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STRATEGY OF WORKFORCE MANAGEMENT BASED ON RISK ASSESSMENT OF MANUAL HANDLING WORK WITH SUITABILITY 0F WORK ORGANIZATION

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ABSTRACT: *A research on Makassar Industrial Area (Kawasan Industri Makasar or KIMA), South Sulawesi, Indonesia has been done for the following aims: 1) to assess risks of manual handling work with the suitability of work organization; and 2) to analyze strategies of workforce management based on the risk assessment of manual handling work that corresponds to work organization. The research applies Risk Assessment and SWOT four quadrants design. The results of the design show that: (1) more than half of the workforces do not experience risk of manual handling work with the suitability of work organization, and (2) industry supervisors should apply growth strategies, as has been proved and suggested by the result analysis based on the research data. This growth strategy corresponds to the strength of risk possessed and the magnitude of opportunities of risk reduction available, where the supervisors endeavor to enlarge industry by taking advantage the stregnth of manual handling work with the suitability of work organization, the risk of which has been successfully assessed to maximally exploit greater opportunities of manual handling work.*

KEYWORDS: Work Organization, Not At Risk, And Growth Strategies.

INTRODUCTION

IT HAS been ascertained by Osh (1991: 13), that the work organization can affect level of risk by interacting with other factors of manual handling. The factors include staffing grade, availability of equipment, work schedules, shift work, pace of work, rest and recovery time, and work procedures. The same thing also mentioned by Gavin (2010: 4), that the work organizational factors that can affect the risk to interact with other risk factors include: (1) level of workforce; (2) availability of equipment; (3) work schedule; (4) time shift work; (5) workplace; (6) various tasks; (7) break; (8) recovery times; and (9) working procedure.

Furthermore, Kompier (2006: 421, 427-428) reminds that a new system of organization of work has been more common, although it does not represent a radical change at fields of economics, politics, technology, and social landscape. It is worth noting that changes in work organization can strengthen traditional occupational health, that according to Evans et al (1994: 18), for as early as possible and thoroughly interact between physical and psychosocial work characteristics.

Meanwhile the Semmer's (2006: 516) research, focusing on the domain of interventions, aims at changing the organization of work into three categories: (1) characteristics of the task; (2) working conditions; and (3) social conditions. Then a research by Aittomäki et al. (2003: 159), report that the lower socio-economic groups have a lower ability to work. These changes according to Ostry et al. (2000: 273) have health implications, especially to unskilled workforce that is organizationally restructured. If we observe and try to understand what Semmer (2006:

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519) reports in his research, the change of work organization has led to a divergence between various subsystems, as has been also proved by Korunka et al. (1993: 17). Some workforces may react in many ways, for example, like fear of loss of legality, fear of change, or fear of being not ready enough.

Unfortunately, better changes in work organization is not found in workforces of age spread evenly. The research of Cau-Bareille et al. (2012: 127) has reported a difficulty faced by workforces of older age, indicating a problem in workforces themselves in terms of managing rather than training due to older age. It is interesting to note that Semmer (2006: 519), while studying the findings of Larsson et al. (1990: 270), is able to combine changes in work organization and work stress intervention with Stress Management Model Program, and can target a very disturbing aspect of a particular person. Furthermore, Feng et al. (2006: 1047) present a model in determining optimal point to maintain software applications, namely the effective maintenance programs for work equipment used in manual handling works.

Based on the above background, the risk assessment on the work organization include: (1) flow of material processes that affect working frequency; (2) availability of workforce in a deadline; (3) availability of work teams; (4) availability of the workforce at the time of peak workload; (5) availability of effective maintenance programs for work equipment; (6) availability of procedures for reporting and repair of equipment; (7) suitability of the manual handling work flow; and (8) program selection, instruction and effective treatment for loads, equipment, and mechanical handling devices. From these conditions, the strategy of industrial supervisors in managing workforces will be examined based on the risk assessment of manual handling work with the suitability of work organization.

MATERIALS AND METHODS

Type of research

This writing belongs to a quantitative research applying survey. This type according to Morissan (2012: 165) needs a number of samples to be respondents to whom a set of standard (default) questionnaire is distributed.

The respondents in this research are workforces who perform *manually handling* work with the suitability of work organization. Besides, the respondents include also a number of industry supervisors that perform certain strategy in managing workforces based on the results of risk assessment of *manual handling* work with the suitability of work organization; meanwhile the set of questionnaire is in the form of: a checklist for risk identification; a check list of factors of manual handling risk assessment; risk assessment worksheet; risk assessment; risk control worksheets; and industrial strategy instrument supervisors.

Location and time of research

This research was conducted at KIMA, Makassar South Sulawesi, Indonesia under important consideration that, on one side, KIMA has industrial workforces that performs *manually handling* work with the suitability of work organization, and on the other side, the location is concentrated on a bonded area.

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Weanwhile, this study was done in 6-months (December 2013 – May 2014) including one month instrument piloting.

Operational definition

Manual handling risk assessment, is an assessment of work manually handled which is extremely important to estimate health risks of workforce experiencing physical workload, on the work organization, covering: 1) material process flow; 2) availability of workforce on a deadline; 3) availability of work teams; 4) availability of workforce at peak load; 5) availability of maintenance programs; 6) availability of procedures for reporting and repair of equipment; 7) suitability of the work flow; and 8) availability of program selection, instruction, and effective treatment for loads, equipment, and mechanical handling devices.

Population and sample

This research applies saturated samples due to homogeneity on one side, and the population is small or less than 30 respondents, on the other. So, population is also samples (Ihsanuddin (2008: 5). Thus, the generalization of research data is with a very small error. The research that applies saturated sample is also termed census. This research, as said above, includes only 23 homogeneous workforces as both population and saturated samples. This decision was made under considering seven ways of how to handle work manually. In other words, the risk of *manual handling* work by the samples are assessed to see the suitability work organization.

Meanwhile the industry supervisor samples are determined in accordance with workforce samples who work in the research industry, namely the Production Manager and HR/PR Manager. Further, the strategy of how the industry supervisors manage the workforce was assessed based on the risk assessment of manual handling work with the suitability of the work organization.

Research instrument

The detail of the instrument with KPI/questions used for workforces and industry supervisors is shown in Table 1.

Table 1. Details of the instruments (indicators/KPIs) for workforce and industry supervisors

Variable	Quantity			Design/ Analysis	Answer Weighted		Sample
	Instru-ment	Indi-cator	KPI		Weight	Value	
A. Risk assessment of manual handling work with the suitability of the work organization.	1	3	8	Risk assessment with Guttman Scale (quantitative)	Work-force (1-100)	-	Work-force
B. Workforce management strategies based on risk assessment of manual handling work with the suitability of the work organization	1	3	8	SWOT-4Q (quantitative)	Super-visor industry (1-100)	Work-force (1-100)	Super-visor in-dustry
Quantity	2	6	16				

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Techniques and procedure of data collection

Data collection techniques are used to guide the assessment of manual handling work with the suitability of work organization and workforce management strategies.

Data processing procedures include: (1) observations, especially to get data of the current workforce while doing the work; and or (2) interviews (closed questionnaire), to get data mainly from the workforce who do not do the work yet, who are going to do the work, or who have done the work. Similarly, observation and closed questionnaire were also used to get data from industrial supervisors who were responsible for workforces who are working, covering strategies used in managing workforces based on the risk assessment of manual handling work with the suitability of work organization.

Data processing and analysis

Data processing

Data processing refers to the distribution of risk assessment of manual handling work with the suitability of work organization, for the workforce to answer. YES = 1 means there is an increased risk of manual handling, while NO = 0 there is no risk of manual handling work.

Then, Table 2 is done by following the steps suggested by Trochim (2006: 1) and Effendi (1999: 116-119), including: (1) ordering eight KPI (two for teamwork, three for work procedures, and three for the work program); (2) pre-testing the KPI to a sample (workforce) of n = 23 respondents; (3) getting rid of KPIs of extreme answers; (4) ordering the answers obtained in a Guttman table. On the same line, the respondents are ordered in ascending way that is from the lowest to the highest scores. Then in the column, the indicators are ordered according to the amount of answers (from biggest to smallest amount); (5) calculating the *reproducibility coefficient* (RC) and *scalability coefficient* (SC). The scales that have RC = 0,90 and SC = 0.60 upwards are acceptable; and (6) Guttman scale score is calculated from NoA = number of answer 'Yes' for the KPI in that scale. The results are shown in Table 2.

Table 2. Guttman method for grading scale "organization of work"

Workforce	KPI								Σ
	1	*2*	*8*	*4*	*7*	*5*	*3*	*6*	
B	1								1
H	1								1
O						1			1
S		1							1
D	1		1						2
J	1	1							2
Q	1	1							2
W					1	1			2
C	1	1	1						3
T	1			1			1		3
U	1	1					1		3
V	1	1		1					3
A	1	1	1			1			4
E	1		1				1	1	4

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F			1	1	1		1		4
K	1	1	1	1					4
R	1	1	1	1					4
L	1		1		1	1		1	5
N	1		1	1	1		1		5
I	1	1	1	1		1		1	6
M	1	1	1	1	1			1	6
G	1	1	1	1	1	1		1	7
P	1	1	1		1	1	1	1	7
e	1	1	1	1	1	1	1		**7**
NoA	19	13	13	9	7	7	6	6	**80**
n	23 x 8 = 184								
x	n – NoA = 184 – 80 = 104								
RC	1 – e/n = 1 – 7/184 = 0.962				RECEIVED, because 0.962 > 0.90				
SC	1 – e/x = 1 – 7/0.5 (104) = 0.865				RECEIVED, because 0.865 > 0.60				

Data analysis

The data analysis includes risk assessment and SWOT-4Q analysis, to be sequently presented next.

1) Risk assessment analysis

The analysis of data of risk assessment of work with the suitability of work organization is explained next. Based on the results of the data processing, the risk assessment of manual handling work with the suitability of work organization is then analyzed by applying descriptive statistics. The results of the statistical analysis are then analyzed by applying a design of analyzing strategy of workforce management that corresponds to work organization.

2) SWOT-4Q analysis

The data analysis of workforce management is done by applying SWOT-4Q matrix analysis intended to produce a workforce management strategy based on: (1) the results of data (based on answers) of workforce on risk assessment of manual handling work with the suitability of work organization; and (2) the results of the data of supervisors based on the results of risk assessment manual handling work with the suitability of the work organization.

There are two main things to be considered in designing the SWOT-4Q matrix, as is adopted from Muhammad (2008: 39-48), that is, on the basis on the framework of the concept of SWOT-4Q matrix as well as steps of matrix formulation. Visually, the SWOT matrix with four quadrants design for the industrial supervisors' strategy is shown in Figure 1.

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Figure 1. Design SWOT-4Q Matrix for industrial supervisors

RESULTS AND DISCUSSION

The results

Analysis of the results of the risk assessment of manual handling work with the suitability of the work organization

In short, 56.52% of workforces do not experience any risk with the suitability of work organization. See Table 3.

Table 3. The results of the risk assessment data manual handling work with the suitability of work organization

U-P	Indicator/KPI	% Answers Yes	% Answers No
	The work team:		
1 [3]	Unavailable work teams, so that the work is carried out safely	26.09	73.91
2 [4]	Not enough workforce to do the job at time of peak workload	39.13	60.87
	Work procedures:		
1 [1]	Sudden changes or delays in the flow of material processes affecting the working frequency	82.61	17.39
2 [6]	Unavailable procedures for reporting and repairing equipment, or unsafe working conditions	26.09	73.91
3 [7]	The flow of manual handling work is not appropriate	30.43	69.57
	Work program:		
1 [2]	Work is influenced by the unavailability of workforce to complete the task in a deadline	56.52	43.48
2 [5]	Unavailable effective maintenance programs for work equipment used in the manual handling work	30.43	69.57

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3 [8]	Lack of selection programs, instruction and effective treatments for load, equip-ment, and mechanical handling devices	56.52	43.48
		Average 43.48	56.52

Description: U = number sequence indicator; and P = number of risk assessment KPI.

Three of the eight assessments show an increase, namely: "sudden changes or delays in the flow of material processes affect the working frequency" (82.61%); this is risky to creating a jump of manual handling, that may lead to greater probability for getting fatigue; "Work is influenced by the unavailability of workforce to complete the task in a deadline" (56.52%). This may lead to increase the risk of fatigue and risk of injury; and so the "lack of selection programs, instruction and effective treatment for loads, equipment and mechanical handling devices" (56.52%) may lead to increase the risk of potential injury.

Analysis SWOT-4Q results on the suitability of the organization of work

Based on the steps of SWOT-4Q analysis and the results of the data (on Table 4), then the total value weighted (on Table 5) is calculated, based on which the difference between the weighted values (on Table 6) is calculated.

Table 4. Results of data of workforce management strategies based on the risk assessment of manual handling work with the suitability of the work organization

KPI for workforce	% Answers		Industrial supervisor strategy	Weight (%)			
	Yes	No		S	W	O	T
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1. Sudden changes or delays in the flow of material process affecting working frequency	82.61	17.39	W: placement workforce is already in the working position respectively, but if there are sudden changes or delays in the process flow, the workforce can not respond	■	33	■	■
			T: the process will not load smoothly; and workforce can not be imposed, it is likely to decrease stamina and pose a risk of fatigue	■	■	■	31
2. The work is influenced by the unavailability of workforce to complete the task in a deadline	56.52	43.48	W: the work presented to the workforce does not correspond to the target (deadline) to be achieved	■	34.5	■	■
			T: workforce condition will get tired; and the completion of the work is not achieved on target	■	■	■	35
3. Unavailable work teams, so that the work can be done safely	26.09	73.91	S: workforce has the skills; and the cooperation of operators and helpers operator as teamwork	21.5	■	■	■

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		O: the process will be faster; and the workload to be light	■	■	22	■
4. Not enough available workforces to do the work during the time of peak workload	39.13 60.87	S: workforce has the appropriate skills to work; and technical factors outside the workforce	18	■	■	■
		O: workforce does not feel overwhelmed by the job, despite a peak workloads	■	■	19	■
5. Unavailable effective maintenance programs for work equipment used in manual handling work	30.43 69.57	S: available work equipment, so as not to rely on the strength of the workforce; and effective maintenance program, so that work equipment is well maintained in accordance with its function	18	■	■	■
		O: manual handling work will be lighter to be completed	■	■	19	■
6. Unavailable procedures for reporting and repairing equipment or unsafe working conditions	26.09 73.91	S: faulty equipment, reported to be remedied; and safety cables properly maintained on a working basis	20	■	■	■
		O: the target is reached; and workforce safety is assured	■	■	20	■
7. The work flow is not appropriate with manual handling work	30.43 69.57	S: system layout or the flow of regular work; and a work area free to move	22.5	■	■	■
		O: facilitate workforce to move; and expedite the process of	■	■	20	■
8. Lack of selection programs, instruction and effective treatment for loads, equipment, and mechanical handling devices	56.52 43.48	W: to support, can not be processed quickly if there is any damage or shortage	■	32.5	■	■
		T: the process will be hampered; and financing costs will rise	■	■	■	34
Average (%)	43.48 56.52	Total (%)	100	100	100	100

Description: S= strength; W= weakness; O= opportunity; dan T= threat.

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Table 5. Value weighted analysis of the results of workforce management strategies based on risk assessment of manual handling work with the suitability of the work organization

NU	Analysis of strategy ... with suitability organization of work	Weight (%)	Value	The weighted value
	Strength:			
3	Each workforces already has individual skill; and there is cooperation between operator and the operator assistants as a work team	21.50	73.91	1589.07
4	Workforces have appropriate skills to work; and there are technical factors beside the workforces	18.00	60.87	1095.66
5	Available work equipment, so as not to rely on the strength of the workforces; and effective maintenance program, so that work equipment is well maintained in accordance with its function	18.00	69.57	1252.26
6	Defective (broken) equipments are immediately reported to be repaired; and safety cables are properly maintained on a working basis	20.00	73.91	1478.20
7	Layout system or the flow of work is well-regulated; and a work area is free to move	22.50	69.57	1565.33
	Total strength	100		6980.52
	Weakness:			
1	The placement of workforces is already in its working position but if there are sudden changes or delays in the flow process, the workforces can not respond	33.00	82.61	2726.13
2	The work given to the workforces is not in accordance with the target (deadline) to be achieved	34.50	56.52	1949.94
8	To support can not be quickly processed if there is damage or a shortage	32.50	56.52	1836.90
	Total weakness	100		6512.97
	Opportunity:			
3	The work execution will be faster; and the workload is lighter	22.00	73.91	1626.02
4	Workforces do not feel burdened by the work, despite of peak workloads	19.00	60.87	1156.53
5	Manual handling work will be lighter to be completed	19.00	69.57	1321.83
6	Target is achieved; and safety is guaranteed	20.00	73.91	1478.20
7	Facilitate workforces to act; and expedite the process of work	20.00	69.57	1391.40
	Total opportunity	100		6973.98
	Threat:			
1	Process of doing workload will not be smooth; and workforce can not be forced, it is likely to decrease stamina and pose a risk of fatigue	31.00	82.61	2560.91
2	Conditions of workforces will be easily and very soon exhausted; and the completion of the work is not on target	35.00	56.52	1978.20
8	The process of work execution will be hampered; and financing costs will increase	34,00	56.52	1921.68
	Total threat	100		6460.79

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Table 6. Differences weighted value of the analysis results of workforce management strategies based on risk assessment of manual handling work with the suitability of work organization

The weighted value of strength	6980.52
The weighted value of weakness	6512.97
Positive difference	467.55
The weighted value opportunity	6973.98
Value weighted threat	6460.79
Positive difference	513.19

Because the difference of both weighted values are positive, the strategy position is in Quadrant I, as shown in Figure 2.

Figure 2. The position of the organization's growth strategy over the suitability of work

Therefore, the industry supervisors should apply the **growth strategy** in accordance with the strength of risk assessment possessed and the big opportunities of risk reduction.

Management should maximmally afford to exploit greater opportunities of manual handling work with the following strategies: (1) a solid working team can finish the work easily; and (2) the work equipment which is well maintained expedites the process of work. Such strategies are also evident on the lack of risk (43.48%), due to: (1) the availability of work teams in adopting a forward bent posture or above the height of a shrug; (2) the sufficient availability of workforce right at time of load peak, thus reducing occurrence of risks; (3) the availability of maintenance program, thus reducing the use of force; (4) the availability of procedures for reporting and repairing of equipment and safe working conditions; and (5) the suitability of the flow of manual handling work, so there is no stress increase at the peak workload.

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THE DISCUSSION

Discussion of risk assessment of manual handling with the suitability of work organization

Based on the analysis results (see Table 3), where 56.52% of workforces do not experience risk. Of the eight conformity assessment, only three showed an increase, namely: "sudden changes or delays in the flow of material processes affecting the working frequency" (82.61%) this is risky to creating a jump of manual handling, that may lead to greater probability for getting fatigue; the risk of creating a surge in manual handling, with a greater likelihood of fatigue. Osh (1991: 13), Gavin (2010: 4), and Evans et al, (1994: 18) have made sure if the changes affecting the level of risk of work organization by interacting with other factors. Furthermore, "work is influenced by the unavailability of workforce to complete the task in a deadline" (56.52%) increases the risk of fatigue and injury. This is due to the lack of workforce to work faster to achieve deadlines. Research by Korunka et al. (1993: 17) have proven that some of the workforces react in a way, for example, for fear of losing the legality, or the fear of change, or because they have not ready yet.

Similarly, the "lack of selection programs, instruction and effective treatment for loads, equipment and mechanical handling devices" (56.52%) increases the potential risk of injury, due to improper equipment; or the workforce is not trained on how to use it, so it can not be processed quickly if there is damage. As a result, the process is hampered and financing costs increases.

Discussion of the results of SWOT-4Q on the suitability of work organization

Industry supervisors should apply growth strategies, as it is proved and suggested by result analysis (see Tables 5 and 6) based on the results of research data (Table 4). This growth strategy corresponds to the strength of risk assessment possessed and big opportunity of risk reduction. Such condition has motivated to enlarge industries, taking advantage the strength of manual handling work with the suitability of work organization, the risk of which has been successfully assessed to maximmally exploit greater opportunities for manual handling work.

The strategy of work organization is also evident with minimity of risk (average 43.48%) where ***the first*** risk (26.09% of the unavailability of work teams means the work can be done safely) is due to the strength of workforces who have individual skills and good cooperation between the operators and operator assistants to work as a team, thus giving an opportunity for faster process and lighter workload. The researchers also assume that such process is also possible by high body postures workforces, that is lifting the workload with bending position, or by those of low body postures, that is lifting the workload a bit above their shoulders. The results of this research are consistent with the evaluation done by Saunders and Zuzel (2010: 15), assessing the strength of teamwork higher than the skills of individuals working alone. Meanwhile the strategy of the minimity of ***the second*** risk (39.13% of the insufficiency of available workforce doing the job at the time of peak workload occurs) is due to the strength of the workforces who have appropriate skills to work and technical factors of the workforces. Thus giving an opportunity to workforces is not to feel overwhelmed by the work, despite a peak of workloads. The strategy of the minimity of ***the third*** risk (30.43% of the unavailability of effective maintenance programs for work equipment used in the manual handling work) is caused by the availability of strength of the work equipment, in order not to rely on the strength of the workforces and effectiveness of maintenance program, as well as well as maintained

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work equipment in accordance with its function. Such conditions provide opportunities to manual handling work which is found easy to be done. These results support the research of Feng et al. (2006: 1047) which presents a model in determining optimal point to keep software application, assumed to be able to meet effective maintenance programs for work equipments used in the manual handling work.

The strategy of the minimity of the ***fourth*** risk (26.09% of the unavailability of reporting procedures and repair equipment that is not safe or unsafe working environments), is caused by the strength of reporting broken equipments to be immediately repaired and there is maintained safety cable on the runway work, thus giving opportunity to achieve the targets and ensure the safety of the workforce. The strategy of the minmity of the ***fifth risk*** (30.43% of manual handling work flow is not appropriate), is caaused by the strength of layout system or regular work flow as well as work area for free movement, thus giving opportunity to facilitate the activities of workforce and to expedite working process. The strategy of the supervisors is in line with that of Akrani (2010: 12) in setting operation sequence that ensures proper flow of work.

CONCLUSION

1. More than half of the workforces do not experience risk of manual handling work with the suitability of work organization.

2. Industry supervisors should apply growth strategies based on the strength of risk assessment possessed and magnitude of opportunitie of risk reduction available, in order to enlarge industry by taking advantage the strength of *manual handling* work with the suitability of work organization, the risk of which is successfully assessed to maximmally exploit greater opportunities of manual handling work.

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