Application of Lean Tools In Leather Processing Industry

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Abstract- *The value and non-value added process in a leather manufacturing process is differentiated. The batches per week attainable at each process / station is studied. The utilization rate at each process / station is calculated. The idle time at each process / station is calculated. Ergonomic assessment using RULA is done for unhairing operation.*

Keywords- value added, non-value added, leather manufacturing, ergonomic assessment, RULA

I. CLASSIFICATION AS VALUE ADDED AND NON-VALUEADDED ACTIVITIES

A process of manufacturing raw skin to 30,000 square feet of upper leather is taken for study[1,2,3].

S.No.		Procesing time in hrs	Value added activities	Non-value added activities
	Table.1.1.Raw skin to finished Upper Leather - 30,000 sq.ft			
1	Soaking	7	7	
2	paint liming	24		24
3	unhairing	32	32	
4	reliming	72		72
5	fleshing	32	32	
6	washing	0.25		0.25
7	deliming	0.75		0.75
8	bating	0.75		0.75
9	pickling	1.67		1.67
10	chrome tanning	1.5	1.5	
11	basification	1.5		1.5
12	wetback	1		1
13	pretanning	0.58		0.58
14	rechroming	1.75		1.75
15	overnight	12		12
16	retanning and	2.67	2.67	
	fatliquoring			
17	fixing	2		2
18	sammying	32	32	
19	setting	32	32	
20	vacuum drying	32	32	
21	hooking	6	6	
22	staking	32	32	
23	buffing	32	32	
24	finishing	13	13.00	
	Total in hours	372.42	254.17	118.25
	Total in days	16	11	5
			68.25%	31.75%

Table 1.2. The process time with achievable number of batches in a week

No.	Process	process time in hrs	Number of batches/ week
1	soaking	7	24
2	paint liming	24	7
3	unhairing	32	5

4	reliming	72	2
5	fleshing	32	5
6	tanning drum	0	31
7	post tanning drum	20	8
8	sammying	32	5
9	setting	32	5
10	vacuum drying	32	5
11	hooking	6	28
12	staking	32	5
13	buffing	32	5
14	finishing	13	13

Table 1.3. The utilization rates of various stations:

No.	Process	Section output per week	Line output per week	utilization
1	soaking	24	2.33	9.71%
2	paint liming	7	2.33	33.29%
3	unhairing	32	2.33	7.28%
4	reliming	2.33	2.33	100.00%
5	fleshing	5.25	2.33	44.38%
6	drum tanning	30.5	2.33	7.64%
7	post tanning	8.4	2.33	27.74%
8	sammying	5.25	2.33	44.38%
9	setting	5.25	2.33	44.38%
10	vacuum drying	5.25	2.33	44.38%
11	hooking	28	2.33	8.32%
12	staking	5.25	2.33	44.38%
13	buffing	5.25	2.33	44.38%
14	finishing	12.92	2.33	18.03%

Table 1.4. The idle time at each section is calculated in hours

No.	Proces	cycle time	section process time	idle time (in hours)
1	soaking	72	7	65
2	paint liming	72	24	48
3	unhairing	72	32	40
4	reliming	72	72	0
5	fleshing	72	32	40
6	drum tanning	72	5.5	66.5
7	post	72	20	52

	tanning			
8	sammying	72	32	40
9	setting	72	32	40
10	vacuum drying	72	32	40
11	hooking	72	6	66
12	staking	72	32	40
13	buffing	72	32	40
14	finishing	72	13	59

- The value added & non-value added activities in a leather process is established.
- The utilization rates and idle time are also calculated for each process / station.

II. ERGONOMICS

ERGONOMICS (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. RULA and REBA are two common assessment methods. In this paper RULA is applied for manual-unhairing process and the results are discussed.

2.1.RULA

RULA (rapid upper limb assessment) is a survey method developed for use in ergonomics investigations of workplaces where work-related upper limb disorders are reported. This tool requires no special equipment in providing a quick assessment of the postures of the neck, trunk and upper limbs along with muscle function and the external loads experienced by the body. A coding system is used to generate an action list which indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator. It is of particular assistance in fulfilling the assessment requirements of both the European Community Directive (90/270/EEC) on the minimum safety and health requirements for work with display screen equipment and the UK Guidelines on the prevention of work-related upper limb disorders.

RULA was developed to provide a rapid assessment of the loads on the musculoskeletal system of operators due to posture, muscle function and the forces they exert. It is designed to assess operators who may be exposed to musculoskeletal loading which is known to contribute to upper limb disorders. RULA fulfils the role of providing a method for screening a large number of operators quickly, but the scoring system developed also provides an indication of the

level of loading experienced by the individual body parts. RULA is used without the need for any equipment and, after training in its use, has proved a reliable tool for use by those whose job it is to undertake workplace assessments. It can be used as a screening tool or incorporated into a wider ergonomics assessment of epidemiological, physical, mental, environmental and organizational factors[4].

2.2.REBA

Rapid Entire Body Assessment (REBA) has been developed to fill a perceived need for a practitioner's field tool, specially designed to be sensitive to the type of unpredictable working postures found in health care and other service industries. A team of ergonomists, physiotherapists, occupational therapists and nurses collected and individually coded over 600 postural examples to produce a new tool incorporating dynamic and static postural loading factors, human-load interface (coupling) and a new concept of a gravity-assisted upper limb position.

The development of REBA aimed to:

- Develop a postural analysis system sensitive to musculoskeletal risks in a variety of tasks.
- Divide the body into segments to be coded individually, with reference to movement planes.
- Provide a scoring system for muscle activity caused by static, dynamic, rapid changing or unstable postures.
- Reflect that coupling is important in the handling of loads but may not always be via the hands.
- Give an action level with an indication of urgency.
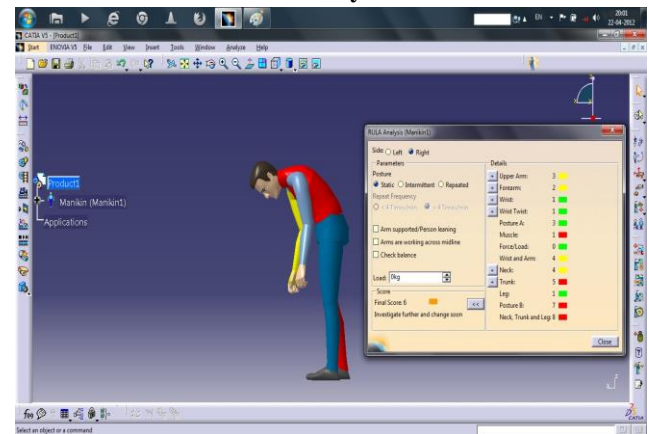- Require minimal equipment - pen and paper method.[5]

2.3. UNHAIRING – a process that is un-aired

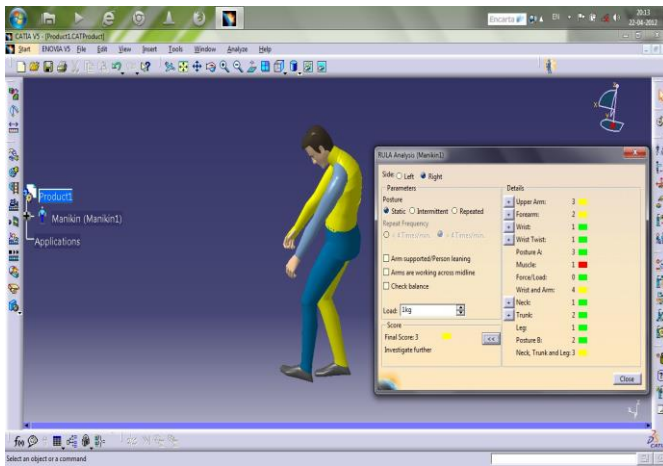**RULA: a survey method for the investigation of work-related upper limb disorders**
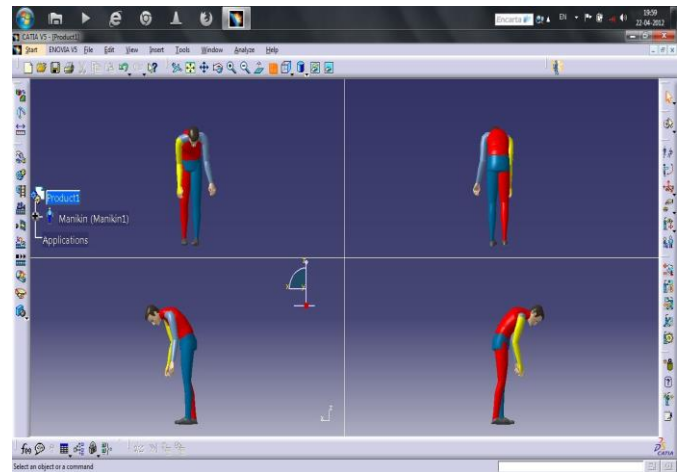
The backbone is tilted more than 66 degree causing harm to the human musculoskeletal system

A score of 6 indicates that investigation and changes are required soon

When the backbone is not tilted more than 81 degree and one foot has a support to rest on

A score of 3 indicates that further investigation is needed and changes may be required

The challenge lies in designing a beam that gives a score less than 3 !!!

Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time and can lead to long-term disability

III. FUTURE WORK

- Making the process semi-automatic with aid of conveyor beam (motorised) instead of static wooden beam
- Automating the entire process with robots[6]

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