Integrated Model of Supply Chain Processes and Performance Measures: A Case of Dairy Industry

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Acknowledgements

This project was supported by the National Research University Project, the Higher Education Commission of Thailand and Faculty of Engineering, Thammasat University.
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ABSTRACT: This study proposes a conceptual framework of integrated model of supply chain processes and performance measures. The proposed model is illustrated using a case of dairy industry. The integrated model provides decision makers with overall view of supply chain components and direct links that need to be maintained for supply chain performance measurement. It is shown that integration of supply chain components enables performance measurement and monitoring, based on supply chain process integration supported by real-time data. Integration of supply chain processes and performance measures is a novel approach for effective supply chain performance measurement in complex supply chains. Implementation of integrated model requires maintenance of key and information in a system environment such as enterprise resource planning.

Keywords: Integration, logistics, performance measurement, supply chain management

As complexity of supply chains increases, the need for performance improvements must increase to keep pace with the factors affecting supply chain practices including ever increasing competition and collaboration among many supply chain partners. At the same time, it is a challenging task for decision makers at all levels of organisations, if they were to maintain sustainable levels of performance measures under current levels of competition, complexity and flux of dynamic conditions, including uncertainty and stochastic demand. Although there is considerable research on various aspects of supply chain performance measurement (Beamon, 1999; Gunasekaran et al., 2001; Holmberg 2000; Akyuz and Erkan, 2010), there is very limited research into holistic approaches to performance measurement and evaluation using integrated models of supply chain processes (procurement, manufacturing and distribution) and individual performance measures for real-time performance measurement, evaluation and monitoring.

In this research, a conceptual framework of integrated model of supply chain processes, components (materials, resources, activities, operations, suppliers, etc.) and performance measures is proposed, as the basis for supply chain performance measurement, evaluation and monitoring under dynamic conditions. The integrated supply chain model is illustrated using a case of dairy industry. The illustration of integrated supply chain model aims to address the broader research question of how does supply chain integration support various partners of a supply chain through real-time information for performance measurement, evaluation and monitoring. The integrated supply chain model of key processes associated with the selected industry case is based on unitary structuring technique.
(Woxvold, 1992) and combines key supply chain processes and associated components are directly linked to performance measures using real-time data associated with each component.

The paper presents a brief literature review next, followed by the research methodology. Integrated supply chain model of processes and performance measures, including mathematical model of total cycle time is presented next. This is followed by integrated supply chain model of selected industry scenario, illustrating main processes and components involved. Finally, the paper concludes with research findings and future research directions.

**LITERATURE REVIEW**

Among various aspects of supply chain management widely studied and reported over the last two decades, supply chain integration and performance have received significant attention in recent times. Many research studies have focused on a range of research topics including identification and definition of performance indicators and measurement systems (Gunasekaran and Kobu, 2007; Mondragon *et al.*, 2011), supply chain models, tools and techniques, in particular on strategic planning of a supply chain for effective supply chain performance (Shankar *et al.*, 20012), supplier integration strategy for performance improvement (So and Sun, 2010), evaluating the performance of global third party logistics service providers in a supply chain (Kumar and Singh, 2012).

In the context of supply chains, a number of supply chain models have been developed for managing complex supply chain practices through systematic planning/scheduling of supply chain operations as well as measuring, evaluating, monitoring and improving supply chain performance across various industry sectors. The SCOR model, developed by the Supply Chain Council, is recognized as one of the well-established system for identifying, evaluating and monitoring supply chain performance (Shepherd and Gunter, 2006) and has been adopted in various other areas including providing insights into the physical characteristics and value points along the supply chain (Burgess and Singh, 2006). Furthermore, SCOR has been adapted as supply chain performance measurement framework, using a series of measures based on the sourcing function of the SCOR model (Chae, 2009), setting a foundation for the environmental and business performance of supply chain (Bai *et al.*, 2012) and addressing competitive dimensions of modern supply chains (Zhu *et al.*, 2010).
Recently, Zaman et al. (2012) adopted the SCOR model for performance evaluation in lean supply chains, recognising SCOR model as one of the systematic and balanced performance measurement systems. Very recently, Alfalla-Luque et al. (2013), based on empirical research proposed a framework for measuring supply chain integration, which enables any organization to identify critical success factors for integrating their supply chain. While their framework provides a basis for measuring levels of integration from a system perspective, there is still lack of research on integrating supply chains with associated performance measures using direct links between processes and components, from business perspective.

Several studies have examined broader supply chain performance systems and methods, in particular implementation and improvement aspects. While recognizing lack of research into performance measurement systems for supply chains, Neely et al. (1995) emphasises a number of approaches for performance measurement as well as the need for new measurement systems and metrics. Other research studies on broader supply chain performance systems have examined factors influencing the successful implementation of performance measurement systems (Bourne et al., 2003), the forces which shape the evolution of performance measurement systems (Kennerly and Neely, 2002; Waggoner et al., 1999), how to maintain performance measurement systems over time (Bourne et al., 2003; Kennerly and Neely, 2002); what factors need to be considered in the process of selection of lean manufacturing systems (Anand and Kodali, 2008); and the need to identify dimensions and variables for supply chain integration and how it affects the overall supply chain performance (Alfella-Luque et al., 2013). In addition, the relationships between supply chain processes and performance measures are highlighted, based on process and performance measures hierarchy (PPMH) model for performance measurement (Chan and Qi (2003) and a performance assessment tool that measures the performance of key supply chain processes and activities (Banomyong and Supan, 2011).

It is evident from broader research on supply chain performance measures and measurement that on-time delivery is commonly considered measure across every part of the supply chain and is very sensitive to dynamic changes and quality issues in particular with perishable materials such as dairy products. However, the research on supply chain performance measurement and improvement lacks sufficient depth and clarity regarding the linkages that exist between performance measures, supply
chain components and their relationships using detailed supply chain models; this is particularly true in relation to dynamic conditions. Therefore, the aim of this research is to develop a conceptual framework of integrated supply chain model with performance measures through direct links between supply chain components (materials, resources, activities, operations, etc) for evaluating and monitoring supply chain delivery performance in real-time under dynamic conditions.

**RESEARCH METHODOLOGY**

This research employed a two-stage approach: (i) development of integrated model of supply chain processes and key performance measures as the basis for performance measurement, evaluation and monitoring in dynamic conditions; and (ii) illustration of the integrated supply chain model using a case of dairy industry scenario. The proposed conceptual framework integrates supply chain networks (processes and components) and performance measures through direct links between supply chain components and individual performance measures. The integrated supply chain model is based on unitary structuring approach, by incorporating supply chain components (materials, activities, operations, resources, suppliers, etc) and relationships, by expanding key elements of the SCOR model (source, make, deliver, etc) with key functions and components as well as associated relationships. The conceptual framework is illustrated using a selected dairy industry supply chain scenario, based on integrated supply chain models.

In this case, performance measures across main processes (procurement, manufacturing and distribution) are defined and formulated (mathematically modeled) using key parameters associated with supply chain processes, components, and relationships. Once performance measures are defined across the supply chain, they can be measured and evaluated using a set of input variables and parameters associated with processes and components in real-time. All individual performance measures are two-dimensional where each one is measured horizontally (time-scale) and vertically connected with supply chain components across main processes for direct inputs. For example, complete cycle time is a function of individual lead times (sourcing, making, and distribution) in the horizontal axis and linked to individual processes and components (eg. availability of materials and completion of relevant activities/operations with finite loading of resources). Key performance measures are evaluated and linked to time-related performance such as on-time delivery and individual
lead-times. A case of dairy supply chain is demonstrated with data collected from the selected manufacturing organization of dairy industry.

INTEGRATED SUPPLY CHAIN MODEL

In order to develop an integrated supply chain model, a typical dairy industry case of many supply components (materials, resources, activities, operations, etc.) across key processes (procurement, production and distribution) is considered. It is assumed that key processes are sequential where production is driven by demand using a make-to-order strategy.

[INSERT FIGURE 1]

The conceptual framework of integrated supply chain, based on unitary structuring technique is shown in Figure 1 and represents key processes of sourcing of raw materials, manufacturing of finished product (only one product is selected for the framework) and distribution of the finished product across the distribution network. It is noted from the conceptual framework of integrated supply chain model with performance measures (Figure 1) that integrated supply chain model (upper section of Figure 1) represents supply chain processes and components, using unitary structure relationships (parent-component, component-component and component precedence), while performance measures are identified and connected across supply chain processes (lower section of Figure 1) for evaluating overall supply chain performance. In the terminology of the unitary structuring approach, the outline of the component icons appear as “M”, “A”, “R”, “S” and “C” which represent the first letter in the words Material, Activity, Resource, Supplier and Customer respectively. Individual components are identified with their first letter and incremental number in the sourcing, manufacturing and distribution networks of the supply chain.

Based on the integrated model, overall supply chain performance can be expressed as a function of performance measures of each supply chain process. For example, total cycle time is a function of individual times associated with procurement of raw materials, manufacturing of finished product and delivery of finished product to customers. In this case, individual lead times are dependent on activity time durations of corresponding supply chain process, which can be taken directly from the activity component of the integrated supply chain. Similarly, overall performance can be a function of various individual performance measures associated with the respective supply chain operations. In the case
of sourcing/procurement, performance is dependent on procurement lead times, inventory of individual materials (including shortage and spoilage) and inventory cost.

Since performance measures are defined as overall measures, based on the supply chain model of the selected scenario, total cycle time (TCT), as one key performance of the supply chain, is a function of procurement lead time (PLT), manufacturing lead time (MLT), and delivery lead time (DLT). This function can be expressed as:

\[ TCT = PLT + MLT + DLT \]  \hspace{1cm} (1)

In this case, lead times are dependent on various factors and best evaluated using direct links between supply chain components and performance measures. Thus, PLT, associated with sourcing of raw materials and stocks (inventories and shortages) is a function of individual procurement lead times and availability/shortage of stock items. In this case, raw materials include all the stock items, excluding raw milk since it is directly delivered to manufacturing plant. Since availability of stock items is identified as inventory or shortage at storage locations (events E1-E5 of the unitary structure-based supply chain model of Figure 1), earliest event time of sourcing (EET\text{\textsubscript{sourcing}}), based on both availability of stock items and direct delivery (distribution lead time) of raw milk can be expressed by:

\[ EET\text{\textsubscript{sourcing}} = \max\{PLT_{\text{mt}}, \ DLT_{\text{RMt}}\} \]  \hspace{1cm} (2)

Where PLT\text{\textsubscript{mt}} is PLT of raw material m in period t, and DLT\text{\textsubscript{RMt}} is DLT of raw milk in period t.

In this case, PLT of each stock item can be evaluated using activity durations associated with procurement of each material into the corresponding storage (E1-E5). Given that each raw material is externally procured, through a set of activities (Figure 1), the average procurement lead time can be expressed as a function of average activity times for sourcing individual raw materials (stock items), assuming raw milk is delivered on time for each production shift without any delay. Thus the average procurement lead time is given by:

\[ PLT_i = \left( \sum_{i=1}^{N} A_i \right) / (R) \]  \hspace{1cm} (3)

Where A\text{\textsubscript{i}} is activity duration of activity i (related sourcing of raw materials) and R is number of raw materials.

In the case of parallel activities along the supply chain, the critical path is selected for evaluating the average lead time. In addition, a set of sequential activities are considered as one activity for the simplicity.
Since sourcing of each raw material involves two sequential activities (eg. A1 and A2 for material ROW), there are 10 activities (N=10) while there are only 5 raw materials (R=5). Raw milk is excluded from raw material category list because it is delivered directly to the production line without storage. In this case, any delay in the delivery of raw milk can influence overall production lead time and can be accommodated by adding delay time to PLT expressed in equation 3 above. Incorporating any delay of raw milk delivery into PLT allows for a real time update of cycle time.

Similarly, MLT is based on the individual activity times and availability of resources and raw materials (i.e. bottles and caps). Since each activity is attached to a single resource, total resource requirements are equivalent to total activity durations. Thus, MLT is evaluated by taking both activity duration and availability of stock items into account. In this case, MLT is evaluated using the methodology adopted earlier in evaluating total activity duration of a maintenance project (Samaranayake and Kiridena, 2012). For the purpose of lead time calculation, each storage location of integrated supply chain model is considered an event. Thus, realization of each event corresponds to receiving goods (main ingredients, raw milk, bottle, cap, etc). Therefore, for event i which is directly preceded by J events and shared by M materials, the earliest event time at event i (EET) is given by:

\[
EET_i = \max \{ \max_j \{ EET_j + \max_{\alpha} (D_{j\alpha}) \} , \max_m (PLT_m) \} \quad j \in J \quad m \in M
\]

(4)

Where \( D_{j\alpha} \) is duration of activity \( \alpha \) from event \( j \), PLT \( m \) is PLT of material \( m \) (material required for realisation of event i) at event i. The earliest event time is calculated from the forward schedule.

For the last event in production (i.e. storage of finished product – pasteurised milk), incoming activities include mixing, homogenizing, cooling and filtration up to first storage of homogenised milk followed by standardisation, filling, capping, packing palletizing and storing (A15-A18, A21-A22 and A25-26) on the main production line while there are two other branches associated with bottles and caps at different stages of production. The earliest event time of production is the latter of the material availability times (procurement lead times of (i) bottles in time for filling and (ii) caps for capping operation) and completion of production. Earliest event times of all events can be represented by:

\[
EET_7 = \left[ \max \left\{ \max_j \{ EET_j + (A19 + A20) \} + (A21 + A22) \right\} , \left( EET_A + (A23 + A24) \right) \right] + (A25 + A26)
\]

(5)
\[
\begin{align*}
EET_1 &= \{ (A1 + A2) \}, \quad EET_2 = \{ (A3 + A4) \}, \quad EET_3 = \{ (A5 + A6) \}, \\
EET_4 &= \{ (A7 + A8) \}, \quad EET_5 = \{ (A9 + A10) \}, \\
EET_6 &= \left[ \max \{ EET_3, \max (EET_1, EET_2) + (A15 + A16) \} \right] + (A17 + A18) \\
\end{align*}
\]

(6)

It is assumed that earliest event times (events E1-E5) are dependent on the availability of the respective materials. In this case, the earliest event time is determined by the average lead time of individual materials with reference to current time (time=0). Since the manufacturing lead time (MLT) depends on the availability of raw materials and sourcing lead times of individual materials, the latest time of all the events associated with sourcing must be determined first. Thus, the earliest time for sourcing is considered to be the earliest time for production start. It is defined by \( EET_{\text{sourcing}} \) and is expressed by:

\[
EET_{\text{sourcing}} = \max_i EET_i \quad i \in I
\]

(7)

Where \( I \) is a set of all events in sourcing process level of supply chain and consists of events E1-E5.

Thus, MLT is given by:

\[
MLT = EET_7 - EET_{\text{sourcing}}
\]

(8)

Alternatively, MLT can be expressed by absolute times of activity durations and associated event times within manufacturing, based on the assumption that raw materials are available in stocks and raw milk is delivered on-time for each production shift, as follows:

\[
MLT = \left[ \max \left[ \max \left( A15 + A16 + A17 + A18, (A19 + A20) \right), \left( A21 + A22 \right), \left( A23 + A24 \right) \right] + (A25 + A26) \right]
\]

(9)

Similarly, delivery lead time can be evaluated using delivery times of individual customer orders (multiple customers and products). Average delivery lead time, based on three customer orders (C1, C2 and C3), loading & delivery time of order of product k, for customer l (\( DA_{kl} \)), number of customers \( n \) and number of products \( p \) can be expressed by:

\[
DLT = \left( \sum_{k=1}^{n} \sum_{l=1}^{p} DA_{kl} \right) / (n)
\]

(10)

In this simple case of only three customer orders of one product, DLT can be expressed by:
Although individual lead times (PLT, MLT and DLT) are expressed in generic terms, they can be evaluated for each period of planning/scheduling (time t) over a total planning horizon (T). Thus, average total cycle time (TCTₜ) can be expressed as:

\[
TCTₜ = \left\{ \frac{1}{p} \sum_{i=1}^{p} \left( PLT_i + MLT_i + DLT_i \right) \right\}
\]  

(12)

It is noted from mathematical expressions leading to Eq. 12 that total cycle time is a function of individual lead times (procurement, production and distribution) over a number of products and periods, and can be evaluated using real-time data associated with the key variables of supply chain components, identified through the conceptual framework (Figure 1) over planning horizon. Furthermore, the conceptual framework of integrated supply chain model of processes and associated components can be used to evaluate various other key performance measures including overall supply chain cost, on-time delivery of products across a customer-base and quality of products.

Depending on the variability and dynamic nature of each cost element associated with supply chain processes, total cost can be expressed as a function of individual cost elements associated with supply chain components (materials, activities and resources), using relationships among supply chain components and cost rates. For example, the cost of raw materials is based on BOM quantities and component relationships while the cost of production operations is based on activity duration and resource utilization for each activity. Similarly, delivery cost is based on activity duration and resource utilization of each delivery. In this case, procurement and inventory cost of raw materials associated with the finished product (Pasteurized Milk) is based on the proportion of total procurement cost and inventory of related raw materials. Once the complete supply chain of the selected dairy industry is modeled using key components and relationships, all raw materials, activities/operations and resources are accounted for calculating the total cost.

Similarly, all other performance measures can be described/defined using key variables across each process and component relationships and can be evaluated using planning/scheduling outcomes with a set of input values over a selected period of time (planning horizon). For example, capacity utilization can be evaluated using a production schedule over a period of time (one week), capacity
loading of each resource (mixing, filling, storing, etc.) and capacity availability (shift time). In addition, each performance measure can be evaluated in real-time when the models are implemented in an integrated system environment such as enterprise resource planning system, using associated functional applications and key data records. It can be concluded from the proposed integrated supply chain model that procurement, manufacturing and distribution processes are integrated using key functions and associated components and relationships, which forms the basis for integrating supply chain performance across the supply chain. Thus, the proposed integrated model, illustrated with delivery performance highlights the linkages between performance measures, in particular time-related performance measures and supply chain components. At this stage, the implementation of an integrated supply chain model in an integrated system environment is beyond the scope of this paper. However, the proposed conceptual framework is illustrated, by considering one of the key performance measures in the selected dairy industry scenario and is presented next.

INTEGRATED SUPPLY CHAIN MODEL: A DAIRY INDUSTRY CASE

Dairy manufacturing organization of this study, located in Bangkok, Thailand is part of large supply chain involving a number of suppliers and customers. Key data for modelling of the supply chain was collected in 2012-2013, based on interviewing of different department managers. Each manager provided process data related to respective area of operations, in terms of key activities involved, average times of each activity/operation using operations/productions weekly reports. In this study, we focused on action research rather than empirical survey. Main supply chain processes of selected dairy industry scenario include contract farming, cooperative farming, pre-mixing, pasteurizing of fresh milk and drinking yoghurt, filling and packing and delivery through the distribution network. A schematic view of the complete supply chain is shown in Figure 2. Supply of raw milk and other materials include (i) delivery of raw milk to co-operative suppliers, (ii) delivery of packaging materials, flavors and fresh fruits directly to the dairy manufacturer. Immediate and important customer base include distribution of retailers (i.e. Tesco, 7-11) and warehouse of local/sales agents. The main reasons for choosing the case company for this research include (i) Accessibility of all relevant real data/information; and (ii) This company has been experiencing difficulties of evaluating overall performance, in particular lead-times, which leads us to set-up the main research problem. In addition, we were able to observe the company's supply networks at site, interview middle to top managers to clarify some unclear process sequences, and verify both manufacturing and distribution networks for developing overall supply chain model ed as part of network modelling.

[INSERT FIGURE 2]
Furthermore, manufacturing network of the supply chain is integrated directly with suppliers (at the sourcing) and customers (at the distribution) and involves inventories of both raw materials and finished products. Since a supply chain of this nature involves direct input of some raw materials into the production line (e.g., raw milk), supply chain models of integrated sourcing, production and distribution is unique, from a planning perspective, and is closely related to the make-to-order scenario. Sourcing of both stock (ingredients, bottles and caps) and non-stock (raw milk) items are considered as key inputs into the main production of four different products. It is expected that some products are more in production/demand than others. Depending on the proportions of individual products, the supply chain model represents the majority of products using relevant supply chain components and relationships. Integrated supply chain model of processes and performance measures, associated with manufacturing of one finished product and corresponding procurement and distribution operations is illustrated next.

**Integrated Supply Chain Model with Performance Measures**

The supply chain of the selected industry scenario shown in Figure 2 is a complex one involving a number of downstream and upstream partners. It is also characterized by fast moving consumer goods and make-to-order planning strategy in manufacturing segment of supply chain. Since the supply chain is a complex one with various inputs across a range of products and customers involved, the integrated supply chain model is a combination of individual supply chain models where each model represents one product from the manufacturer’s perspective. In addition, each model is linked to key performance measures through process components. For example, overall total cycle time is a function of individual product cycle times and can be evaluated and monitored at process levels (sourcing, manufacturing and distribution) over various combinations of products and customer demands. It is expected that individual performance measures be used to address any issue and/or problem at the process level and subsequently improve overall supply chain performance. The integrated supply chain model of the selected industry, based on key supply chain processes (procurement, manufacturing and distribution), associated data elements and relationships, is shown in Figure 3. In this case, supply chain components are identified using process maps and defined as process and components (data elements) of the integrated supply chain model, using a unitary
structuring approach. Although the selected supply chain of the dairy industry produces three major products and can be represented by a combination of three individual models, only one product (Pasteurized Milk (PM)) is considered for the purpose of illustration and is shown in Figure 3.

[INSERT FIGURE 3]

Although some of activities within the procurement and manufacturing areas of the supply chain are common for more than one or all products, each activity is uniquely identified and defined for the sake of simplicity for modeling. Thus, activities related to procurement and production processes of Pasteurized Milk (Figure 3) are labeled with the first letter “A”. For example, activities deboxing/feeding/labeling and rinsing associated with a material component (bottle) are labeled A39 and A40 in Figure 3. Since there are fewer numbers of distribution activities, each distribution activity is identified and labeled by DA. For example, DA1 represents distribution activity 1 on the distribution side of the integrated supply chain model of finished product. Although resource components are not identified with labels, each resource component of sourcing and manufacturing is identified as R while each resource component of distribution side is identified by DR. The number assigned to a resource component is the same as the corresponding activity component. For example, resource component of activity A5 is identified as R5 while resource component of DA5 is identified as DR5. In addition, C1, C2 and C3 represent customers 1-3.

It is evident from the conceptual framework (Figure 1) that there performance measures identified across the supply chain are dependent on various parameters associated with supply chain components across three main processes (procurement, manufacturing and distribution) and key entities (suppliers, manufacturers, wholesalers, distributors and customers) of a supply chain. The limitation of the proposed integrated supply chain model was the requirement of maintaining individual data and relationships in a system environment for real-time performance measurement, in particular under dynamic conditions. In addition, the integrated framework is limited to only time-related performance measures and can be extended with cost-related performance measures, once cost elements associated with each process element are identified and modelled accordingly. Thus, future studies can focus on testing of integrated supply chain model on other performance measures (cost and quality related) as well as selected performance measures such as delivery performance, since improving lead time
significantly impacts various other performance measures (Gunasekaran et al., 2001) and is directly linked to improving customer service levels (Karim et al., 2010).

CONCLUSION

The paper proposed a conceptual framework of integrated supply chain model incorporating supply chain processes, components and performance measures for evaluating and monitoring key supply chain performance. It is shown from the integrated supply chain model of selected dairy scenario that supply chain components across the entire supply chain can be used as the basis for modeling of overall supply chain performance measurement, evaluation and monitoring with real-time information flow.

Thus, the integrated supply chain model form the basis for the evaluation and monitoring of supply chain performance in complex and uncertain situations. In addition, the integrated supply chain model of processes and data with direct links between performance measures is a novel approach for effective performance evaluation in complex supply chains. Therefore, process and data integration at process level provides a basis for real-time evaluation and monitoring of performance under dynamic conditions. The integrated model provides decision makers with overall view of supply chain components and direct links that need to be maintained for performance evaluation and monitoring. However, implementation of integrated model requires maintenance of supply chain components (data elements) with all necessary data and information in a system environment such as enterprise resource planning. In addition, data maintained in an ERP system needs to be extended with additional relationships (eg. component-component) associated with the proposed unitary structure-based supply chain model. Implication for research practice is that wider adaption and diffusion of the proposed model requires further validation of the model and feasibility of implementation, using real-time data and information on selected performance measures. It is suggested that in the future research the proposed model be validated using (i) an industry case with key supply chain processes and components, (ii) selection of key performance measures, (iii) a plan/methodology for relevant data collection, model development and testing. Future research can also focus on developing and testing more complex industry situations/scenarios with broader performance measures of supply chain (cost, time and quality related performance measures), so that the robustness of the proposed framework can be demonstrated further.
Once the model is validated and tested with more complex industry scenarios, the feasibility of implementation needs to be carried out, using maintenance of key data in a system environment, with required performance indicators.

REFERENCES


**FIGURES**

**Figure 1:** Conceptual Framework of Integrated Supply Chain and Performance Measures

**Figure 2:** Schematic view of Supply Chain of Selected Dairy Case Study
Figure 3: Integrated Supply Chain of Selected Dairy Industry Organisation - Pasteurized Milk