

# Cloud Computing for Green Supply Chain Management

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## Abstract

Due to the rigorous environmental policy Organizations of several countries are facing difficulties and are forced to follow extended manufacturer task to diminish sources of waste and pollution throughout the Supply Chain (SC). This led to the conversion of traditional Supply Chain Management (SCM) in to Green Supply Chain Management (GSCM) where the manufacturer takes the responsibility from birth of the product to the cradle. The decision makers of GSCM are facing tedious situation not only in Forward flow of products and information but also in Reverse flow of products and information in the form of uncertainties like supply, process and demand. Cloud Computing (CC) develops as an important tool in reducing this by providing services such as infrastructure, platform and software with the aid of Internet. In this paper the application of Cloud Computing for GSCM has been discussed in brief and also explains the benefit and demerit of using CC for GSCM.

**Keyword-** GSCM, CC, Forward and Reverse Flow

## I. INTRODUCTION

In the modern days Organizations are facing difficulties by the stringent environmental regulations imposed by governments and are forced to follow extended manufacturer task to diminish sources of waste and pollution throughout the SC. Traditional Supply Chain Management (Forward Supply Chain) changes in to Closed Loop Supply Chain Management (Combination of both Forward and Reverse Supply Chain Management) taking responsibility of their product from birth to cradle literally called as Green Supply Chain Management (GSCM). Green Supply Chain Management (GSCM) is the design, control and operation of a system to maximize value creation over the entire life cycle of a product with vigorous recuperation of worth from diverse types and volumes of returns over time [1]. Decision makers are facing difficulty with uncertainty in GSCM. Davis [2] finds out three types of uncertainty in SC. They are supply uncertainty, process uncertainty, and demand uncertainty. Uncertainty is defined as the distinction among the quantity of information essential to execute an assignment and the information that is really available [3]. Uncertainty has a great influence on the effectiveness of SC configuration [2]. In the recent era Cloud Computing (CC) emerges as an important tool for decision makers to reduce uncertainty by providing services such as infrastructure, platform and software with aid of Internet [4]. The main purpose of this article is to evidently present how cloud computing can be implemented in GSCM environment as well as divulge the benefit and detriment of using CC for GSCM in reducing uncertainties. The paper in the following sections is ordered as follows. Section 2 deals with CC technology. Section 3 deals with all the activities in GSCM under the influence of CC. Section 4 deals with the implementation of CC for GSCM to reduce Uncertainty. Section 5 deals with the Benefit and detriment of using CC for GSCM. Section 6 deals with conclusions.

## II. CLOUD COMPUTING TECHNOLOGY- OVERVIEW

Cloud Computing is defined as the new generation of computing that utilizes distant servers for data storage and management, allowing the contrivance to use less significant and added proficient chips that consumes a smaller amount power than regular computers [5]. It has three components IAAS (Infrastructure as a Service), SAAS (Service as a Service) and PAAS (Platform as a Service) [www.esat.net] and is explained by Fig 1a and 1b.

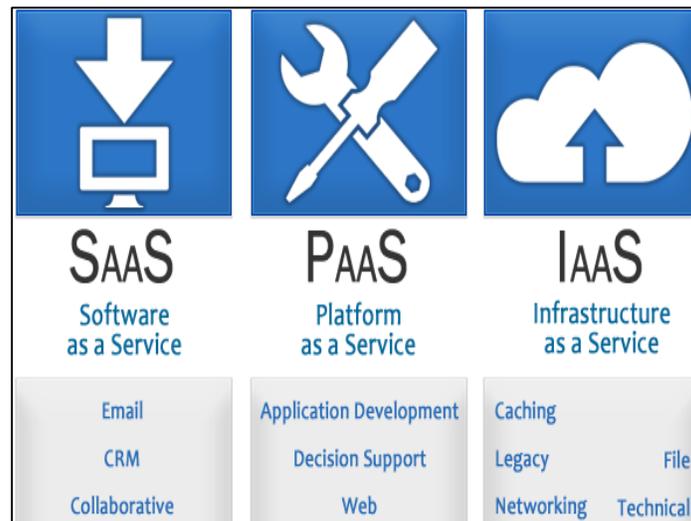


Fig. 1: (a) Business Model for CC

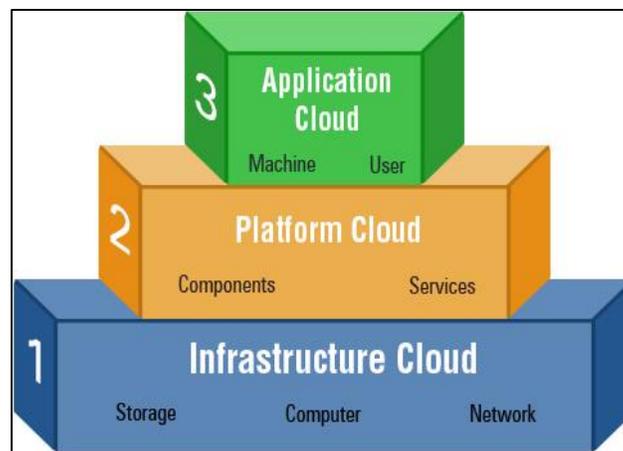


Fig. 1: (b) Business Model for CC  
(www.tatvasoft.com)

Clouds are classified in to four types they are:

- 1) Public Cloud-Available to Company and Customer.
- 2) Private Cloud-Available for Customer.
- 3) Hybrid Cloud- Combination of two clouds.
- 4) Community Cloud- Available for MNCs.

Characteristics of Cloud [www.esat.net]:

- 1) On Demand Self Service.
- 2) Broad network access.
- 3) Resource pooling.
- 4) Rapid Elasticity.
- 5) Measured service.

### III.ACTIVITIES OF GSCM

Cloud Computing is making a great influence on GSCM function market. The functions such as planning and forecasting, e-procurement, warehouse management systems, logistics system, collection systems will be carried out by the component SAAS (Software As A Service) [7].SAAS solutions plays a vital role in reducing uncertainties by providing on demand information about product flow or information flow from the echelon of supplier to echelon of customer in forward flow and from echelon of customer to echelon of supplier through collection center in reverse flow.

#### A. Planning and Forecasting

Cloud-based SAAS are going to help organizations by collaborate with the echelons (retailers, suppliers, distributors, collectors) that are playing a leading part in demand forecasting. SAAS dig up the information from internet and execute necessary actions

like analytics and carry out more precise demand forecast for all echelons [8]. This will help to reduce uncertainty in demand and supply and aware the echelons to check if there is volatile of real demand.

**B. Sourcing and E-Procurement**

Sourcing includes getting hold of, delivery and examination of inward supplies as well as procurement procedure. SAAS operate on catalog that contains numerous statistics from disparate suppliers which offer knowledgeable and unusual guide for companies that handle many of them. Further companies are talented to decide on amongst suppliers that which of them are competent to afford suitable material as their requirement and in moment. SAAS also facilitate companies and suppliers to jointly widen contracts and boost relationship management.

**1) Warehouse Management System**

Warehouse management systems are facing great difficulty due to uncertainty created by Bull Whip effect. These uncertainties are reduced by many organizations using bar coding technologies and wireless services. RFID system integrates with the SAAS data management system to deliver the global detection and tracking of any items or goods across the global supply chain management lifecycle.

**C. Logistics System**

Logistics systems which comprises the combination of Forward Logistics (FL) that carries product from supplier to customer through echelons and Reverse Logistics (RL) that carries used or returned product from customers to collection centre for recycling or refurbishing until End Of Lifecycle (EOL). Logistics information system on demand keep track on products through RFID thereby reducing uncertainty in each echelon such as Supplier, Manufacturer, warehouse, retailer, Customer, Collection center.

**D. Collections System**

Collections systems where the return products from customer, retailer, and manufacturer will be collected in collection centre are facing difficulty due to uncertainty. SAAS system will keep track on products with RFID tag and the system will keep information on returned products status there by deciding Inventory at supplier, manufacturer, and retailer. RL plays a vital role in collecting RFID tag products from each echelon with the SAAS information there by reducing uncertainty.

**IV. IMPLEMENTATIONS OF CC FOR GSCM**

Implementation of Cloud Computing for GSCM is evident which is based on the work by Thomas Schramm, Jonathan wright, Dirk Seng and Derk Jones and they break up the period of SCM in cloud computing in three parts and is given below [9]. From the period 2013-2015 it is clearly known that CC will reduce uncertainty in each echelon by SAAS.

2010-2011	2011-2013	2013-2015
<i>Processes &amp; providers characteristics &amp; examples</i>	<i>Processes &amp; providers characteristics &amp; examples</i>	<i>Processes &amp; providers characteristics &amp; examples</i>
<p><i>In early pilots SCM using cloud needs innovation and continuous improvement. Testing attitude also needed. Support &amp; administrative processes. These can easily be abstracted and isolated, and do not require complex integration.</i></p> <p><i>Examples:</i></p> <ul style="list-style-type: none"> <li>- Capability development/</li> <li>- Training Delivery</li> <li>- Simple analytics</li> </ul>	<p><i>This era captures maturing phase, first providers disappears from the market and other invest to grow and improve service offering. Higher focus on core and rather complex processes.</i></p> <p><i>Examples:</i></p> <ul style="list-style-type: none"> <li>- Pricing optimization</li> <li>- Replenishment planning</li> <li>- Order processing</li> <li>- Transportation load building</li> </ul>	<p><i>Here consolidation phase starts and major player in each category of SCM defined. SCM accept well establish models for usage and Payment of cloud based services. Also complex process covered in cloud e.g. requiring Collaboration between many entities and tighter integration with other processes and perhaps involving physical capacity constraints.</i></p> <p><i>Examples:</i></p> <ul style="list-style-type: none"> <li>- Collaborative engineering</li> <li>- Warehousing and distribution of physical product</li> <li>- Reverse logistics/returns processing</li> <li>- Fleet management</li> </ul>
<i>Customer benefit</i>	<i>Customer benefit</i>	<i>Customer benefit</i>
<p><i>Companies with highest pressure for operational excellence and through competition, Examples: Products /Consumer Goods, High-Tech.</i></p>	<p><i>Broader industry scope, companies with higher integration needs will start using cloud based services as part of their operating model</i></p>	<p><i>All industries applied cloud based processes</i></p>

Table 1: Implementation of CC in GSCM [9]

CC structure utilizes lot of knowledge like consistency technology, online tracking technology, statistics supervision technology and proposal supervision technology. Litheness is immense authority of cloud computing system. It has the facility to boost or reduce computing authority as per requisite by clients. This is referred as flexibility. Flexibility ensures that on demand services presented to the clients at any position in time. This feature of CC paves way to reduce uncertainty.

Cloud offers Flexibility services through that any GSCM client gets benefit. The echelons of any organization which has different branches in different geographical can access the SAAS of cloud Fig 2. If the echelon of any organization scattered worldwide afterward it requires a discrete communications of cloud for every unit. Information allotments have to be consistent and protected among dissimilar echelons so in nearby no need of secretive cloud system. In secretive cloud communications allocation has completed trustworthy and protected way. Further with a centralized Cloud information hub, any organization should utilize disseminated information center under confidential cloud state of affairs [8].



Fig. 2: GSCM with CC

## V. BENEFIT AND DETRIMENT OF USING CC FOR GSCM

Implementation of CC for GSCM provides Decision makers of any organization to decide at right place, right time, right product, and right quantity. SAAS Cloud helps the decision makers by reducing uncertainty by the way reducing Bull whip effect. SAAS Cloud provide a low price method to get GSCM functions, effectively works on budget constraint , rapidly transfer information about any products with help of RFID tag, enable organizations to try innovations at a lesser price with no long-standing commitment. Some of the benefits and detriments are listed below.

<i>Benefits</i>	<i>Detriment</i>
1) Scalability 2) Immediacy 3) Cost control 4) Elasticity 5) Accessibility 6) Competence 7) Optimization	1) Requires High Speed Internet Connection 2) Requires Constant Internet Connection 3) No Backup

Table 2: Benefits and Detriment

## VI. CONCLUSIONS

This paper outlines how CC influences GSCM with SAAS and its impact on functionality. CC can offer the facility of lithely third party software for supply chain partnership and communications desires in a superior mode and reduce uncertainties created by supply, demand etc. CC is an automated prototype through that responsibility is assigned to a amalgamation of associations, software and services accessed over a network. This network of servers and connections is collectively known as the cloud. The demand for CC services has developed immensely in this 2013-2015 period. GSCM Cloud provides an on demand services to any cloud user in a proficient, accurate, consistent and protected manner.

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