

METHODOLOGY FOR MONITORING AND MANAGING THE ABNORMAL SITUATION (EVENT) IN NON-HIERARCHICAL BUSINESS NETWORK

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ABSTRACT

Because of substantial impact, potential and value, business collaborations are nowadays turning to be an important issue of contemporary business management. Although business network supports competitive advantages however, it often becomes difficult to manage the integration of the operational processes. During the operational processes there might evolve unexpected situations or events within the network boundary. These events create various obstacles to run the business collaboration smoothly. Monitoring and managing of such abnormal situations create huge challenges for the collaborative firms in respect to production processes. The main objective of event monitoring and management (EMM) is to provide warning and managing any uneven situations that might cause serious damage for the firms. The research presented in this article provides the fundamental concept of EMM that are common in any industrial establishment. A case example is also highlighted within the scope of this paper with the view to demonstrate the ICT-based EMM process, applicable in a non-hierarchical business network.

KEYWORDS

Event Monitoring and Management (EMM), Event Management Ontology, Non-Hierarchical Business Network, Virtual Organization

1. INTRODUCTION

In the current competitive business world, manufacturing firms are moving forward to expand their businesses across organizational boundaries. This new environment inspires and motivates them to be collaborative for achieving specific business benefits. Collaborative business offers extended market opportunities for the partners in terms of sharing valuable resources and expertise among each other (Camarinha-Matos et al., 2009). In running such operational environment, there often evolves several uneven or abnormal situations that hampers the overall benefit of such business collaboration. This abnormal situation often termed as event that has the adverse effect on productivity and profitability. Therefore, the business mission is

to prevent and reduce the frequency and severity of abnormal situations through early detection and IT-based monitoring and management.

Increased demand levels for higher efficiency and productivity create tremendous pressure in the process control that results uneven situations within manufacturing firms (Alexopoulos et al., 2010). This abnormal situation (event) results a wide range of minor to major production disruptions which need to close monitoring and control. Continuous monitoring and control of the events are the prerequisite for achieving key business goals including improved operational efficiencies, optimized processes, reduced plant incidents, life cycle costs and maintenance costs, increased plant uptime and profitability, etc. In order to ensure continuous or real-time operational monitoring,

collaborative business partners need an ICT-based communication infrastructure. The event monitoring and management (EMM) system is basically controlled by the IT-based infrastructure, where non-hierarchical business network promotes the definition and description of the events.

The approaches of monitoring and managing of events varies from firms to firms and also depends on the structure of the business network such as hierarchical network or non-hierarchical. In hierarchical business collaboration, usually the largest partner takes the overall control of the network and the other partners support its decision or command. On the other hand, in non-hierarchical network, all the partners enjoy the equal power and control over the business collaboration. In this research paper, the EMM is demonstrated based on the non-hierarchical business network. This research develops an IT-based framework for categorizing the abnormal situations or unexpected events faced by the collaborative partners in their daily business operations and the essential practice for controlling them is presented.

The rest of the paper is organized as follows: Section 2 presents review of the existing literature on EMM applicable in collaborative business network, while Section 3 defines the event with its different types commonly available in a business network. Section 4 outlines the concept of non-hierarchical business network. Section 5 illustrates the methodology for EMM process, whereas, Section 6 presents an example based on monitoring and managing an event in non-hierarchical network. The basic outcomes from this research are discussed and concluded with future research direction in Section 7.

2. LITERATURE REVIEW

The monitoring and managing the abnormal situation of any industrial establishments is considered an important step towards minimizing the damages caused by it. It is eventually occurred within the manufacturing firms without any notice and the damage can be even severe which can not be recovered easily. The abnormal situations in any business network have always challenged the aggressive application of increasingly complex processes, sophisticated control strategies and highly integrated approaches to production planning (Cochran and Bullemer, 1996). They are responsible with a wide range of minor to major process disruptions for which the productivity is reduced considerably, lower the operational efficiency and increases the maintenance cost substantially. In such a consequence, the success of a firm usually measured by the capability on how it can prevent or at least immediately identify and resolve the

deviations from the planned activities (Andreas, 2003).

It is required to identify the abnormal activities in an operational process in order to minimize their negative impacts before they are detrimental to customer satisfaction and operational efficiency. Managing of an event needs double actions: firstly, to eliminate the possible delay between the identification of the event and the remedial action for it; secondly, to eliminate the delay between the time when it occurs and the time when the decision maker finds it out (Categoric software, 2002). In order to remove or minimize the gap of both types of delay, manufacturing firms need to generate rule-based resolutions plan. The formal method of event monitoring and management can be defined as repair, reschedule, re-plan and learn (Andreas, 2003). If it is impossible to repair an immediate event, the subsequent steps or processes should be rescheduled. This reschedule might require re-planning the complete operational activities. In learning process, the main objective is to prevent future occurrences of events through proper managerial attention (Llog, 2002).

The general trends of managing collaborative events among participating firms are through online communication and using SMS and/e-mail. This type of communication pattern ensures the true visibility among the business collaboration, which enables collaborative partners to resolve individual events in more efficient and effective way (Rintala et al., 2010). This approach obviously mimics the learning mode for the traditional industrial partners and pursues them to reduce deviations, preferably by prevention. The visibility of information flow among partners is considered as a crucial step towards the collaborative event monitoring and management system (Kemmeter and Kimberly, 2002; Banker, 2002). It is seemed to be a useful technique or methodology for the organization managers to implement the decision making process for preventing from an abnormal situation.

Different aspects of event monitoring and management can be achieved through traditional information buffering and/or introducing automated process monitoring techniques such as statistical process control (SPC) and by implementing expensive and error prone human attention (Thomson, 1967; Pfeffer, 1972; Deming, 1992; Shigeo, 1986). In an automated event monitoring technique human attention is replaced by the infusion of software, which offers strategy to stabilize inter-organizational processes more efficiently and more effectively. In this process, the collected execution data from the inter-organizations is stored in a central database that allows the necessary monitoring to the inter-organizational processes. Other technique like track and trace

solution is usually applied in managing the events in logistics and supply chain network, where the service providers monitors their logistics operations and update the customers through reporting the progress of the delivery shipment in real-time or near real-time information (Stefansson and Tilanus, 2001; Bretzke et al., 2002). This logistics and supply chain environment ensures the production of highly customizable products through providing robust plan, ensuring the supply of the right part at the right time at a rather reasonable cost, thus eliminating the quality defects of the end product (Makris et al., 2011).

3. DEFINING EVENT AND ITS TYPE IN THE BUSINESS ENVIRONMENT

The term event can be defined as the deviation from a plan such as unexpected delivery delay, operational accident, unnoticed labour unrest, etc. The importance of monitoring and managing the events are quite high in terms of both organizational and market perspectives. The event monitoring and management process should have to be considered from various prospective such as to identify, detect and analyze event occurrences and identify and manage the implementation of counter measures (Rintala et al., 2010). Before adopting suitable strategy to controls events, entrepreneurs need to identify different types of events commonly evolves during operational consequences. Based on the various operational circumstances, the events within a business network can be classified as follows.

- *Internal event*: A logistic occurrence can be classified as internal event stating that the event has only internal impact and VO does not need to be notified. This type of event does not have operational and/or economical impact to VO but only impacts internally to an individual partner.
- *External event*: This type of events usually evolves from external factors of an enterprise or a VO.
- *VO event*: This type of event has economical and/or operational impact on the surrounding VO.
- *SOS event*: This defined event considers with highest priority level and has a huge impact to the operations of a VO. The production process needs to be shutdown entirely if there are SOS events.
- *Predicted event*: The event that has been predicted previously and managerial procedures have been defined for it is termed as predicted event. This type of event can be noticed before it causes negative impact.

- *Unpredicted event*: The event that has not been predicted before but its impact is visible is termed as unpredicted event.
- *Temporal event*: The consequence of this type of event is to indicate a time strap such as either late or early of an operational activity.
- *Quantitative event*: It defines the quantitative measures of an event such as level of resources whether it is null, low, medium or high.
- *Qualitative event*: This type of event is concern with the characteristics of the occurrences (events) in terms of qualitative manner. For instance the a product need to be colour blue but accidentally it finishes up with black due to the problem of the painting machine.
- *Spatial event*: It identifies the spatial features in terms of location, status, state, etc. For instance, address of a partner, location of a shipment such as GPS position, etc.
- *Structured or expected event*: The event evolves due to the causes of preceding event and can not be avoided by any means. In this situation management usually pre-planned to tackle such event in well ahead.
- *Unstructured or unexpected event*: This type of event never expected by the organizational management team and therefore no actions or plans have been made in advance.

All the events as mentioned above have their individual states and the possible consequences. The management team of the partner organization needs to be pre-planned in case of possible event which might damage or slowed down the operational processes. Although most the event as occurred during operational processes is unknown or unidentified, however, managers need to be aware to adjust the possible consequences of an event. The generic types of events are always dependent on the circumstances of each business network, company branch, and even on economical situation. Events of the business partners are related with their objectives. It is beneficial for the business network to differentiate among events in order to minimize their impact to the operations of the partners' organization. The theme of information of these events can be used to conclude more precisely to the urgency of the events and their immediate impacts on the VO partners.

4. CONCEPT OF NON-HIERARCHICAL BUSINESS NETWORK

The concept of business collaboration or networking is evolving rapidly due to its inherent potentials or benefits. It is prime concern in today's competitive business environment to be competitive in terms of

sharing resources and expertise with other companies. The first and most prerequisite condition of developing such networking is to building the trust among the partner organizations. Without established trust and commitment it is not almost impossible to be successful in any kind s of collaboration. Manufacturing firms need to be collaborative in respect to their individual strengths and weaknesses too. This open environment can help for building valuable trust and longer term relationships among the networking partners.

In the business network there are various types of networking commonly available which can be mentioned such as virtual organization breeding environment (VBE), virtual enterprise (VE), virtual organization, business community (BC) [Carneiro et al. 2010], etc. The objectives of all these networking types are mostly similar with their levels and terms and conditions. However, specific business opportunities demands for certain type of networking. It also depends on the geographical location, culture, motivation level, etc.

Other two types of business collaboration can be considered in terms of level of control and running a network such as hierarchical and non-hierarchical networks. In hierarchical network, mostly larger organizations are networked with comparatively small and weak organizations for achieving specific business goals. Here the partners do not enjoy the equal power but dominated by the larger organizations in the network. On the other hand, in non-hierarchical network (NHN) the business partners are usually similar capacities and capabilities collaborated together for definite mission (Shamsuzzoha et al., 2010). The partners in the NHN enjoy equal power within the network and mostly organized among small and medium enterprises (SMEs). This NHN is usually implemented within the SMEs that are producing high variety, low volume complex products. The collaboration helps SMEs in terms of complex product designing and preparing quotations.

5. METHODOLOGY FOR EMM PROCESS

Specific approach is necessary in order to manage events within any organizations. Proper identification and planning enhance the overall event management activities. Before considering the operational events following steps or measures could be focused.

- (a) Event identification
- (b) Event assessment and prioritization
- (c) Event monitoring and control

In a collaborative business environment, each partner should have shared its events with others and

to manage and monitor in a collaborative means. However, individual partners are also responsible for their own planned deviation of operations (events) and should manage them accordingly. The detailed processes of the event management in a collaborative business environment are displayed in Figure 1 and discusses briefly at the following paragraphs.

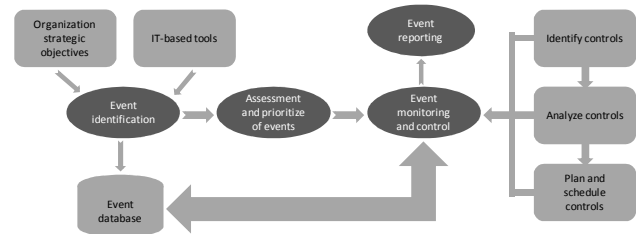


Figure 1 – The generic processes of event management

5.1. EVENT IDENTIFICATION

The prime concern before managing the events is to notify the potential events that cause unnecessary interruption in the business operations. The main objective of event identification is to avoid future uncertainties and to be able to manage these reactively. The nature of identified events could be interruptions in regular operations, order and delivery fluctuations in case of logistics, fluctuations in resources in case of inventory management, quality failures in production processes, etc. Both internal and external events within a firm are needed to be identified. It is not often easy but cumbersome task to identify the potential events especially in case of events that occur as feedback loops.

In a collaborative business, identification of events needs to be done on shared basis in order to avoid repetitions and for mutual benefits. The partners in the business network could implement IT-based tool to identify and mitigate the events, which are stored within an interface engine. The identified events should be visible for the partners on a daily, monthly and yearly basis. During event identification it is required to gather information, transmission to the partners and filtered for important features. This effective information sharing among partners is the key factor to decrease external and internal uncertainties. The fast observation of the event and sharing is crucial. The through put times are short and the faster the partner network can adjusts their activities based on the changes needed the better result they achieve.

5.2. EVENT ASSESSMENT AND PRIORITIZATION

After identifying the potential events within an organization it is required to assess those events for prioritization. This prioritization helps for choosing

appropriate management actions for the predefined events. The events can usually be ranked in a scale of 1 to 5, where 1 represents the low level event while 5 is the highest level, others are between them. The complete scales of the events and their descriptions, impacts and likelihoods are shown in Table 1. From Table 1 it is observed that if the events are not properly identified and assessed, it might cause the worst case of discontinue in business potentials. The probability of occur the events also can be identified and assessed for the business safety reason.

Table 1- Assessment scale for events prioritization

Rank	Description of the event	Impact	Likelihood
1	Low level	Can be ignored	May not be noticeable (insignificant)
2	Moderate level	Moderate	Might be harmful for business
3	Substantial level	Medium	Frequent business interruption
4	Serious level	Crucial	Causes huge loss for business potential
5	Extremely serious level	Destructive	Possibility of discontinue in business

The partners in a collaborative business network might have their own event assessment criterions from where they could share their experiences to other partners. During the assessment works the potential consequences of events should be noted down from the view of their impacts and likelihood. Any critical event from a partner might have equal or even worst impact on the other partners in the collaborative business. The selection of proper partners in the business network can reduce the potential events. Good partners utilising a proper event monitoring system are less risky than average partners. The overall compensation or cost in order to mitigate the impact of events can be shared among partners. The assessment of events gives an overall view upon all the consequences and offers the most important events requiring the highest attention.

5.3. EVENT MONITORING AND CONTROL

The event monitoring is the last major element of event management and considered very important step in event planning. Monitoring event means to review it and update it continuously. It is an ongoing process and constant monitoring is essential for its

mitigation plan. Effective monitoring and reporting of events help to identify insufficient resources, inefficient use of resources and substandard performance that detract from customer service and product delivery. Monitoring and reporting also support reactive systems management that can help the organization position itself to meet its current needs and plan for periods of growth, mergers or expansion of product lines. Regular event monitoring whether centralized or decentralized provides management to ensure resources are operating properly, used efficiently and identify the root causes of problems. The basic framework for detection, handling, and reaction planning of an event can be displayed as in Figure 2.

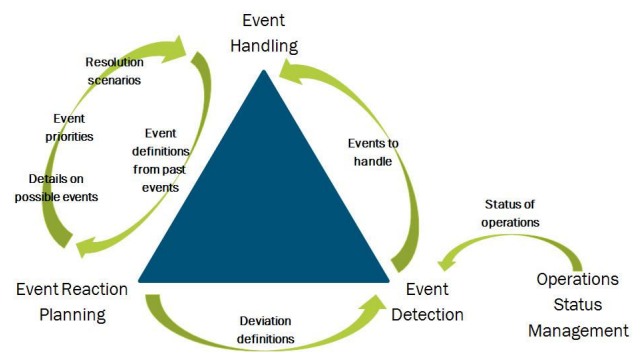


Figure 2 – The basic framework for EMM (Rintala et al., 2010)

From Figure 2, it is observed that event detection or monitoring is mainly based on event handling and event reaction planning. The event detection process identifies the operational status within the VO and transfer the updated event for required handling from an activity based point of view. If an event is identified as a manifestation of risk which threatens the realization of production system or logistics network, it would be then deployed to event reaction planning. During event reaction planning details information related with possible events is collected, prioritizes them and plans for resolution scenarios (Andreas, 2003). This planning process supports the event handling which also get feedback from the definitions of the past events. In event reaction planning any deviation definitions of possible events is forwarded to the event detection process for necessary handling. Through event management process, the risks evolves from potential events can be deployed to be monitored or to be utilised in other manners.

Monitoring the status of specific events is required in order to control the progress in their respective actions plans. It is essential to make sure that the partners in the collaborative business networks are aware of the status of top level events and the corresponding plan to manage them. Before controlling the events it is required to identify the

specific controls, analyze the controls and plan and schedule them accordingly. To identify and analyze the controls, it is necessary to monitor the changes of events in the business network such as changing customer needs, technology, partner strategies and competitors and to update the event assessment correspondingly. The information obtained from event identification and assessment requires formulating the strategic plan and schedule for monitoring and controlling the actions for event mitigation.

6. EMM FOR NON-HIERARCHICAL NETWORK (NHN): AN EXAMPLE

The monitoring and managing of an event in a non-hierarchical business network can be explained by using the following example, where an ICT-based framework is presented. The overall structure of the collaborative event management is displayed in Figure 3. From Figure 3, we could observe three VOs namely 'Red pen', 'Star T-shirt' and 'Big boots' connected with each other within a business network or BC. This IT-based collaborative event monitoring and management system provides the real-time information of an event within the BC. It also provides the detailed of the event such as event's priority level, event's name, time of occurrence, name of the VO where the event occurs, name of the Source Company or partner, status of the event and possible solution how to manage that event. Figure 3, displays two example events namely machine break and employee strike within different VOs in the BC. After taking necessary counter measure to manage an event, the event log updated the status of the event to indicate whether the event is managed or not.



Figure 3 – Overview of collaborative EMM in NHN

In NHN, the event monitoring and management system can also be presented in terms of mapping the view by using Google map, where the locations

of the VO partners can be easily visible. Figure 4, displays an example of partners' locations, where the possible source of an event is visible along with the location of the affected partners. From this map view, the event can be filtered by choosing a single VO or information from all the VOs in the business network. Below the map view in Figure 4, there displays two tables titled with 'unconcluded events' and 'concluded events'. The unconcluded events present the events still need to be managed by the system or are in progress whereas, concluded events presents a history log of the past events occurred within the business network.

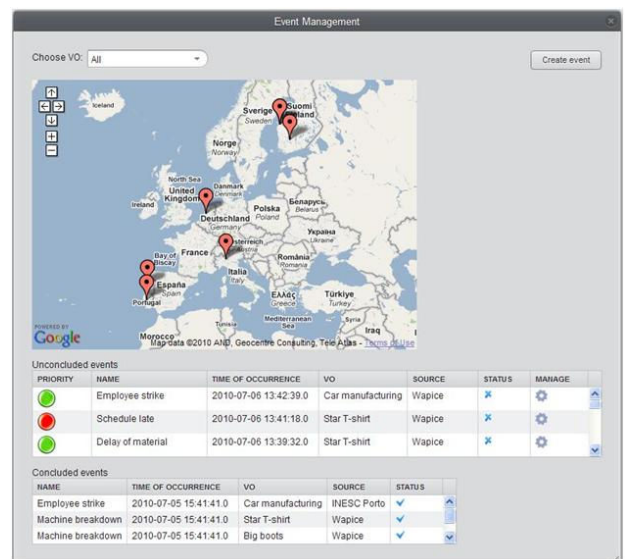


Figure 4 – The map view of collaborative event management approach

Figure 5 displays two sub-windows of event management namely, 'create event' and 'define deviation' which can be opened from the main event management window by pushing the create event button situated in top right corner of the window. The create event sub-window contains create event and notification menu which provides the basic information of creating an event such as event name, event description, urgency level of the event (high, medium, low), event type and effect range.

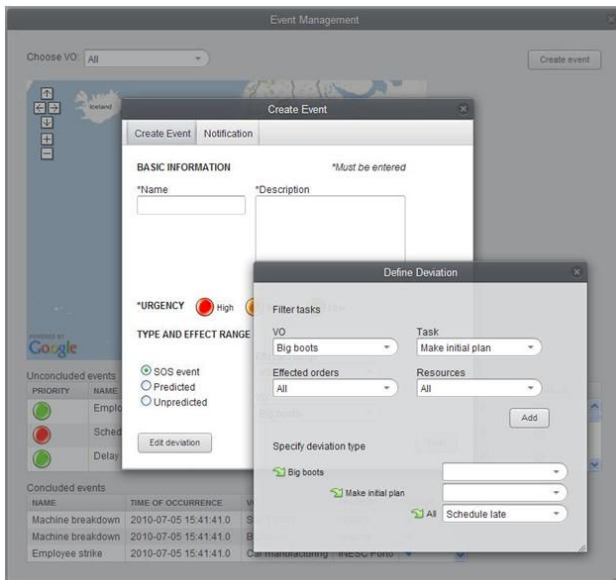


Figure 5 – Display of sub-windows for create and define an event

The other sub-window ‘define deviation’ provides the information relating to filter tasks such as name of the VO, required task, effected orders, necessary resources and specification of deviation type. All these required information initiates the event monitoring and management process of an individual company or a collaborative business network on a real-time environment. This implementation example provides the fundamental ideas of monitoring and managing an event of business collaboration based on IT system.

7. DISCUSSION AND CONCLUSIONS

The evolving trends of business network demands for continuous safety during operational processes in order to ensuring quality and productivity. However, often this environment can not be ensured due to operational disruptions as caused by various reasons in the production sites. Before forming the business collaboration, partners need to plan about the possible disruptions which might be occurred during production run. This disruption or abnormal situation termed as an event can be expected and unexpected depending on the nature of the operational consequences. The expected disruption can be pre-planned according to its adverse effect on the operational processes within the business network in order to avoid completely or reduced substantially the resulted damages. While, unexpected disruption can not be noticed early and it can cause in severe damage to the operational activities. Both the expected and unexpected event lowers the productivity due to decreased efficiency

It is therefore, prime concern for business network to avoid such events through monitoring

and controlling them properly. The event monitoring and managing (EMM) scenario as evolved in any business network need to be carefully controlled in respect to run the collaboration successfully. The concern about the EMM is needed to be demonstrated to the individual partners within the business network with the view to understand its interim consequences. The effect of events over production processes can result in the business network with increased lead time and cost and reduced operational safety. A pre-planned approach to handle the events always encouraged to the collaborative partners to ensure sophistication of the operational processes.

In order to EMM in non-hierarchical business network, the collaborative partners need to have a common communication infrastructure. This communication infrastructure formulates the events description and maintains the remedial measures and history of the events. This event monitoring and management system basically controlled by IT-based infrastructure, where the business network promotes the definition and description of the events commonly available within the network. The identification, assessment and prioritization of events are the prerequisite for managing them properly. The event management and monitoring process differs from hierarchical business network to non-hierarchical network. In hierarchical network, this process is monitored and controlled by equal participation of the partners, whereas, in hierarchical network it is mostly dominated and controlled by the largest partner.

The research presented in this article, provides the fundamental concept of events that are usually occurred in an industrial establishment. The objective of the research theme is to indentify, scaling down and to demonstrate the practicality of how an event can be managed and monitored properly, especially, in a non-hierarchical collaborative environment. The ICT-based event management and information modelling approach for event monitoring is illustrated within the scope of this paper. An example case is also elaborated with the view to explain the procedural steps and methodology to event monitoring and managing process. In the future research, the extension of this work will be conducted towards the analysis of several real case implications within the non-hierarchical network with the view to generalize the concept and plan for EMM process.

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