. With the correct assessment of the business needs, existing infrastructure and through understanding of an organization's strategic objectives, a capable partner can provide relevant and focused solutions. However, there are a few major factors that hold back business from deploying Cloud Computing. The most prominent one is the security issue. Many potential users are still apprehensive about releasing their in-house data to the datacenter of an external Cloud Services Providers due to issues such as privacy, security etc. Apparel and Garment Companies should develop an overall understanding of Cloud Computing enabled supply chain. Supply Chain Infrastructure and architecture to create Supply chain vision is to be arrived at before implementing the Cloud Computing modules for management of supply chains. In addition, companies should constantly re-evaluate and improve management of supply chains by creating benchmarking efforts in Cloud Computing enabled SCM.

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