International Journal of Engineering & Technology, 7 (2.33) (2018) 946-949

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Risk factors influencing humanitarian operations: a case of temple cart festival

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Abstract

The traditional Indian beliefs are concentrated on the strong holy force of positive vibration inside the temples and also during special occa-sions. Hence the human population gathering during the special occasions is uncontrollable. To control and manage the population, effective humanitarian operations are required and hence a framework is also required. In this paper, the objective is finding the risk factors influenc-ing on humanitarian operations in temple cart festivals and analyzing these factors. In order to study this, Interpretive Structural Modelling (ISM) approach is used to analyse the relationship among the risk factors of humanitarian operations. For the case study purpose, the data has been collected from the selected temple cart festival organizers in India. The paper projects forwards the most influential factors of oc-currence, detectability, disaster, preparedness which influences the humanitarian operations.

Keywords: *Risk Factors; Humanitarian Operations; Interpretive Structural Modelling; Risk Analysis; Temple Cart Festival*

1. Introduction

India is a land of temples and pilgrimage sites. It's architectural and rich cultural heritage attracts thousands of people from all over the world to visit the place and seek spiritual enlightenment. As there are many advantages there are also chances of risks and disruptions that may occur due to huge number of people gathering during auspicious occasions. The occasions account to varying amounts of human and economic loss. Economic damages can be recovered in a period of time, but loss of humans cannot be recovered and controlling these losses is one of the important indicators of the performance of governments and the organisers involved in the humanitarian operations. In case of any emergency, the relief organizations must respond quickly by delivering the basic supplies to those in needs. In such cases the humanitarian operations must be effective and quick to prevent and recover from losses. There are several risk factors influencing the humanitarian relief operations in such places. In this paper a detailed literature review of the risk factors influencing humanitarian operations is given and a framework is provided for the risk factors influencing the humanitarian operations in temple cart festivals happening in India.

2. Literature review

The literature is comprised of two parts, namely risk factors influencing humanitarian operations and it is followed by ISM approach.

2.1. Literature review on risk factors influencing humanitarian operations

Kumar et al. (2013) studied about the operational approaches and risk assessment methodologies to manage risk in global supply chains. They proposed a closed loop risk management system that consists of inputs, outputs, and feedback. The occurrence as a failure mode factor because it represents the frequency of supply chain disruption in the event. Vitoriano et al. (2011) developed a model for the distribution of humanitarian aids. Overstreet et al. (2011) developed framework for humanitarian logistics. Van Wassenhove (2006) focus in understanding the complexities of managing supply chains in humanitarian settings. The paper outlines the importance of supply chains to be adaptable, agile and aligned and provides strategies for better preparedness. Gonclaves (2008) applied system dynamics modelling for developing humanitarian relief operations framework. Anson et al. (2017) analysed social media data for preparedness of disaster. Haavisto and Kovacs (2014) developed a framework for analysing the sustainability in humanitarian supply chains. Resources are critical in humanitarian relief operations and thus resource utilization is essential.

2.2. Literature review on ISM

ISM approach is applied in the various areas and it is demonstrated in Table1.

Table 1: ISM Approach Applications

Sl.No	Authors	Application area
1	Chidambaranathan et al. (2009)	Applied ISM for analysing the development factors for supplier.
2	Kuo et al. (2010)	Applied ISM for barrier analysis in remanufacturing of product service systems.
3	Borade and Bansod (2012)	Applied ISM for analysing mutual relationship between variables of vendor managed inventory.
4	Saleeshya et al.(2012)	Applied ISM with analytic hierarchy process for framework development for agility assessment in supply chain network.
5	Jia et al. (2015)	Applied ISM for analysing the sustainable supply chain management practices.
6	Kannan et al. (2014)	Applied ISM for anaysing the interrelationship between drivers of end-of-life tires.

7	Govindan et al. (2012)	Applied ISM for analysing drivers of third party reverse logistics providers.
8	Ambika Devi Amma et al. (2015)	Applied ISM for analysing major threads of cloud computing.
9	Patri and Suresh (2017b)	Applied total ISM for analysing agile factors in healthcare organisation.

3. ISM methodology

The following steps are used to illustrate modelling procedures of ISM (Patri and Suresh, 2017a):

1) The factors were identified from a thorough literature review and expert interview. Table 2 contains the risk factors influencing humanitarian operations in temple cart festivals.
2) Self-structured Interaction matrix is created to depict the contextual relationship among two factors and it is represented as following,

V: i alters j
A: j alters i
X: J and I are mutually influences
O: J and I do not influence each other
The SSIM matrix derived from the interaction among the variables according to the data collected is shown in Table 3.

3) The initial reachability matrix is developed using the SSIM. The step carried for conversion is as follows

From SSIM (i,j)	V	A	X	O
Initial reachability matrix (i,j) entry	1	0	1	0
Initial reachability matrix (j,i) entry	0	1	1	0

It is shown in Table 4.

4) Development of final reachability matrix from initial reachability matrix through transitivity analysis.If A=B and B=C then A=C

It is shown in Table 5.

5) The partition of the final reachability matrix is done based on three sets namely, reachability set, antecedent set and intersection set. The various iterations are depicted in Table 6, 7, 8 and 9.
6) Using the level partitions and final reachability matrix the digraph is created. The factors are divided into levels and the interaction between the factors in the same level and the adjacent levels are represented and the digraph is noted as Figure 1.

Table 2: Risk Factors Influencing Humanitarian Operations

Sl. No	Factors	Definition	Reference / Expert opinion
1	Velocity (F1)	The frequency with which the disruption proceeds in the event	Kumar et al.(2013)
2	Severity (F2)	The time taken to settle the disruption in the event	Kumar et al.(2013)
3	Occurrence (F3)	Frequency of any disruption happening in the event	Kumar et al.(2013)
4	Detectability (F4)	The ability that the disruptions in the event can be identified	Kumar et al.(2013)
5	Disaster (F5)	An unexpected event which causes major disruption	Van Wassenhove (2006)
6	Political (F6)	Political influence which alters the expected outcome and value of an event	Expert opinion
7	Invisibility (F7)	The inability to identify the potential risk causing events	Van Wassenhove (2006)
8	Ambiguity(F8)	The incapability of identifying where the disruption might lead	Van Wassenhove (2006)
9	Scheduling(F9)	Activities planned for the smooth flow of financial and humanitarian operations prior to the event	Expert opinion
10	Preparedness (F10)	The initiatives that are taken as precautionary measures for any disruption happening in the event	Anson et al.(2017)
11	Financial continuity (F11)	The ability with which the financial needs of the event can be provided without any disturbance	Haavisto and Kovacs (2014)
12	Resource Utilization (F12)	The proper maintenance and utilization of resources for the entire event	Haavisto and Kovacs (2014)

Table 3: SSIM Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F1	1	A	A	O	A	V	O	V	O	A	A	O
F2		1	O	O	A	X	A	A	A	O	O	O
F3			1	O	A	O	V	O	V	V	O	O
F4				1	A	O	O	O	O	X	O	O
F5					1	V	O	O	O	A	V	V
F6						1	O	O	O	O	O	O
F7							1	O	X	A	O	O
F8								1	O	O	O	O
F9									1	O	A	A
F10										1	O	V
F11											1	X
F12												1

Table 4: Initial Reachability Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F1	1	0	0	0	0	1	0	1	0	0	0	0
F2	1	1	0	0	0	1	0	0	0	0	0	0
F3	1	0	1	0	0	0	1	0	1	1	0	0
F4	0	0	0	1	0	0	0	0	0	1	0	0
F5	1	1	1	1	1	1	0	0	0	0	1	1
F6	0	1	0	0	0	1	0	0	0	0	0	0
F7	0	1	0	0	0	0	1	0	1	0	0	0
F8	0	1	0	0	0	0	0	1	0	0	0	0
F9	0	1	0	0	0	0	1	0	1	0	0	0
F10	1	0	0	1	1	0	1	0	0	1	0	1
F11	1	0	0	0	0	0	0	0	1	0	1	1
F12	0	0	0	0	0	0	0	0	1	0	1	1

Table 5: Final Reachability Matrix

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F1	1	1*	0	0	0	1	0	1	0	0	0	0
F2	1	1	0	0	0	1	0	1*	0	0	0	0
F3	1	1*	1	1*	1*	1*	1	1*	1	1	1**	1*
F4	1*	1**	1**	1	1*	1**	1*	1**	1**	1	1**	1*
F5	1	1	1	1	1	1	1*	1*	1*	1*	1	1
F6	1*	1	0	0	0	1	0	1*	0	0	0	0
F7	1*	1	0	0	0	1*	1	1**	1	0	0	0
F8	1*	1	0	0	0	1*	0	1	0	0	0	0
F9	1*	1	0	0	0	1*	1	1**	1	0	0	0
F10	1	1*	1*	1	1	1*	1	1*	1*	1	1*	1
F11	1	1*	0	0	0	1*	1*	1*	1	0	1	1
F12	1*	1*	0	0	0	1**	1*	1**	1	0	1	1

Table 6: Iteration-1

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 2, 6, 8	1, 2,3,4,5,6,7,8,9, 10,11,12	1, 2, 6, 8	I
2	1, 2, 6, 8	1, 2,3,4,5,6,7,8,9, 10,11,12	1, 2, 6, 8	I
3	1, 2,3,4,5,6,7,8,9, 10,11,12	3,4,5,10	3,4,5,10	
4	1, 2,3,4,5,6,7,8,9, 10,11,12	3,4,5,10	3,4,5,10	
5	1, 2,3,4,5,6,7,8,9, 10,11,12	3,4,5,10	3,4,5,10	
6	1, 2, 6, 8	1, 2,3,4,5,6,7,8,9, 10,11,12	1, 2, 6, 8	I
7	1, 2,6,7,8,9	3,4,5,7,9,10,11,12	7, 9	
8	1, 2,6,8	1, 2,3,4,5,6,7,8,9, 10,11,12	1, 2,6,8	I
9	1, 2,6,7,8,9	3,4,5,7,9,10,11,12	7,9	
10	1, 2,3,4,5,6,7,8,9, 10,11,12	3,4,5,10	3,4,5,10	
11	1, 2,6,7,8,9,11,12	3,4,5,10,11,12	11,12	
12	1, 2,6,7,8,9,11,12	3,4,5,10,11,12	11,12	

Table 7: Iteration-2

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
3	3,4,5,7,9, 10,11,12	3,4,5,10	3,4,5,10	
4	3,4,5,7,9, 10,11,12	3,4,5,10	3,4,5,10	
5	3,4,5,7,9, 10,11,12	3,4,5,10	3,4,5,10	
7	7,9	3,4,5,7,9,10,11,12	7, 9	II
9	7,9	3,4,5,7,9,10,11,12	7,9	II
10	3,4,5,7,9,10, 11,12	3,4,5,10	3,4,5,10	
11	7,9,11,12	3,4,5,10,11,12	11,12	
12	7,9,11,12	3,4,5,10,11,12	11,12	

Table 8: Iteration-3

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
3	3,4,5,10,11,12	3,4,5,10	3,4,5,10	
4	3,4,5,10,11,12	3,4,5,10	3,4,5,10	
5	3,4,5,10,11,12	3,4,5,10	3,4,5,10	
10	3,4,5,10,11,12	3,4,5,10	3,4,5,10	
11	11,12	3,4,5,10,11,12	11,12	III
12	11,12	3,4,5,10,11,12	11,12	III

Table 9: Iteration-4

Factors	Reachability Set	Antecedent Set	Intersection Set	Level
3	3,4,5,10	3,4,5,10	3,4,5,10	IV
4	3,4,5,10	3,4,5,10	3,4,5,10	IV
5	3,4,5,10	3,4,5,10	3,4,5,10	IV
10	3,4,5,10	3,4,5,10	3,4,5,10	IV

4. Results and analysis

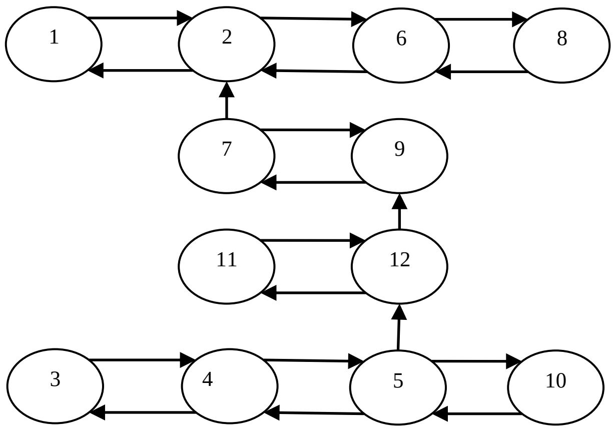

Fig. 1: Digraph of ISM

Level IV factors: 3, 4, 5 and 10

Factors 3, 4, 5, 10 are occurrence, detectability, disaster and preparedness respectively. All these four factors are interdependent on each other. If any disruption occurs in the event the disruption is detected and each time the disruption happens the frequency increases. When disruption is detected it might lead to any disaster and similarly if any disaster happens the disruption will occur and be detected. Precautionary measures must be taken for any unexpected event that might happen. Thus all these factors are interdependent on each other. Factor 5 disasters have a direct influence with the factor 12 resource utilization.

Level III factors: 11 and 12.

The factors 11, 12 are financial continuity and resource utilization. These factors are very closely related to each other and hence they are interdependent. Here resource utilization is the proper maintenance and utilization of resources for the entire event and this won't happen without financial continuity. Similarly the financial needs can be provided with proper resource utilization. Factor [12] resource utilization has a direct influence on factor 9 scheduling.

Level II factors: [7] and [9].

The factors 7, 9 are invisibility and scheduling. Scheduling of events should be done considering the inability of identifying the disruption causing risks and similarly invisibility affects the scheduled event. Factor 7 invisibility has a direct influence on factor 2 severity. When there is inability to identify the potential risk causing events, the time taken for settling the disruption in the event is more. So these factors are directly proportional to each other.

Level I: [1], [2], [6] and [8].

The factors 1, 2, 6, 8 are velocity, severity, political and ambiguity. The time taken to settle the disruption in the event depends on the rate of impact of the disruption in the event and similarly the severity depends on the velocity. The political decisions by the authorities will affect the time taken to settle the disruption and similarly it affects the ambiguity of the problem. Thus, these factors are interdependent on each other.

5. MICMAC analysis

MICMAC analysis is the cross-impact matrix multiplication applied to classification and it is an operational method.

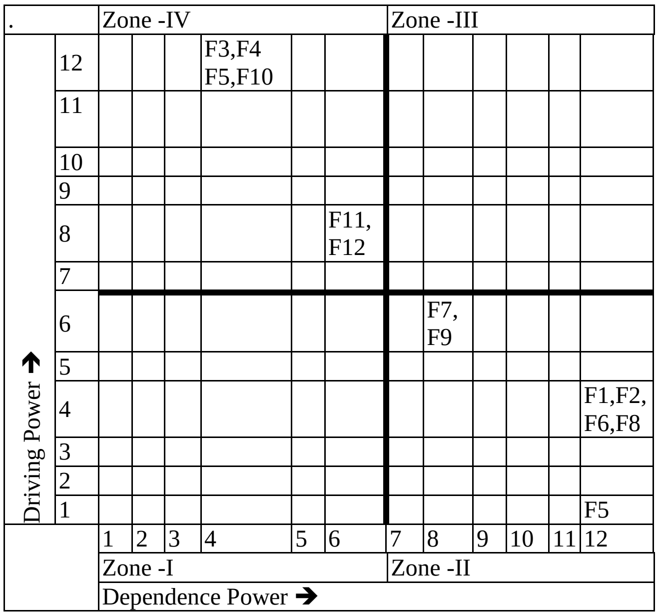

Fig. 2: MICMAC Graph.

The MICMAC graph (Figure 2) has four zones and each zone is categorized into different area. Based on the driving and dependence power in each zone the analysis can be done. The zone I does not contain any variables but usually the variables which exhibit autonomous nature are usually exist in this zone. Thus zone I is otherwise termed as the autonomous area. The zone II consists of F1, F2, F5, F6, F7, F8 and F9 namely the velocity, severity, disaster, political, invisibility, ambiguity and scheduling. The variables, which usually exist in this area, exhibit dependent nature. In this zone F7, F9 has the higher dependent characteristics compared to F1, F2, F6 and F8.Thus zone II is otherwise known as dependent area. The zone III does not contain any variables but generally this zone occupies the variables which have linkage characteristics. Thus zone III is otherwise termed as the linkage area. The zone IV consists of F3, F4, F5, F10, F11 and F12 namely occurrence, detectability, disaster, preparedness, financial continuity, resource utilization. In this zone F3, F4, F5, F10 have higher independent characteristics compared to F11 and F12. Thus zone IV is otherwise termed as the independent area. The variables having the high driving power namely occurrence, detectability, disaster and preparedness which directly influence the humanitarian operations in temple cart festival.

6. Conclusion

For any event that functions with a large number of human involvements requires effective humanitarian operations to prevent and recover from disruptions happening during the event. In India temple cart festivals attracts a huge number of pilgrims both from inside and outside the country. So the temple management should have effective humanitarian plan to perform the event. There are several risks involved in this, and a step-by-step procedure is needed in analyzing the risks influencing the humanitarian operations. This study takes into consideration of twelve factors for the ISM approach. This model helps in understanding the relationship between the factors and the framework to identify the risks influencing the humanitarian operations. This framework helps the management to concentrate on the effective risk causing factors and provide effective humanitarian operations by timely action. The factors are found to be occurrence, detectability, disaster and preparedness are the most important/key risk factors in temple cart festivals.

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