QUESTIONNAIRE

Lean Manufacturing through Management of Manufacturing Flexibility

This questionnaire has three sections.

Section- I seeks general information of industrial units.

Section- 2 contains 6 subsections as under :

(a) Parameters of labour flexibility

(b) Parameters of machine flexibility

(c) Parameters of volume flexibility

(d) Parameters of product flexibility,

(e) Parameters of routing flexibility and

(f) Parameters of material handling flexibility

Section -3 seeks information on parameters of lean manufacturing.

Section - I	
Name of Industry	
Address	

Total number of employees	**<50,** **50-250,** **above 250**	**Size of Industry**	Micro/small/medium/large
Sector	private /public	**Products**	Components/Sub-assemblies/ Assemblies
Market	Supplier to a bigger company / Spare parts market/ Original equipment manufacturer		

Each of the following questions have four options from 1 to 4, 1 being the lowest and 4 the highest. Pick up the appropriate choice among (1) Strongly Disagree (SDA) (2) Disagree (DA) (3) Agree (A) and (4) Strongly agree(SA)

Section - 2

(a) Labour Flexibility

(i) Ability of workers to work on different machines	**SDA**	**DA**	**A**	**SA**
1. Workers have the necessary education and skill levels for multiple tasks	1	2	3	4
2. Workers have the necessary attitude and motivation on carrying out diverse tasks	1	2	3	4
3. Workers have been trained on multiple machines within a classification of tasks	1	2	3	4
4. Workers perform more than one task	1	2	3	4
5. Workers achieve similar performance levels for all tasks	1	2	3	4
(ii) Skill level of workers to perform different jobs				
1. Workers possess diverse skills to perform tasks	1	2	3	4
2. Workers can perform large number of tasks with in a classification of tasks e.g. machining	1	2	3	4

3. Workers can perform tasks which differ greatly from one another(out of classification) e.g. machinist doing an inspectors job	1	2	3	4
(iii) Cost effectiveness of workers over a job change				
1. When a worker performs a task which is not his usual task, it is cost effective.	1	2	3	4
2. Workers are equally efficient at multiple tasks they can perform.	1	2	3	4
3. When a worker performs a task which is not his normal task, the utilisation of machine and other resources are not affected adversely.	1	2	3	4
(iv) Reliability of workers over job change				
1. Workers are equally reliable for all tasks.	1	2	3	4
2. Workers are equally effective in terms of quality for all tasks.	1	2	3	4
3. A short time delay occurs when workers are moved between different tasks.	1	2	3	4
(v) Attitude of workers towards change of jobs				
1. Workers show positive attitude towards change of job.	1	2	3	4
2. It is easy to move workers between different tasks with in a classification of tasks.	1	2	3	4
3. It is easy to move workers between different tasks even outside the classification of tasks or on entirely different job e.g. a fitter performs the task of a fork lift driver.	1	2	3	4
(vi) Productivity effectiveness due to change				
1. Resources of materials, energy and machine time are utilised optimally when workers are assigned tasks other than their usual tasks.	1	2	3	4
2. Workers are usually effective, in terms of	1	2	3	4

productivity, for all tasks.				
(vii) Cooperation of workers in achieving production targets				
1. Workers cooperate in achieving production targets.	1	2	3	4
2. Workers can move easily between different tasks in the interest of the organisation.	1	2	3	4
(viii) Ability of production workers to perform inspection jobs				
1. Production workers are able to perform inspection jobs related to the products made by them.	1	2	3	4
2. Production workers understand the basic ideas of quality control and statistical quality control.	1	2	3	4
(ix) Ability of production workers to do maintenance autonomously				
1. Production workers are able to do autonomous maintenance.	1	2	3	4
2. Production workers take care of machinery and equipment operated by them.	1	2	3	4
3. Production workers normally find out the cause of the quality problem and rectify minor problems.	1	2	3	4
(x) Training of workers				
1. Workers are trained to perform many different tasks with in a classification.	1	2	3	4
2. Workers are trained to perform many different tasks outside a classification.	1	2	3	4
3. Workers are trained to perform inspection on tasks.	1	2	3	4
4. Workers are trained to perform maintenance tasks.	1	2	3	4

(b) Machine Flexibility				
(i) Ability of machines to perform diverse set of operations	**SDA**	**DA**	**A**	**SA**
1. The product type, range and volumes are such that specialised machines with flexibility of producing different jobs on machines are required.	1	2	3	4
2. The ability of performing various tasks on machines is achieved by set up change-overs by changing jigs and fixtures.	1	2	3	4
3. CNC machines are used to a large extent in the organisation.	1	2	3	4
4 Machining centres are used to a large extent in the organisation.	1	2	3	4
5. Machines can perform same operation on similar jobs which only differ in size.	1	2	3	4
6. Machines can perform diverse operations on similar/non similar jobs.	1	2	3	4
(ii) Machine setup or change over				
1. Set up change-over between production of various products are easy and efficient.	1	2	3	4
2. Machine set ups between operations are quick.	1	2	3	4
3. The company uses concept of Single Minute Exchange of Dies (SMED).	1	2	3	4
4. Set up change over requires only a sensor and / or a computer programme.	1	2	3	4
(iii) **Time and effort needed to change the tools and operations**				
1. The change of tooling etc. on the machine requires less effort and changeover gets approved mostly in the first time.	1	2	3	4
2. Change over requires some effort and time.	1	2	3	4

(iv) Cost effectiveness of operations over machine change				
1. Processing cost of operations is not affected by machine choice.	1	2	3	4
2. Machines achieve similar performance levels across all operations.	1	2	3	4
(v) Productivity effectiveness due to change of machine				
1. Machines are equally effective in terms of productivity for all operations.	1	2	3	4
2. Machines are equally efficient, for all processing operations.	1	2	3	4
3. Machines are equally effective in terms of quality for all operations.	1	2	3	4
(vi) Obsolescence rate of machines due to introduction of new products				
1. The machines do not become obsolete at a higher rate when a new product is introduced.	1	2	3	4
2. Existing machines can be used to perform some other operations in the company.	1	2	3	4
(vii) Reliability of machines over a job change				
1. Machines in a classification are equally reliable for all operations.	1	2	3	4
2. Machines breakdown frequency does not increase due to rapid change in product and operations.	1	2	3	4

(c) Volume Flexibility				
	SDA	DA	A	SA
1. You have encountered situations in which your production levels (due to demand) have been more or less than your installed capacity.	1	2	3	4
2. In case of lower demand (production), you are able to use your idle capacity on some or the other operations (machine).	1	2	3	4

3. You can deploy your manpower on some other operation/activity/functions.	1	2	3	4
4. The extent of idle capacity as a percentage of total capacity in the case of less demand is generally low.	1	2	3	4
5. For putting idle capacity to use on alternative operations, the rescheduling time and cost (for identifying alternative operations and deployment) is low.	1	2	3	4
6. You have devised a system to meet such situation of under demand by installing your capacity to meet the lowest assured demand and sub contract the fluctuating portion of the demand.	1	2	3	4
7. In case of a situation in which your demand is more than the installed capacity you use subcontracting.	1	2	3	4
8. In case of a situation in which your demand is more than the installed capacity you resort to overtime.	1	2	3	4
9. In case of a situation in which your demand is more than the installed capacity, you hire additional manpower and work on off days.	1	2	3	4
10. With the use of strategy listed in Q7 to 9 above, you are able to meet the order requirements fully.	1	2	3	4
11. In a situation where you find that the demand is higher and likely to remain higher in times to come, you are able to procure additional equipment without difficulty.	1	2	3	4
12. You use inventory as a strategy for meeting situation of fluctuating demand which is higher or lower than installed capacity (when demand is low, the inventory is stored; and used up when demand is high) but production rate remains constant.	1	2	3	4

(d) Product Flexibility				
	SDA	DA	A	SA
1. With present resources available with you, you are able to produce very large variety of products.	1	2	3	4
2. You are able to meet customers' demands by introducing new products frequently.	1	2	3	4
3. In order to introduce new product, you find that change in tools and software is very difficult.	1	2	3	4
4. For introducing new products, you have to invest/spend a very large amount.	1	2	3	4
5. While changing over to new range of products you find that shifting of machines or making necessary arrangement to set up is highly time consuming.	1	2	3	4
6. You have CNC machines and flexible machining centres which can produce new variety of products with ease.	1	2	3	4
7. You have facilities of rapid prototyping, rapid tooling, 3D printing, etc. for new product introduction.	1	2	3	4

(e) Routing Flexibility				
	SDA	DA	A	SA
1. You have encountered situations where in downtime because of breakdown of machinery is considerable.	1	2	3	4
2. In case of breakdown of a machine in a production line, you are able to shift the work of the machine to another available in the same shop to continue production.	1	2	3	4
3. The shifting of machines as mentioned in question 2 is very difficult.	1	2	3	4

4. The shifting of machines as mentioned in question 2 is highly time consuming.	1	2	3	4
5. In case of breakdown of a machine, when the work is shifted to another machine, the material handling system can be shifted.	1	2	3	4
6. For creating alternative routes, you keep adequate redundant capacity in production shop.	1	2	3	4
7. When alternative routes are not used, the spare capacity is fully utilised.	1	2	3	4
8. You have built in flexibility in your machines and operations so that these can be utilised for various operations to take care of breakdowns.	1	2	3	4
9. You have CNC machines and flexible tooling to accommodate various products and operations so that breakdown of one machine does not affect some specific operations on products.	1	2	3	4
(f) Material Handling Flexibility				
	SDA	DA	A	SA
1. You have machining centres which are interconnected and support transportation of products, tools etc. and the time required to transport material between machine centres is low.	1	2	3	4
2. In case of requirement of shifting paths between machine centres, you are able to change paths very easily.	1	2	3	4
3. Of the total machines, most of the machinery is interconnected.	1	2	3	4
4. In case of breakdown of some machinery, material handling system in your company is able to support change of path without much problem.	1	2	3	4
5. Material handling system installed in your company works both for products (in process) and tooling etc.	1	2	3	4

Section – 3				
Lean manufacturing				
	SDA	**DA**	**A**	**SA**
(i) Elimination of waste				
1. The organisation does not produce many products which have to be reworked or repaired as compared to the industry standard.	1	2	3	4
2. The percentage scrap rate is very low as compared to the industry standards.	1	2	3	4
3. The lay out and location of the plant is such that excessive movement for picking up or stacking parts is not carved out.	1	2	3	4
4. The company generally makes as many products as are ordered by the customers. Excessive number of products are not made and kept in ware house.	1	2	3	4
5. Production is carried out just before the time that the products are to be supplied to the customers. it is not carried out much in advance.	1	2	3	4
6. Extent of wasted effort to transport raw material is very low.	1	2	3	4
7. Extent of wasted effort to transport finished goods into or out of storage is very low.	1	2	3	4
8. Extent of wasted effort to transport WIP between processes is very low.	1	2	3	4
9. Raw material inventory levels are worked out scientifically and maintained. Excessive inventory is not kept.	1	2	3	4
10. WIP inventory is scientifically calculated and maintained. Excessive inventory is not maintained.	1	2	3	4
11. Inventory levels have declined over time.	1	2	3	4
12. Product designs are focused on customer requirements. Excessive features or processing is	1	2	3	4

not carried out.				
13. Waiting time for other resources is low and machines do not remain excessively idle on account of this.	1	2	3	4
14. Waiting for supplies, parts etc is very low and does not affect machine up-time.	1	2	3	4
(ii) Continuous Improvement				
1. Annual percentage scraps shows a declining trend.	1	2	3	4
2. Labour productivity shows rising trend.	1	2	3	4
3. Machine productivity shows rising trend.	1	2	3	4
4. TQM and Kaizen status has improved.	1	2	3	4
5. Training Programs for latest techniques and methods are held regularly.	1	2	3	4
6. Up gradation of machines and tools is done regularly.	1	2	3	4
7. Cost of production has declined.	1	2	3	4
8. Process improvements have reduced cycle time, setup time, waste, breakdown, and have resulted in fool proofing.	1	2	3	4
9. Suggestions per employee per year have increased.	1	2	3	4
10. Percentage suggestions that have been implemented increased over a period of time.	1	2	3	4
11. Rework percentage has reduced over a period of time.	1	2	3	4
(iii) Zero defects				
1. You have implemented fool proofing mechanisms and devices in your machinery and equipment.	1	2	3	4

2. Gauges and comparators are deployed in machines.	1	2	3	4
3. Machines giving quality related problems are upgraded /replaced promptly to restore the capability index for the products manufactured on them.	1	2	3	4
4. Workers deployed on machines are skilled and can maintain quality of products.	1	2	3	4
5. Statistical quality control of manufacturing processes is carried out.	1	2	3	4
(iv) Just in time deliveries				
1. Inventory investment shows declining trend over passage of time.	1	2	3	4
2. Production lead times as well as setup times have reduced /shortened over a period of time.	1	2	3	4
3. Products are made against orders only. The company does not manufacture large quantities before receiving customer orders.	1	2	3	4
4. Group technology and cellular layouts have been implemented wherever feasible.	1	2	3	4
5. Total Productive Maintenance (TPM) has been implemented.	1	2	3	4
6. ERP has been implemented in your organisation.	1	2	3	4
(v) Pull of raw materials				
(1) Kanban cards for material movement and production purposes are used.	1	2	3	4
(2) One piece lot is followed.	1	2	3	4
(3) Quality checks of incoming materials are performed at source.	1	2	3	4
(4) Stock levels in stores have reduced over a period of time.	1	2	3	4

(vi) Multifunctional Teams				
(1) Manpower is trained on multiple and complete jobs.	1	2	3	4
(2) Workers are given freedom in their area of responsibility and are empowered.	1	2	3	4
(3) Project teams have members and experts from various areas	1	2	3	4
(4) Small group activities or quality circles have been constituted and are active.	1	2	3	4
(vii) Decentralisation				
(1) Authority and responsibility are delegated and is properly communicated.	1	2	3	4
(2) Financial powers are delegated at different levels.	1	2	3	4
(3) Workload is logically and effectively distributed at various levels.	1	2	3	4
(viii) **Integration of functions**				
(1) Quality policy clearly reflects and represents various functions / area of industry.	1	2	3	4
(2) Quality objectives are integrated with production objectives.	1	2	3	4
(ix) Vertical information System				
(1) Information flows are adequate both from top to bottom and from bottom to top.	1	2	3	4