Investigation on Futuristic Supply Chain Risk Management Initiatives for Loss Reduction in Manufacturing Organisations

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Abstract: Manufacturing organisations are expected to produce their products with prompt delivery to satisfy their customers by using better supply chain activities. Starting from procurement of raw materials to the delivery of final products, there is inevitable losses due to various issues in supply chain activities and its executions. Ultimately, these issues are causing time delay in the entire manufacturing cycle. Thus, it is essential to study, understand and track the various expected risk events in supply chain executions for loss reduction and continuous improvement. Hence, organisations must pay more attention in futuristic supply chain risk management initiatives for better, systematic and dynamic executions using appropriate strategies. This paper investigates time delay issues in supply chain executions of manufacturing organisations with an elaborate discussion on various forms of expected risk events. It also suggests more dynamic models for risk mitigation with a future scope of risk prevention towards continuous improvement.

Keywords: Supply Chain, Supply Chain Management, Risk, Risk Management, Risk Mitigation, Loss Reduction, Continuous Improvement

1 Introduction

Global market influences the role of the cooperation, coordination and consistent integration of various activities during the supply chain execution in order to reduce the likelihood of risk events. On the other hand, manufacturing organisations are in need of implementing the risk management practices to observe a key challenge that lies in the trade-off between opportunity and loss (Schwab and Schwab, 1997). Thus, continuous monitoring and execution of supply chain activities are essential to stay in the fierce competitive environment. Nowadays, manufacturing organisations are ready to focus and adopt newer techniques, principles and strategies to achieve an overall effectiveness in the entire system. The introduction of variety of products from various competitors insists manufacturing organisations to focus better alternative strategies in the internal as well external supply chains to meet the customer expectations and due date demand requirements.

Starting from procurement of raw materials to the delivery of final products, there are inevitable losses due to various issues in supply chain activities and executions. Ultimately, these issues are causing time delay in entire manufacturing cycle. Supply chain planning is vital for prompt execution of various supply chain activities (Kok and Fransoo, 2003). Applications of optimisation techniques for various strategic issues are highly contributing better supply chain planning (Muriel and Simchi-Levi, 2003). Flexibility considerations in supply chain (Bertrand, 2003) activities and its executions are necessary for an effective manufacturing system. Thus, the streamlined investigations in supply chain activities and its execution are necessary to satisfy the customers in time. Hence, it is essential to study, understand and track the various expected risk events in supply chain executions for loss reduction and continuous improvement.

2 Literature Review

Recently, it is increasingly observed as a part of a supply chain that has to compete against other supply chains (Christopher, 1992) rather than as a single organisation competing against other individual organisations. The increasing global competition, the changing customer's expectations and technological innovations challenge organisations to aim for business agility through process-focused thinking. The global performance of business processes is however constrained by unpredicted events, which cause deviations from the expected purpose. By anticipating these probable events, the process management team shall balance cost, risk and associated performance. Thus, it is necessary to provide methods for risk considerations (Sienou et al., 2006) for mitigation and loss reduction. The number of potential response for particular risk events is risk avoidance, risk retention, risk transfer and risk reduction. The related data are properly recorded as risk documents for further reference and future review analysis. Hence, continuous monitoring and supply chain integration for risk mitigation, loss reduction and its future elimination are essential.

Global competition and maturing domestic markets have driven supply chain members to reassess their activities and its execution to remain competitive in the market. Recently, the issue of buyer–seller relationships in *Supply Chain Management* (SCM) is highlighted (Myers et al., 2000) to achieve enhanced supply chain executions. Thus, the essence of information sharing and supply chain coordination is necessary to retain customers in the fierce competition (Chen, 2003) and timely respond to the customer demand requirements. Effective risk control measures are executed by adopting appropriate cause consequence analysis (Lewis, 2003) to achieve risk identification, reduction and control. Mathematical approaches such as 'Evolutionary computation' have shown an interesting potential in the engineering fields. The optimization strategies that are used in these approaches have led an increasing number of researchers to address several types of problems encountered in the area of manufacturing systems (Pierreval et al., 2003).

Fast and dramatic changes in customer expectations, competition and technology are creating an increasingly uncertain environment. In order to respond this, manufacturers are seeking to enhance flexibility across the entire supply chain executions. It is strategically important for enhancing competitive position and winning customer orders. It also has strong, positive and direct relationships with customer satisfaction (Zhang et al., 2003). A framework was proposed for prioritising lead time reduction to achieve desirable levels of market mediation performance explored (Treville et al., 2004). When a company faces the global market, they would have to reengineer their processes and reorient their operations by adopting strategies such as *supply chain positioning* to achieve better performance. This refers to actions taken by organisations to respond and satisfy customer's demand requirements (Sen et al., 2004). A framework which defines ideal profiles of products and markets for manufacturing and investment decisions that relate to alternative process choices of priorities have been explored (Silveira, 2005). Six dimensions of SCM practices (strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices and postponement) were conceptualised, developed and validated to provide a precise measurement instrument to assess the performance of the overall supply chain (Li et al., 2005). Integrating the parts of the supply network will create operationally outperforming business models that further boost the inherent dynamics of supply chain executions (Hameri and Paatela, 2005). A model predictive control methodology is proposed with a stochastic optimisation approach and adopts a scenario-based multistage stochastic mixed integer linear programming model is introduced to address the problem of dynamic SCM. This study also incorporates uncertainty and process dynamics into enterprise wide models which contemplate cross-functional decisions. It is emphasized that the significance of merging uncertainty treatment and control strategies improve the supply chain performance (Puigjaner and Lainez, 2008).

Uncertainties are ultimately causing time delay in the manufacturing cycle. Supply risk or the likelihood of supply chain disruptions is emerging as a key challenge to SCM. Recently, the challenges posed to supply chains due to the turbulent environment of both from within the industry along with external influences (Trkman and McCormack, 2009) often dominate system dynamics and affect the dynamic operability of the organisations. A major challenge for an enterprise to stay in today's highly competitive market environment is to be able to capture and handle the dynamics of its entire supply chain (Puigjaner and Lainez, 2008). Hence, it is essential to address the reasons and the associated root causes of various issues in supply chain executions and its associated *Loss Producing Events* (LPEs) with a view to reducing and preventing them in future. Thus, manufacturing organisations must pay more attention in futuristic supply chain risk management initiatives for better, systematic and dynamic executions by using appropriate risk mitigation strategies. This paper investigates with an elaborate discussion on various forms of expected risk events due to time delay in supply chain executions of manufacturing organisations. It also suggests more dynamic models for risk reduction with a future scope of risk prevention for loss reduction towards continuous improvement.

3 Objectives of the Research

The research briefly reported in this paper was carried out to achieve three objectives. They are listed below:

- to investigate the various forms of expected risk events due to time delay in supply chain executions of manufacturing organisations
- to justify the necessity of and attention to futuristic supply chain risk management initiatives for better, systematic and dynamic executions by using appropriate risk mitigation strategies
- to emphasize the need for more dynamic models for risk reduction with a future scope of risk prevention for loss reduction

4 Investigation on various forms of LPEs due to time delay in supply chain executions of manufacturing organisations

Manufacturing organisations are seeking better strategies and ways to identify, evaluate, control and monitor supply chain risk, which will serve to safeguard business continuity and maximise profitability. It is becoming increasingly clear that traditional supply chain risk management approaches must be enhanced to include ways and means by which the new uncertainties arising from these trends and developments can be identified and addressed. But, there is a gap between theory and practice of the supply chain risk management. Hence, there is more scope of doing research improvements for reducing this gap.

The decisions at the strategic level of the supply chain influence its effective execution of various activities. There are five major activities that take place within a supply chain at the strategic level namely buy, make, move, store and sell (Govil and Proth, 2002). If there is any execution deficiency in these supply chain activities, then there is inevitable time delay in the manufacturing cycle. These issues must at least be identified, listed and addressed in an appropriate manner for loss reduction. To achieve these objectives, an investigation conducted in few batch production manufacturing organisations. The various forms of expected risk events due to time delay in supply chain executions of manufacturing organisations are investigated and listed below.

4.1 Time Delay due to Materials and Suppliers

The materials and suppliers are causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 1.

Table 1 Reasons for time delay due to materials and suppliers

S. No.	Primary reasons	Secondary reasons
1.	Inadequate inventory	Failure to give orders and instructions clearly in time
		Permitting improper materials
		Permitting improper suppliers
		Not knowing the right kind of suppliers to order
2.	Over inventory	Ordering more materials that are necessary
		Not returning excess material of stock, when there is no further necessity
3.	Lack of knowledge of materials	New men not thoroughly instructed
		Men not instructed on new work
		Blueprints or sketches torn or illegible
		Machines being out of order or not adjusted
		Failure to follow each job thoroughly
4.	Inadequate and slack supervision	Resulting in spoilage of material
		Failure to explain to workers about money value of material and suppliers
5.	Lack of attention and follow-up	Not paying much attention to workers' eyesight and health as possible causes of spoiled work
		Lack of discipline among workers, thereby encouraging carelessness
6.	Lack of utility of materials and traceability of defective materials	Allowing men to use supplied materials unsuited for the work or too good or not good enough
		Inability of the worker to identify defective work so that it can be corrected
7.	Lack of control in man-material handling	Taking men's ability for granted about material handling
		Not ensuring that workers are qualified for the work, especially new men
8.	Loss of materials	Failure to see that materials are inspected, piled and stored properly
		Lack of system in controlling the supplied materials to prevent loss and theft
9.	Loss due to material condition and wastages	Failure to investigate all bare wires, leaky valves, pipes, fitting sun steam, water, gas, electric and compressed air lines, etc.
		Permitting the waste or abuse of such supplies as brooms, stationery, oils, gloves, shovels, rubber hose, etc.
10.	Lack of material processing and associated wastages	Letting defective material go through as standard
		Scrapping materials that could be salvaged
		Allowing workers to use oil, compressed air, small tools, chemicals etc. for their personal use

4.2 Time Delay due to Machinery and Equipment

The machinery and equipment are causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 2.

Table 2 Reasons for time delay due to machinery and equipment

S. No.	Primary reasons	Secondary reasons
1.	Improper planning and scheduling	Failure to plan full day work to properly use all available machinery
		Lack of time-related considerations and planning
2.	Loss due to machine selection and completion of jobs	Foreman's lack of knowledge on possible use and capacity of various machines
		Lack of knowledge of jobs to be completed with available machinery and equipment
3.	Lack of maintenance activities	Failure to inspect machinery to keep it in good condition and to prevent breakdowns
		Failure to make regular examinations of wire ropes, belts, chain drives, gear drives, conveyors, lubrication systems, valves etc.
		Lack of cooperation with maintenance department
4.	Loss due to machine utilisation	Using unnecessarily large and powerful machines for small work
		Abusing small machines for large work
5.	Lack of knowledge in latest machinery and equipment	Failure by the foremen to keep information about latest types of machinery and equipment
		Failure to keep the suppliers' database for machinery and equipment
6.	Loss due to idleness of machinery	Not protecting idle machinery from weather, dust, dirt, rust, fumes, etc.
		Allowing machinery to stay dirty by lack of periodical cleaning and follow-up actions
7.	Loss due to improper inspection on machineries	Failure to inspect for proper lubrication of all moving parts
		Failure to make needed repairs promptly
8.	Lack of instructions on machinery handling	Lack of instruction to worker on the proper operation of machinery
		Lack of proper discipline of worker to prevent abuse of machinery or equipment
		Allowing men to make sloppy repairs
9.	Loss due to machinery and equipment condition	Lack of follow-up in machinery's current performance
		Failure to pay attention to workers' opinions on value and condition of machinery and equipment
10.	Loss due to machinery replacement and scrap	Repairing machinery that should be scrapped, it may be costlier than new machinery
		Scrapping machinery that can be repaired

4.3 Time Delay due to Manpower Utilisation

The improper manpower utilisation is causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 3.

4.4 Time Delay due to Work Organisation

The work organisation and related executions are causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 4.

Table 3 Reasons for time delay due to manpower utilisation

S. No.	Primary reasons	Secondary reasons
1.	Failure to control turnover of capable workers	Not considering the direct and indirect costs of labour turnover
		Not keeping promises which could be fulfilled
		Making promises which cannot be fulfilled with regard to wages, promotion etc.
		Discharging men without sufficient root cause and improper use of the discharge slip as a penalty
		Keeping a worker on a job for which he has a violent dislike
		Failure to question men who leave on their own accord
2.	Loss due to man power management	Too much bossing and not enough in intelligent direction
		Too strict or too lax enforcement of discipline
		Treating one man better or worse than others: favouritism
		Taking sides with worker's groups
		Criticising one worker to another
		Failure to interpret correctly management's real aim and policies to workers
		Failure of the foreman to inform the management about the demands of the workers
3.	Failure to get full production from new workers	Not ensuring new workers' cooperation
		Incomplete instruction about the job to new workers
		Failure to impress on new worker about the necessity of a full day work and what it consists of
		Failure to select new worker with proper qualifications for the work to be done
		Impatience with new workers who learn slowly
		Failure to get other workers to show a friendly helpful attitude to new worker
		Failure to contact new worker as often as may be required
		Not informing new worker about the plant's conditions and regulations, safety precautions, pay days, lavorotary, drinking water, lockers, washrooms etc.
4.	Lack of information and knowledge of manpower	Lack of information to new worker about unpleasant or danger parts of his work
		Lack of knowledge on work and inadequate training
		Failure to train a worker under study
5.	Failure to get work extraction from workers	Failure to command worker for doing good work
		Failure to explain as much about the work as possible to make it interesting
		Lack of interest in workers' progress and personal affairs
		Failure on the foremen's part to admit a mistake to worker
		Lack of attention to workers' ability and temperament in assigning work to him
		Failure to study workers as individuals in order to get their best efforts
		The formation of cliques or groups among workers
		Rating worker on any grounds but competence; regional, religious, social, etc.
		Keeping a worker in a job for which he or she is a physically or mentally unsuited
		Permitting a worker to remain at work when he or she is sick
		Not giving worker, all the help that are needed
		Failure to promote workers, when it is possible and advisable
		Lack of due consideration of problems affecting wages and working conditions

Table 4 Reasons for time delay due to work organisation

S. No.	Primary reasons	Secondary reasons
1.	Lack of proper planning	Keeping workers waiting between job
		Keeping workers waiting for materials
2.	Lack of knowledge	Regarding work content
		Regarding full day work
3.	Lack of foreman's orders and instructions	Failure to make orders to workers
		Non-clarity in giving instructions to workers
4.	Lack of traceability	Failure to insist that tools, supplied materials and portable equipment to be kept in proper places
		Failure to use identification and grouping of common tools, supplied materials and portable equipment
5.	Overtime work	Additional time consumption
		Additional resources, associated efforts and cost
6.	Inappropriate utility	Not using proper machine tools and tools for every job
		Not using proper measuring instruments for every job
7.	Lack of work execution	Under utilisation of work force
		Lack of follow-up actions
8.	Deficiency of work force	Lack of adequate man power for work
		Improper communication with employment and training department
9.	More work force utility	Keeping too many persons at work
		Unnecessary discussions in production
10.	Lack of record keeping	Failure in writing of records for further follow-up actions
		Time delay in sending requisitions for further execution
11.	Lack of stability	Inconsistent remuneration for workers
		Failure to question and correct workers who lay off
12.	Lack of time management	Lack of awareness about due date requirements of customers
		Allowing workers to get the habit of talking, visiting and killing time
13.	Slack supervision	Failure to get work started in time
		Failure to monitor and instruct in time
14.	Time delay in decision making	Non-clarity of constraints associated
		Non availability of adequate advise
15.	Absenteeism	Foreman's absenteeism
		Workers' absenteeism
16.	Time delay in report generation	Time delay due to compilation and consolidation
		Time delay of passing report to various levels
17.	Lack of maintenance activities	Lack of corrective maintenance activities
		Lack of initiatives in preventive maintenance
18.	Time delay in work extraction	Lack of necessary intermediate check-up and follow-up actions
		Unnecessary visiting and conversation on the job
19.	Lack of work management	Failure on foreman's part to organise his own time and work
		Failure on workers part to organise their own time and work
20.	Lack of education and training	Inadequate communication and conversation skills
		Lack of interest and involvement in learning

Table 5 Reasons for time delay due to work concept ideas

S. No.	Primary reasons	Secondary reasons
1.	Lack of interactions about work ideas	Failure to listen, encourage and comment, when workers offer suggestions
		Failure to receive suggestions from experts
2.	Lack of problem solving skills	Lack of investigation of problem and its associated constraints
		Not asking workers' advice on problems
3.	Lack of learning	Failure to read and study about the work methods
		Failure to read and study about the business methods
4.	Lack of contacts and conversations	Failure to get from new men helpful ideas, which they may bring from previous employment
		Not consulting enough with other departments
5.	Lack of involvement in work ideas	Failure to consider or refer to the proper person with all usable suggestions
		Failure to take proper interest in meetings

Table 6 Reasons for time delay due to accidents

S. No.	Primary reasons	Secondary reasons
1.	Lack of accident preventive measures	Failure to recognise accident prevention as a part of production
		Failure to give all workers, thorough instruction in safe practices
		Failure to install mechanical safeguards while doing repairs
		Failure to display danger signs at proper places and to see that they are clean and legible
		Failure to stimulate and maintain interest of employees in accident prevention
2.	Loss due to improper handling of safety tools	Allowing worker to work with safety guards out of place
		Poor housekeeping
		Allowing worker to work without necessary protective devices such as goggles, welding helmets, safety shoes, safety belts, etc.
3.	Loss due to improper understanding of safety measures	Failure to thoroughly understand indirect accident costs
		Lack of understanding of what constitutes as accident hazard
		Not setting a good example in the matter of safe practices
		Failure by the foreman to recognise his responsibility for accidents in his or her department
4.	Lack of awareness and involvement in safety measures	Lack of regular and conscientious safety inspection
		Lack of cooperation with state and insurance inspectors
5.	Lack of accident data base for future safety measures	Failure to keep records of accidents to analyse them and to use the information gained
		Failure to enforce consistently all safety rules and regulations

4.5 Time Delay due to Work Concept Ideas

The work concept and related idea generation are causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 5.

4.6 Time Delay due to Accidents

The frequent accidents are causing time delay in supply chain and its executions of manufacturing organisations. The reasons are classified as primary and secondary, as shown in Table 6.

Table 7 Actions taken with risk control measures for risk reduction

Actions taken	Risk control measures
Reduction of unnecessary movements	Monitoring by method study and further follow-up actions
Reduction in over production	Accurate estimates of customer demand requirements and follow-up actions
Reduction in inventory	Accurate estimates of customer demands and due date requirements with follow-up actions
Reduction in defects of materials	Checking inward materials, work in progress materials and follow-up activities
Reduction in waiting time and idle time	Appropriate scheduling, proactive maintenance and follow-up activities
Reduction of under production	Accurate estimates of customer demand/due date requirements and follow-up actions
Layout modification	Minimizing the processing time and movements of both men and materials
Reduction in processing waste	Accurate estimates of material requirements, its database and follow-up actions
Reduction in transportation time	Accurate estimates of internal processing and follow-up actions

5 Development of Appropriate Strategies, Results and Discussions

The root causes of LPEs for the various reasons listed (Section 4) due to time delay in the supply chain executions will be further analysed for risk mitigation, prioritisation and loss reduction. The associated root causes are generally analysed by cost sheet, discussion with employees, discussion with experts and past analysis with collected data. Table 7 indicates a few sample actions taken by risk mitigation for risk reduction with risk control measures towards loss reduction.

The above results and discussions are just sample actions taken, which are used to implement futuristic supply chain risk management initiatives for better, systematic and dynamic executions using risk mitigation with appropriate strategies. Recently, the management and exploitation of external resources have increased and become a new source of business success. This has given rise to various new risks and therefore increased the need for collaborative risk management (Hallikas et al., 2005) for loss reduction. The interest of futuristic investigations in supply chain operational risks remains under development. Hence, this article suggests the necessity of more dynamic models for risk reduction with a future scope of risk prevention towards continuous improvement.

6 Conclusion

Modified competitive, technological and social circumstances have magnified the potential impact on supply chain operations related time delays. This will be generally solved by using additional resource utilities or facilities to meet customer demand and due date requirements. The reasons are normally not investigated in detail, and this paper made an attempt to sort out various forms of expected LPEs due to time delay in supply chain executions of manufacturing organisations. Few sample corrective measures are also suggested for loss reduction. Hence, it is essential to explore more futuristic supply chain risk management initiatives in this direction with appropriate strategies. This paper also suggests the need for more dynamic models with a future scope of risk prevention for loss reduction. The implications of the above aspects are influencing customer acceptability, retaining customers, reduced cycle time, improved delivery performance and effecting cost reduction.

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