III. METHODOLOGY

There are three main approaches which are the questionnaires, operator observation and motion study. The questionnaire form will be circulated in this study among the manufacturing workers. This questionnaire form will be used for data collection identify workers risk factors. In addition, RULA Assessment sheet will used to evaluate the movement of body region of the workers while doing their job. This approach is the time study which is a Lean tools to identify non value added of the workers job.

Questionnaire will design to obtain the information about the lean implementation and also about the ergonomics knowledge among the workers at the company. Questionnaires were completed through interviews. Interviews were confidential, undertaken in work time but away from the workplace in a confined office and lasted approximately 15 minutes for each individual. Frequency and descriptive analysis of data from the questionnaire was accomplished using Microsoft Excel 2013

The assessment used to evaluate the body region moved during workers doing their job and scores will be recorded on the movements. Total of the score will identify whether the job need investigation in future or need rapid change to reduce the musculoskeletal disorders among workers.

Motion time study is one of method to identify the non-value added in the workers job such as walking, recording or checking. All the non-value added will be listed and future improvement will be discussed.

IV. RESULT

A. Questionnaire Analysis

Workers were asked few questions about perceived pain/discomfort, which lasted, for at least 24 hrs. Pain was measured at past 12 months, last month and 7 days. Results are presented in order as mentioned above.

During the last 12 months, 20% (5) of the respondents reported pain on low back and 8% (2) on the neck. Of about 32% (8) of the employees complained of upper back problem. And 12% (3) of the employees had shoulder problems. Concerning elbows and ankles/feet pain, 4% (1) of the employees complained. There are 5 operators no complaints were reported.

During the last month, 16% (4) of the employees complained of low back pain, 8% (2) of the employees complained of the neck, 28% (7) of the employees complained of the shoulders and 8% (2) of the employees complained of the wrist/hand problems. About 24% (6) of the employees suffered from upper back pain. About 4% (1) of the employees suffered from elbows and ankle feet.

For the last 7 days, 16 % (4) of the employees had an episode of low back pain. About 36% (9) of the employees suffered from upper back. The employees suffered from shoulders is 24% (6). Of about 8% (2) of the employees had an episode of pain on the neck, 24% (6) shoulders and 4% (1) elbows.

B. RULA

The objectives of the study is to evaluate the workers posture while doing his/her job. Hence, there are four workers which assess using the RULA Assessment Worksheet. The assessment focus on the upper arm, lower arm, wrist, neck, trunk and leg position during workers doing their job. Several number of operator assessed on the working postures which each of them handle a piece of metal that has been stamping and also parts that joints using spot welding process.

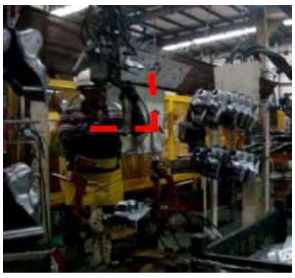
TABLE II. SUMMARY OF RULA RESULT

	Table A (Arm &Wrist)	Table B (Neck, Trunk & Leg)	Table C (Final Score)
Opt 1	5	7	7
Opt 2	5	7	7
Opt 3	5	6	7
Opt 4	4	7	6

The RULA assessments shows that most of the operators critical parts contribute to the risk factors is the neck, trunk and leg analysis. They bend their trunk when lifting or transferring the parts from the container or into the container. The bend more than 20 degree from normal line and this produce stress on their body.

TABLE III. POSTURE ANALYSIS OF THE OPERATOR

No	Picture	Description	No	Picture	Description
Opt 1 Posture 1		Arm ranges	**Opt 2 Posture 1**		Neck ranges >20º
Opt 1 Posture 2		Arm ranges	**Opt 2 Posture 2**		Arm ranges
Opt 1 Posture 3		Trunk ranges - bend to 90º	**Opt 2 Posture 3**		Trunk twisted
Opt 1 Posture 4		Arm ranges- straight hand with load	**Opt 2 Posture 4**		Trunk ranges >60º Leg bending
Opt 3 Posture 1		Neck ranges and shoulder	**Opt 4 Posture 1**		Arm ranges – full entension

Opt 3 Posture 2		Trunk ranges – low back	**Opt 4 Posture 2**		Arm ranges – awkward posture
Opt 3 Posture 3		Arm ranges- extension	**Opt 4 Posture 3**		Neck ranges - extension
Opt 3 Posture 4		Hand and wrist	**Opt 4 Posture 4**		Trunk ranges

C. Motion Study

The graph shows the average 10 minutes job done by four workers. The first worker is at the stamping section others are working at spot weld section.

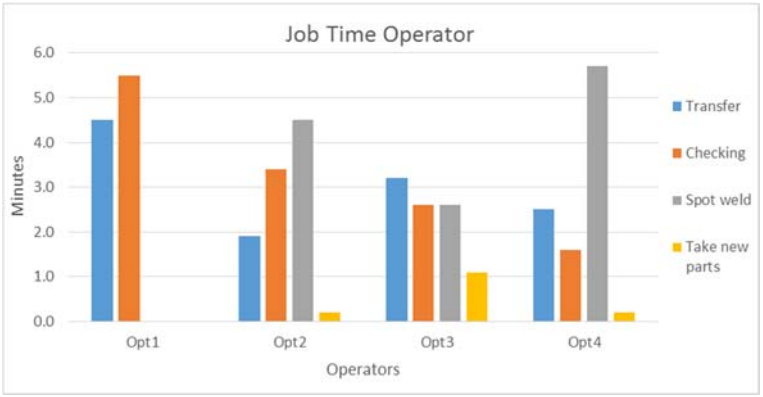


Fig. 1. Job time Operator (minutes)

The graph shows the activity or job by the workers which are transferring, checking, spot welding and also taking new parts. The transferring activity is the most significant job which three workers studied on the working motion. The checking motion also the main activity by the workers and during checking activity, the workers put stress on the shoulder because workers need to nod down their head to check the parts. For Opt 2 and Opt 4, the spot weld process contribute to the risk factors as the weld machine are hanging and they need to use upper bodies to use it. Other workers are using the spot welding machine which attach to the work station

V. DISCUSSION

A. Lean 6S Ergonomic

There is a strong correlation between Lean and safety. The new version of the 5S is called 6S in which "safety" is added that aims at creating a safe workplace for the employees. Many Lean improvement studies in manufacturing environments have been conducted and focused on different Lean aspects. However, a limited number of studies were conducted to improve the safety in the workplace to support the lean implementation process, some examples are given in. The current study focuses on the assessment of ergonomic risks in a manufacturing workplace to eliminate/reduce the risks and improve the performance of the operators.

B. Tools and Equipment Design

The main equipment used in the manufacturing process is the container where it holds the parts before transferred to the next process. The container are the basic one where there is not even a wheel to help the operators to move the container at the working area. The company should invest on the new design of container which has the wheel and also the lifter where the position of the container will not force operators to bend too much to gather the parts or to arrange the parts in it. The other option for new equipment design is table with turn or tilt features. The tilting features makes the parts gather more easily and workers do not have to bend their trunk too much.

C. Checklist for Ergonomics Improvement

There are several risk factors that make manual handling tasks hazardous and therefore increase the risk of injury. The risk factors for MSDs are: length of the MHL, posture of the body, exerted force during the manual handling and frequency of movements. The checklist includes questions related to all aspects of manual handling and offers examples of preventive measures that can help to improve handling and therefore reduce risks. A checklist can help identify hazards and potential prevention measures and, used in the right way, forms part of a risk assessment.

D. Design a Better Workspace for Workers

The observation shows that the workspace area of the workers are not well designed which forces the workers to do awkward posture and extensive hand reach. When the workers are using their hand out of the comfortable zone, the performance of workers will decreased as they have to reach the components which far away or do some extra motion to reach the components. Hence, workspace design must fit to the workers condition. The power zone is the lifting region that is considered optimal by ergonomists area extends from approximately standing elbow height to standing knuckle height and as close to the body as possible

VI. CONCLUSION

As a conclusion, the study was successfully conducted. All the tools that planned to use in the study was used and the result are as expected. The objectives of the study have been achieved by identifying the risk factors among the workers of the company. The result obtained help to determine the control measure that should be taken by the company. All tools indicate earlier used to achieve the objectives. The questionnaire designated and distributed has collected the data on the risk factors of WMSDs among workers. The scores of RULA assessment showed that the most of operators showed in the neck, trunk and leg having scores 3, 4 and 1 consecutively. The scores are in line with the survey feedback from the operators.

The company can choose whether to apply the recommendations proposed or not. In future, the ergonomics factors has to be highlighted as important aspect to the company in order to produce safety working environment and also can protect the workers from any disorders. Currently, most companies only implementing lean tools and not consider the safety aspects to the workers. Hence, by conducting the study, the company can provide safety and healthy environment and working condition to the workers. In addition, the performance of the company can be excelled as the health of the workers are secured and it is one of the advantages to the company.

The study showed that ergonomics can act as a lean manufacturing tools as it can be used to identify hazard and also ergonomic tools reduce the risk factors associated with the risk. Align with the lean purposes which is eliminate or reducing

waste, ergonomic also aims the same and the main concern on the safety aspect where the risk factors reduce or eliminated and less injuries, disorders or accidents occurs. Waste motion of ergonomics that can be reduced are stretching, bending, awkward postures and also extensive reaching.

VII. RECOMMENDATION

In order to further study of the ergonomics factor and lean tools in manufacturing company, there are some recommendation and suggestion. It is recommended to the company to give the employee training about ergonomics so that in future the company can achieve more safety environment.

Besides, the company can construct the questionnaires to evaluate how the opinion of the workers on ergonomic workplace in the working areas from the employee point of view. The better working environment will give the better satisfaction to the employees to do their jobs in the company.

In the study, the questionnaires and RULA method has been used. In the other hand, several others method can be used to evaluate the risk factors in the company. Some examples are REBA and OWAS which this two tools act similar to RULA method.

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