**Theme 1 – The Principles of Scientific Management – F. Taylor.**

**Intro:**

* Great material waste going on everywhere but we cannot see the waste of human effort going on all around us.
* It is only when he realise tat our duty lies in systematically cooperationg to train this competent man that we are on the road to efficiency.
* In the past the man has been first, in future the system must be first.
* First object of any good system must be that of developing first calss men and under scientific management the best man rises to the top faster than ever before.
* Article written to:
  + **First** to point out great loss which whole country is suffering through inefficiency in alsomst all of our daily acts.
  + **Second** to try convince reader that the remedy for this inefficiency lies in systematic management.
  + **Third** to prove that the best management is a true science, resting upon clearly defined laws, rules and principles and that these fundamental principles of scientific man are applicable to all kingd of human activities.
* Problems of industry presented, he encounters the difficulties blindly and the conclusions at which he has arrived are the results of the hard teaching of actual experience.
* Enters machine shop after completing apprenticeship as a machinist. Hard for mechanics to get work at the time. So started as unskilled labourer instead of working on machine.
* Advanced to position of clerk as old clerk was stealing. Shortly after he was given work as a machinist running one of the lathes, and after showing strong productivity compared to everyone else he was made gang boss after a few months.
* Work was done on piece work, the shop was really run by the workermen not the bosses.
* Workmen knew how fast/slow each job should be done and had a set pace for each machine which amounted to about one third of a good days work.
* Every new workman was told how fast he was to work otherwise he was soon out of work.
* Writer came across a principle in the country: the imployer pays just as low wages as he can and the workmen shall retaliate by doing just as little work as he can.
* Thus industry was a warfare, both sides gave out their worse instead of giving out the best they could.
* Soprtmeen strain every nerve to secure victory for his side, does his very best. Sentiment is so strong that any man who fails to give out all there is in him is branded a quitter and treated with contempt from those around him.
* Workers did as little as possible, doing extra would attract abuse. Quitting or soldiering.
* When to soldiering is added the natural inefficiency, ignorance and wastefulness which characterise many industries it results in a deplorable state of a modern industry.
* Cooperation needs to be introduced.
* When gang boss he seen full iniquity of the system.
* Workers told him to take her handy and not break pace. Writer said he was working on management side and would do all he could to get extra work out of them.
* Started a war, writer used every expedient to make the men do a fair days work, such as discharing the wages, lowering the piecework price and hiring new men.
* Bitterness developed, they used their ingenuity to contrive way which the machines would break. Tough for writer to stand up against all men in the workshop.
* Writer had advantages though.
  + First since he was not of working parents the owners of company believed that he had the interest of the works more at heart than any other workman and therefore had more confidence in his word.
  + When broken machines were reported to superintendent he accepted word of writer that the machines were deliberately broke.
  + If writer had liven where workmen lived he would have social pressure on him, impossible for him to stand up to them then.
  + He was abused and so was his family, advised not to walk home on his own.
* After 3 years of this struggle, output of machines had been materially increased in some cases doubled. Writer became foreman of shop.
* As leader of shop he advised workers to turn out more but as a friend he encouraged resistence to boost in production because they would not be earning any more money.
* Changed the system of management so that interest of workman and management would be cooperative. He started experimenting, he started a new type of management-‘a piece rate system’ and ’shop management.’
* Realised greatest obstacle to harmonious cooperation was in the ignorance of the management as to what really constituted a propers days work for a workman.
* Got money to study this., the processes of work in the shops and amount of time required to do various kinds of work.
* These investigatnion made the first step towards scienfific management.
* Alos a similar invest to which tools and implements were best to be used in each trade was begun.
* In the study of tools and methods which constitute the art of cutting metals alone and which lasted through 26 years between 30000-50000 experiments have been made of which no record was kept.
* Had to study shop arrangement, methods of keeping stores, the routing of materials and best ways of using belts etc, and had to establish standards for all details throughout the works and finally undertake the scientific planning of the work
* Certain principles of scientific management were disovered. Gradually fimrs changed from the ordinary to the scientific type of management. At least 50000 workmen were emploued in us in new system. They were receiving from 33-100% higher wages daily than other workmen of similar calibre.
* In these companies the ouput per man per machine has on average been doubled.
* Under the new management type there were no strikes because of cooperation between workers and mastnagement.

**The finest type of ordinary management:**

* In an industrial establishment with 500-1000 workers there is in many cases at least 20-30 different trades. Workmen in each of these trades have had their knowledge handed down to them by word of mouth .
* The methods most commonly in use are an evolution representing the survival of the fittest and best of the ideas which have been developed since the starting of each trade.
* Only those who are intimately acquainted with each of these trades is fully aware of the fact that in hardly any element of any trade is there uniformity in the methods used.
* Instead of having only one way which is generally accepted as a standard there is any number of ways of doing it.
* Methods have been handed down through generations, in no instances have they been codified or systematically analysed or described.
* This means managers who are supposed to be experts actually fall far short of the combined knowledge and dexterity of all the workmen under them because of the way info was passed down.
* The best managers recognise the task before them as that of inducing each workman to use his best endeavours his hardest work and all his traditional knowledgs to yield the larges possible return to his employer.
* The problem before the management then may be briefly said to be that of obtaining the best initiative of every workman.
* On other hand manager would hope to obtain in any full measure the initiative of his workmen unless he felt that he was the something more than they usually receive from their employers.
* It is well within the mark to state that in nineteen out of 20 industrial establishments the workmen believe that it to be directly against their interests to give their employers their best initiative and instead of working hard work slow as they dare.
* A special *incentive*  can be given in many ways. Eg a promotion or advancement, higher wages, shorter hours of labor, better surroundings etc. And above all that personal consideration for and friendly contact with the workement which comes only from a genuine interest in their welfare and their success.
* Only an incentive will buy the initiative of workmen. Offering an incentive has become generally recognised in modern schemes for paying men.
* Broadly speaking the best mang is one where workman gives best initiative nad in return receive some incentive . referred to as management of initiative and incentive.
* Under scientific management workers initiative is obtained unifromally and to a greater extent that is possible under the old system, in addition the managers assume new burdens, new dution and responsibilities never dreamed of in the past.
* Managers gather all the knowledge, and classify and tabulate the knowledge to rules and formulae which are helpful to workers.
* Grouped under 4 heading.

**Four fundamental Elements:**

* **First-** they develop a science for each element of a mans work, which replaces the old rule of thumb method.
* **Second** –they scientifically select and train the workmen, where in the past he chose his own work and trained himself as best he could.
* **Third**- they heartily cooperate with the men as to insure all of the work being done in accordance with the principles of the science which has been developed.
* **Fourth**- is an almost equal division of the work and the responsibility between the management and the workmen. Management take over all work for which they are better fitted than the workmen and, while in the pas t almost all of the work and the greater part of responsibility were thrown upon the men.
* this combo of initiative of workmen coupled with the new types of work done by management that makes scientific management so much more efficient than the old paln.
* It will be shown that they can be applied absolutely to all classes of work and that when thay are applied the results must of necessity be overwhelmingly greater than those of normal management.

**Pig iron example:**

* Typical of perhaps the crudest and most elementary form of labour which is perfomed by man.
* Only use their hands, stoop down pucks up a pig iron weighing around 92 pounds walks a few yards and drops it onto the ground or on a pile.
* Work is so elementaly that writer believes it would be possible to train an intelligent gorillas to be more efficient than the handlers can be.
* However science of handling the iron is so great that it is impossible for th man who is best suited to this type of work to understand the principles of theis science without the aid of a mana better educated than he is.
* Also shows that the workmanwho is beswt suited to actually doing the job is incapable of understanding the science.
* With a large quantity of pig iron to be moved, on a fairly large scale the adbantages of scientific management over the old fashioned daywork would be obvious.
* Betblehem steel company had pig iron gang of 75 men. They were good average handlers under an excellent foreman who himself had been a handler, work was done as fast and cheap as anywhere else.
* Railway track goes into field, inclined plank placed against side of car and iron was walked up plank and dropped into car.
* Gang was loading on average 12.5 tonnes per man per day.
* After a scientific study of the men at work. A first class pig iron handler ought to handle between 47-48 tonnes per day instead of 12.5.
* First step of implementation of method was scientific selection of the workman.
* Had to talk to men individually because of different capabilities and limitations. They were trying to develop each individual man to his highest state of efficiency and prosperity. Therefore watched and studied these men for 3-4 days.
* Picked out 4 men, and looked at their history and looked at habits and ambition for each of them.
* Picked a Pennsylvania Dutchman who walked to and from work everyday. He bought his own land and started building a wall and worked every morning before he went to work and at night.
* The task was to get dutchy to handle 47 tonnes of pig iron a day and making him glad to do it.
* Offered him a higher wage to do exactly what he was told from morning till night. Ie walk when he said, pick up iron when he said eg.
* Dutchy did the work and a t regular intervals was told to take a erst. He worked when he was told to and rested when he was told to rest and bu the end of the day had his 47.5 tonnes loaded on the car. He preactically never failed to work at this pace and do the task that was set to him.
* He earned a higher wage. One man after another was picked out and trained to handle iron at 47.4 per hour and all of this gang were receiving 60% more wages than other workmen around them.
* If dutchy had tackeled the 47 tonnes on hiw own without the guidance or direction of a man who understood the science of handling iron he would have tired himself out by 11 or 12.
* He would ahve kept so steadily at work that his muscles woulnd not have had proper periods of rest needed gor recuperation and would have been completely exhauseted.
* After been under same instruction he became accustomed to the habit of resting at proper interbals and was able to work evenly all day.
* Out of 75, 1 in 8 was physically capable of handling the 47.
* These 1 in 8 werent special they were just suited to this type of work.

**Can workmen select Themselves:**

* under the old forms of mang the attitude of the mang is that of ‘putting the owrk up to the workmen’.
* However these men would not properly select themselves for iron handling and would not get rid of 7 out of 8.
* The man who is suited to handle pig iron cannot possibly understand the science nor even work in accordance with its laws without the help of those who are over him..

**Work a Man Should Do in a Day:**

* That is to study the tiring effect of heavy labour upon a first class man.
* Employed people to study workers, one by physiologist who were studying the endurance of the human animal and the other by engineers who wished to determine what fraction of a horse power a man power was.
* Largely upon men who were lifting loads by means of turning the crank on a suspended laod. Others to determine the energy expended in walking, running and lifting weights in various ways.
* No law could be found so started a series of experiments of our own.
* Two first class labourers selected, men were paid double during experiment and were told that they must work to ther best of their ability at all times, and if they tried to deceive they would be discharged.
* Aim was to learn what really constituted a full days work for a first class man, the best days work that a man could properly do year in and year out and still thrive under.
* Men given different tasks and were observed and timed. Useless motions were eliminated and fsat motions substituted for in efficient movements.
* Every element in any way connected with the work which we believed could have a beraing on the speed and efficiency was carefully studied and recorded.
* Hoped to determine was what fraction of a horse power a man was able to exert, how many foot punds of work a man could do in a day.
* Each mans work was translated into foot pounds of energy and surprisingly they found that there was no apparent relation between the foot pound of energy which the man exerted during a day and the tiring effect of his owrk.
* On some activities he would be tired out when doing not more than one eigt of a horse power while in other he would be tired by doing half a horse power of work. Did not see any law which was an accurate guide to the max days work of a first class man.
* Some years later second series of experiments were made similar to the first but more thorough.
* Resulted in obtaining valuable information but not in developing a law.
* Third series of experiments done.
* After this data was translated into foot pounds of energy no relation between the horse power which a man exerts and the tiring effect appeared.
* Problem was handed over to a mathematician to graph the results giving a birds eye view.
* The maths dude disocered the law governing the tiring effect of heavy labour and was so simple in its nature that it is truly remarkable that it should not have been discovered and clearly understood earlier.
* The law is confined to that class of work in which the limit of a mans capacity is reached because he is tired out.
* It is the law of heavy labouring corresponding to the work of the cart horse, thater than that of the trotter.
* All suchwrok consists of a heavy pull or push on mans arms , mans strength is exerted by either lifting or pushing something which he grasps in his hands.
* The law is that for each given pull or push on mans arms it is possible for the workman to be under load dfor only a definite percentage of the day. Eg for pig iron it was 43%.
* As load becomes lighter % of the day under which the man can remain under load increases.
* When a labourer is carrying a piece of iron weighint 92 in his hands it tires him abouts as much to stand still under the load as it does to walk with it, since his arm muscles are under sever tension whether he is moving or not.
* A man however who stands still under a load is exerting no horses and this accouts for the fact that no constant relation could be traced in various kinds of heavy labofing work between the foot pounds of energy exerted and the tiring effect of the work on the man.
* It is also clear that in all work of this kind it is necessary for the arms of workman to be completely free from load, for the workman to rest at frequent intervals.
* Throughout this time the man is under heavy load the tissues of muscles are weakening and need frequent periods of rest.
* Essential idea of ordinary types of management is that each workman has become more skilled in his own trade than it is possible for anyone in the management t obe and therefore the details of hwo the work shall best be done are left to him.
* New idea o0f training man until it becomes a habit to him is the direct opposite.
* Beside this the man suited to handling the iron is too stupid to properly train himself.
* Philosophy of new places a great part of it upon the management and seeks cooperation.
* 7 out of 8 not suited to iron were thrown out of a job but almost all of them were immedaiately given other jobs.