Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

Partcipant Handbook

Sector
Agriculture and Allied

Sub-Sector
Agriculture Crop Production

Occupation
Farm Machinery and Equipment Operation and Maintenance

Reference ID: **AGR/Q1101, Version 1.0**
NSQF Level 4

Tractor Operator

Published by

Mahendra Publication Pvt. Ltd
E-42,43,44,Sector-7 Noida -201301,
Uttar Pradesh -India

First Edition,March 2016

ISBN 978-1-111-22222-45-7

Printed in India at

Agriculture Skill Council of India
6th Floor, GNG Tower, Plot No.10
Sector - 44 Gurgaon - 122004, Haryana, India
Email: info@asci-india.com
website: asci-india.com
Phone: 0124-4288322, 4047488, 4046678

> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

AGRICULTURE SECTOR SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: '**Tractor Operator**' QP No. '**AGR/ Q1101 NSQF Level 4**'

Date of Issuance: **Sep 30th 2016**

Valid up to*: **March 31st, 2018**

**Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)*

Authorised Signatory
(Agriculture Skill Council of India)

Acknowledgements

We are thankful to all organizations and individuals who have helped us in preparation of this Participant manual. We also wish to extend our gratitude to all those who reviewed the content and provided valuable inputs for improving quality, coherence and content presentation of chapters. This handbook will lead to successful roll out the skill development initiatives, helping greatly our stakeholders particularly trainees, trainers and assessors etc. We are thankful to our Subject Matter Expert Dr. Pitam Chandra who has given the content and helped us in preparation of Participant Handbook.

It is expected that this publication would meet the complete requirements of QP/NOS based training delivery, we welcome the suggestions from users, Industry experts and other stakeholders for any improvement in future.

About this book

A Tractor Operator is a person who is responsible for the operation of the tractors for agriculture purposes and also is responsible for the maintenance of the same. The person continuously keeps the vehicle free of any complaints, takes up basic repairs wherever feasible and is necessary and also would take up various agriculture activities as per the needs of the farmers. A Tractor Operator should have the ability to work independently, sensitive to farmer's needs and must have the ability to take up maintenance and repairs (minor) of the tractor as and when necessary. Should possess basic understanding and acumen towards crop cultivation. The individual should be result oriented and is responsible for his own working and learning. The trainee will enhance his/her knowledge under the guidance of the trainer in the following skills:

- **Knowledge and Understanding**: Adequate operational knowledge and understanding to perform the required task
- **Performance Criteria**: Gain the required skills through hands on training and perform the required operations within the specified standards
- **Professional Skills**: Ability to make operational decisions pertaining to the area of work.

The handbook incorporates well-defined roles of Tractor Operator like Tractor operation, pre check prior to operation, maintenance of tractor, hazards & risks at the work place, health & safety at the work place etc. The participant should be result oriented and responsible for his/her own working and learning. The participant should also be able to demonstrate skills of using various tools and decision making for instant problem solving.

We wishes all the best for your future in the Agriculture Farm Machinery Sector

Symbols Used


Key Learning Outcomes


Steps


Time


Tips


Notes


Unit Objecti es


Exercise

Table of Contents

Table of Contents

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

1. Introduction

Unit 1.1 - Role of agricultural mechanization in India and abroad

Unit 1.2 - History of tractors

Unit 1.3 - Tractor market in India and abroad

Unit 1.4 - Glossary of terms and symbols

Unit 1.5 - Know your tractor and implements/machines

Unit 1.6 - Glossary of terms and symbols

Key Learning Outcomes

At the end of this module, you will be able to:

- Understand the role of Agricultural Mechanization in India and abroad History of Tractors.
- Understand Tractor and implements Glossary of terms and symbols.

UNIT 1.1: Role of Agricultural Mechanization in India and Abroad

Unit Objectives

At the end of this unit, you will be able to:

- Understand the role of Agricultural Mechanization in India and abroad History of Tractors.

1.1.1 Introduction

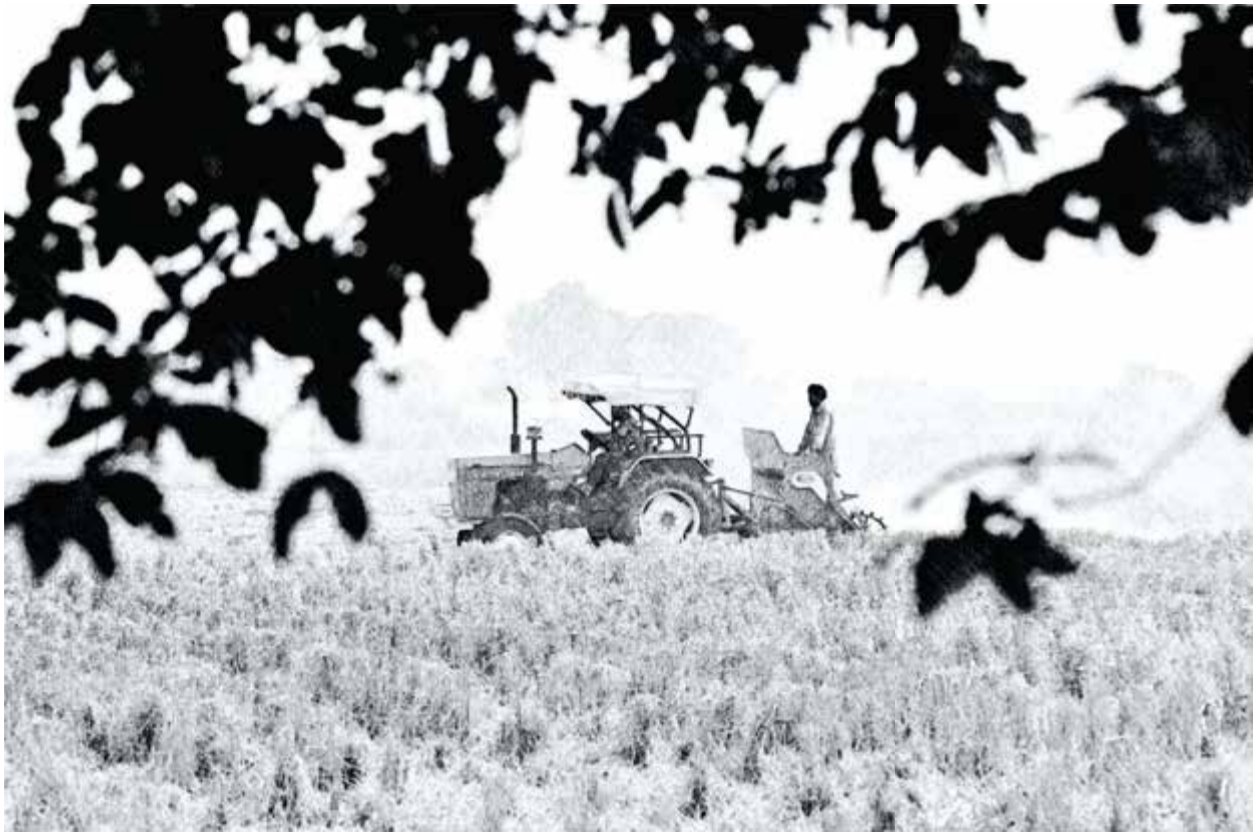


Fig 1.1.1 Role of Agricultural Mechanization in India and Abroad

Indian agriculture has been a success story and the country has been able to hold its head high on account of self-sufficiency in food. Coordination of Governmental policies, scientific efforts and farmers' action made it possible. India today is the net exporter of food and the country has come a long way from the begging bowl situation that existed sixty years ago.

Agriculture in India has tremendous potential for further growth through suitable policy framework coupled with enhanced investment in infrastructure. Indian agriculture has several natural and man-made peculiarities: majority of small and tiny land holdings, poor soil conditions, inadequate irrigation, floods, draughts, poor-quality agro-chemicals, lack of tools and equipment, etc. Nearly 62 per cent of the estimated 142 m ha area is rainfed. Average size of land holding in India is 1.1 ha with 80 percent of the farm holdings less than 1.0 ha. After independence till 1965, the increase in production was achieved mainly through increase in cultivated area without mechanization. But during the Green Revolution phase of 1965-75, the use of high yielding varieties, fertilizer, chemicals and improved agricultural practices improved the cropping intensity and productivity of the crops. Compared to 51 million tones of food grain production in 1950-51, the country-achieved production of 265 million tonne in year 2013-14. However, country could achieve the cropping intensity of only 140% in about 6 decades.

Indian agriculture has been under tremendous pressure today since it is not profitable. Given the choice, many present day farmers would leave farming. Therefore, the challenge is to achieve the higher input use efficiency and improve the profitability of agriculture. Apart from achieving the food grain production of 307 million tonne by year 2020-21, production levels of other associated crops such as oilseed, and horticultural crops also need to be raised for a population of 1.39 billion at that time.

To achieve such higher levels, the projected annual agricultural growth has to be 4-5%. With no possibility of increase in net cultivated area, intensive agriculture with higher input use efficiency coupled with better management practices and value addition of products in production catchments will hold the key. This will require farm machines to ensure timeliness of operation, precise and judicious application of inputs, protected cultivation, handling, storage and value addition to farm produce in production catchments. Any quantum jump in production, productivity, and profitability could be brought about by a combination of factors; farm mechanization will be essential in addition to seeds, fertilizers and water.

Agricultural Mechanization

Fig 1.1.1 Agricultural Mechanization

Mechanization not only refers to interjection of machinery between men and materials handled by them but it has to address the core issues of timeliness of operation, reducing the time required for farm operation, increasing the input use efficiency and minimizing the losses of produce. Traditionally farm family incomes were centered on farming alone. However, with present status of dwindling profitability of the farming sector and increased awareness, farmers take-up other non-farm ventures to improve their family income. Time required to perform agricultural operations, therefore, becomes critical.

Mechanization has varied connotations. While in the developed world it tends to be synonymous to automation but in developing countries, like India mechanization is now demand driven. With diminishing labour availability and increasing labour wages the farmers, specially medium and large ones, are looking for labour saving devices to remain competitive. With preponderance of marginal and small farms, custom servicing in farm operations is in vogue and rightly so because individual ownership is not affordable.

What farm mechanization can do to a developing economy is evident from the history of the agriculture in the USA. In 1900, 41 percent of US labour force was engaged in agriculture and two farmers produced food for five American citizens. In 1930, only 21.5% labour force was engaged in agriculture and the share of agricultural GDP was 7.7%. In 1945, the labour force in agriculture got further reduced to 16% and the share of agricultural GDP reduced to 6.8%. In 1970, the agricultural labour force was down to just 4% and the GDP share was reduced to 2.3%. In the year 2000, the labour force was just 1.9 % and the share of agricultural GDP was just 0.7%. Today, a US farmer feeds 155 persons in his own country as well as out of the USA. This transformation occurred on the strength of farm mechanization. The labour force freed from agriculture were employed by the industry leading to economic growth and higher individual income.

Farm mechanization is often been criticized for displacement of employment opportunities in a labour abundant economy. It is also true that the wages of farm labour have not grown as much as those of industrial labour. With the Indian economy growing faster than agricultural economy and

implementation of Mahatma Gandhi Rural Employment Guarantee Act, labour availability for agriculture is in fact falling short. Therefore, mechanization of Indian agriculture is an eventuality without any misgivings of labour displacement. Potential of mechanization on improving productivity and profitability of farming sector can be well realized by Drudgery Productivity Time

Figure: Effect of power source on agricultural productivity careful analysis of the existing level of farm mechanization in the country, farm power availably and future perspective of improving the farm mechanization level.

The above figure clearly explains that the traditional agriculture with only manual labour is a low productivity and high drudgery enterprise. Supplementation with draft animal power reduces drudgery and improves productivity. However, it is the application of mechanical power that minimizes the human drudgery and maximizes the agricultural productivity.

Level of Mechanization

The assessment of level of mechanization is very cumbersome exercise due to diverse agriculture being practiced in the country. For now, a simple estimate would be the percent of cultivated area utilizing a power operated mechanical devise to carry out a particular farm operation. A rough estimate for the level of mechanization at present is 40% which is based on the following data.

Soil working and seed bed preparation	42%
Seeding and planting	29%
Plant protection	34%
Irrigation.	37%
Harvesting & Threshing	60%-70%

It is clear from the following Table that India has a long journey to make as far as increasing the intensity of farm mechanization to a respectable level is concerned. Moreover as the economy grows, the relative share of agriculture in the total economy of the country keeps going down. Projections for Indian economy for the year 2050 suggest that the agricultural GDP would reduce to only 2%-3% of the country's GDP. The labour force engaged in agriculture would come down to <10%.

Country	Level of Mechanization	Agricultural GDP as percent of national GDP
USA	95%	0.7
Western Europe	95%	<5.0
Russia	80%	4.0
Brazil	75%	5.0
India	40%	13.9
China	61%	9.2

Table 1.1.1 Level of Farm Mechanization and Agricultural GDP in selected Countries

We need to appreciate that crop yields in India are much lower than the yields in other countries. While it points towards the potential for much higher food production in the country, it also suggests that effective growth strategy needs to be envisaged to actualize the potential.

Country	Crop Productivity
USA	7340
France	7074
Japan	6105
Canada	4170
China	5891
India	2961

Table 1.1.1 Relative Crop Productivity in different Countries

The farm mechanization includes availability of farm power at farm level, utilization of farm machinery including type and numbers, and availability of infrastructural support for farm machinery. The different aspects of mechanization have been discussed below.

Farm Power Availability

In Indian agriculture, human, animal and mechanical power is utilized for different on-farm and off-farm activities. It has been found that agricultural productivity has direct correlation with farm power availability. The total farm power availability in 1951-52 was 0.20 kW/ha which increased to 1.01 kW/ha(cultivated area) in 2001-02 and estimated to be 2.02 kW/ha in year 2013-14. As compared to developed countries the farm power availability in India is very low. Mechanical and electrical resources are contributing more than 80 % of the available power. Out of which more than half of the power is being utilized for stationary operations of water lifting. Only 35% of the mechanical power is being utilized for tractive purpose. The contribution of animal power has reduced over the years. The human power has limitation and full of drudgery. Therefore, a proper strategy needs to be adopted for increasing farm power availability.

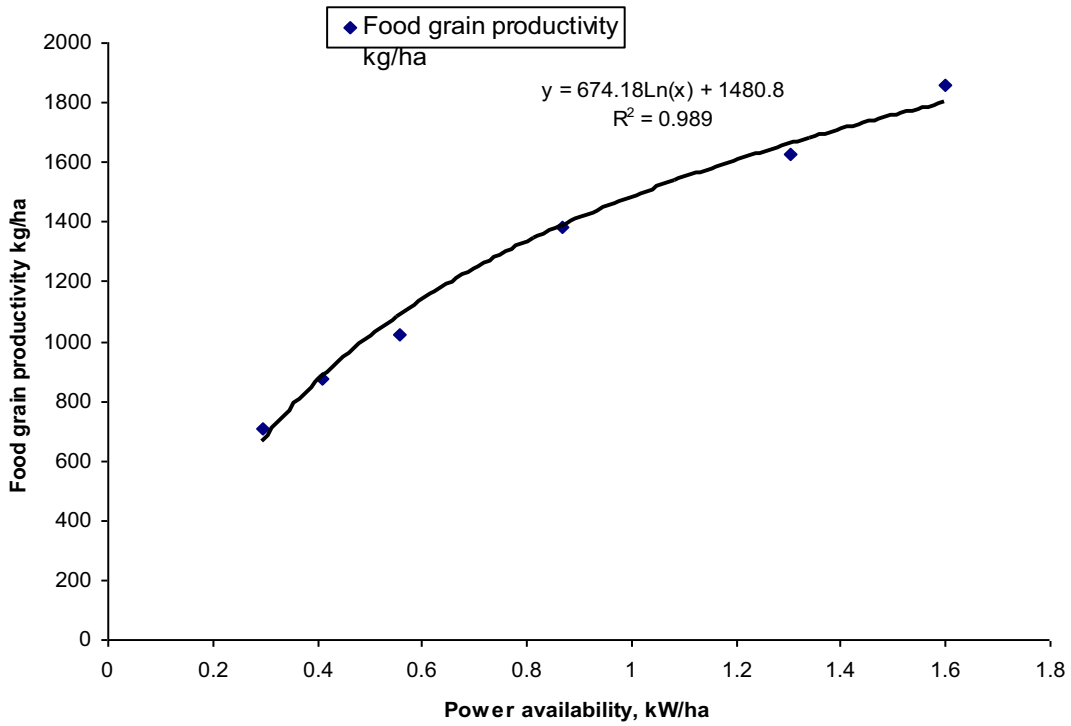


Fig 1.1.1 Relation of farm power availability and food grain productivity

Tractors in India were introduced through importation. In 1951 only 8500 tractors were there. Tractor production in India started in year 1961-62 with 880 no/year. Today India is manufacturing more than 600,000 tractors per year with estimated population of 5.0 million. Power tiller was introduced in the country in sixties but could not gain popularity due to its limitation in field and on-road use as well as ergonomic weaknesses.

The use of power tillers is presently more in rice and sugarcane producing areas of Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, West Bengal, Orissa, Maharashtra and north eastern states. The yearly production is about 50,000 units. Diesel engines and electric motors are used for stationary operations especially for lifting water from irrigation and operating grain mills, oil ghanis, sugarcane crushers, power threshers and chaff cutters. The government incentives for irrigation hardware have played an important role in their popularization. Electric pumps are preferred over diesel engine operated pumps in electrified areas due to low recurring cost and maintenance requirements. It is estimated that about 12 million motors with potential power availability of 44..24 M kW in 2005-06 were in use. Similarly diesel engines have potential power availability of 37.15 M kW.

India at present has farm power availability of about 2.02 kW/ha. On the other hand, farm power availability in Japan, USA, UK, and France is more than 5.0 kW/ha. Even China has about 4.0 kW/ha power availability. The question, therefore, is whether we should set our farm power availability target at 5.0 kW/ha or lower. At present, the consensus is that we should target at 3.0 kW/ha and adopt measures for conservation and higher efficiency for long term sustainability.

The state-wise farm power availability from mechanical power sources has been presented in Table 2. The mechanical power availability among various states shows a large variation across the states of the country more than 80 per cent of the cropped area of country has farm power availability less than 1kW/ha. Only four states namely, Punjab, Haryana, Kerela and Uttar Pradesh has farm power availability more than 1 kW/ha. States of north eastern hill region and Assam have farm power availability of just 0.04-0.05 kW/ha. Therefore, based on farm power availability status, the states could be divided in to three broad groups of states having mechanized agriculture, states with mix of mechanized and animate power source and states heavily dependent upon animate source of energy. The rural electrification programme till date has concentrated on providing power for irrigation purposes. Therefore, to improve the farm power availability, specific policy frame work needs to be put in place. It should include ensuring a continuous supply of electricity and promoting use of it for local level agricultural enterprises. This will not only help in ensuring power availability to farm but ensure local level employment generation at rural level such as small scale value addition, ensuring better storage and quick transportation of food products at rural level. A large scale infrastructural support will

be needed to ensure the continuous supply of electricity at farm level. Till 1960-61 composition of available farm power in India was essentially animate: draft animals 68.7% and humans 20.7%. However, mechanization in India after Green Revolution has changed the scenario,

Tractors	44.3%
Engines	19.3%
Electric Motors	26.2%
Humans	5.0%
Draft animals	5.2%

S. No.	Name of the State	Farm Power Availability (kW/ha)	Food grain productivity (kg/ha)
1	Punjab	3.50	4032
2	Haryana	2.25	3088
3	Uttar Pradesh	1.75	2105
4	Andhra Pradesh	1.60	1995
5	Uttaranchal	1.60	1712
6	West Bengal	1.25	2217
7	Tamil Nadu	0.90	2262
8	Karnataka	0.90	1406
9	Kerala	0.80	2162
10	Assam	0.80	1443
11	Bihar	0.80	1622
12	Gujarat	0.80	1169
13	Madhya Pradesh	0.80	907
14	Himachal Pradesh	0.70	1500
15	Maharashtra	0.70	757
16	Rajasthan	0.65	884
17	Jharkhand	0.60	1095
18	Jammu & Kashmir	0.60	1050
19	Orissa	0.60	799
20	Chhattisgarh	0.60	799
	All India	**1.35**	**1723**

Table 1.1.1 Farm Power Availability and Average Productivity of Food grains in Different States of India

Agricultural Machinery Market

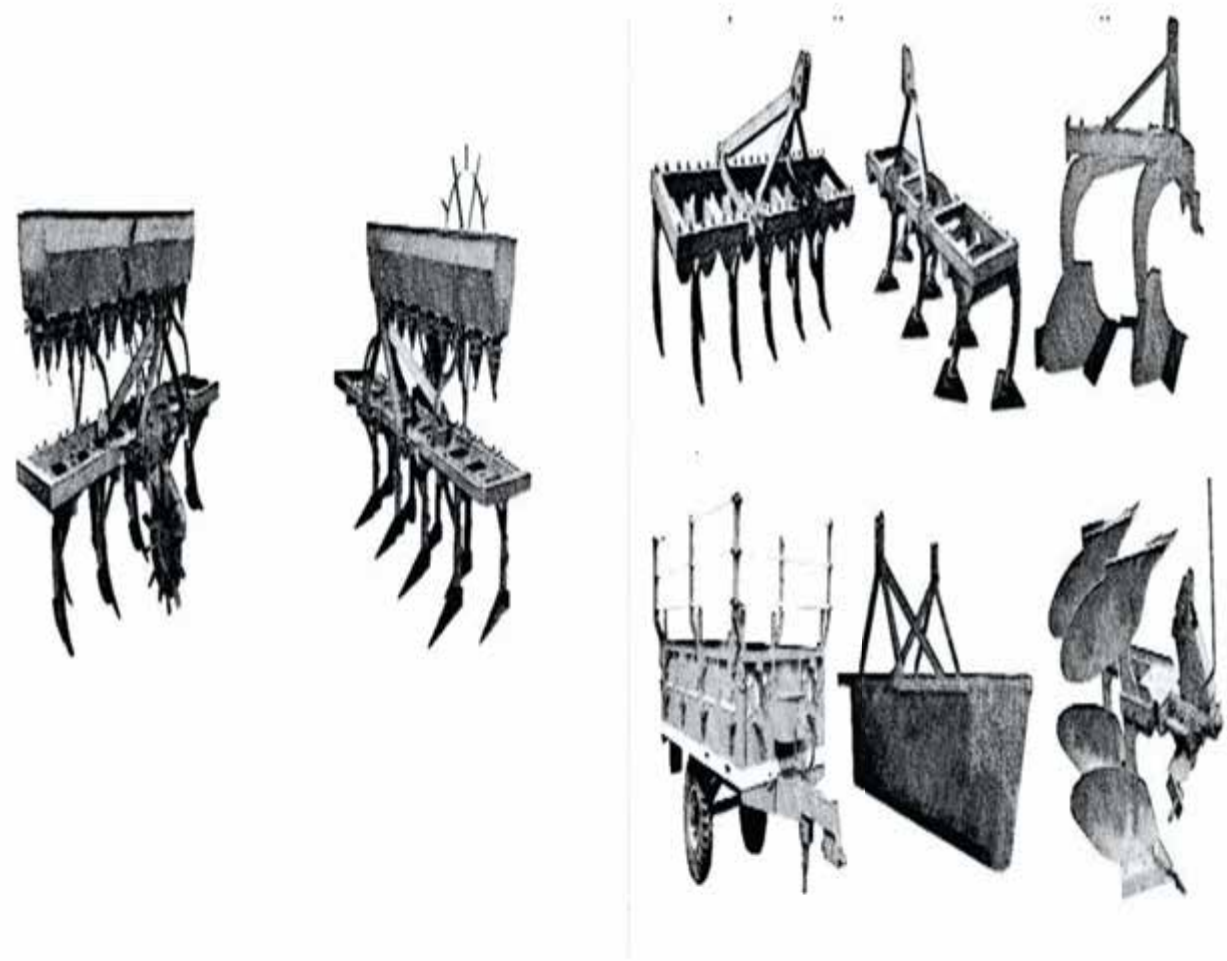


Fig 1.1.1 Agriculture Machinery market

Agricultural machinery market globally at present is equivalent to USD 137 billion and is expected to be USD 200 billion by 2020. In India, agricultural machinery market India today is valued at about USD 8.0 billion and is growing at a CAGR of 10%. The agricultural machinery market is shrinking in European Union as well as North America.

Asia- Pacific represents the largest as well as the fastest growing regional market. The region is projected to register a CAGR of 7.9% in the near future. The market would be driven by greater farm mechanization in highly populous markets of India and China, which hold enormous potential due to the relatively lower levels of mechanization and inefficient farm equipment. Growing incomes and

mechanization of agricultural sectors across developing economies is expected to bestow significant growth and profits for the agricultural implements and machinery industry in the near future. In addition, countries such as Indonesia, Thailand, Brazil and Russia are expected to post robust growth due to increased use of machinery. Further, governments in these countries are increasingly placing greater emphasis on enhancing productivity through automation or mechanizing traditional processes.

Improved Implements and Machines for Farm Mechanization

Improved tools, implements, and machines have always been means for advancing agriculture since prehistoric period. As knowledge about farming, metals, metallurgy, craftsmanship advanced agricultural equipment got refined in India. Incidences of famines and starvations compelled colonial masters to pay attention to agriculture. They imported and tried western animal drawn farm implements like mould board ploughs, harrows, cultivators, seed drills. A few indigenous manufacturers adopted some of those implements. However, these did not become very popular but steadily created awareness about improved agricultural implements and machines, largely as labour saving devices. Traditional *Hal* (wooden wedge plough with its regional variation), *Bakhar, Dufan,* and *Tifan* in vertisol region in Malwa and Gujarat, wooden planker for clod breaking and levelling etc. continued to dominate and are still used by marginal and small farmers. Major developments have occurred in post-independence period more so after on-set of Green Revolution in late 1960s.

State Agricultural Universities and their Faculties of Agricultural Engineering, ICAR Institutes took lead in agricultural mechanization. Establishment of Central Institute of Agricultural Engineering (CIAE) at Bhopal, M.P. was a major step with a view to carry out organized R&D in the areas of agricultural mechanization and allied issues. ICAR launched a number of All Indian Coordinated Schemes - Farm Implements and Machines; Energy Requirement in Intensive Agriculture; Power tillers; Optimization of Ground Water Use through Wells and Pumps; Agricultural Drainage; Utilization of Animal Energy with Enhanced System Efficiency; Renewable Energy Sources; Human Engineering and Safety; and Harvest and Post-Harvest Technology which contributed a great deal in adoption, development, commercialization and pilot introduction of improved implements and machines. Field worthy designs were multiplied through prototype multiplication workshops for test marketing and pilot introduction. Eventually linkages were developed with State Departments of Agriculture and Directorates of Agricultural Engineering, manufacturers, furthering the cause of mechanization. Department of Agriculture and Cooperation (DAC), Govt. of India promoted agricultural mechanization. To protect farmers' interest it established Tractor Testing and Training Stations. However, there is a long waiting (3-10 years) in testing of tractors, self propelled machines, combines etc. DAC also launched promotional schemes providing subsidy to the farmers, bank-loans for the tractor and other machinery. It also established Central Farm Machinery Review and Release Committee. Promotional efforts towards agricultural mechanization are still on. Every year there is interaction meet between DAC and ICAR where agricultural mechanization and on-farm processing and value addition related equipment, practices, and required promotional measures are discussed, progress monitored and future action

plans are formulated. Progressive State Governments also take similar measures. The expectations from agricultural mechanization are as follows.

- Sustainable increase in productivity and cropping intensity
- Conservation of inputs through precision in metering and placement
- Enhancement in income of agricultural workers
- Benefits to all categories of farmers
- Creation of worker-friendly environment
- Reduced cost of production leading to greater profitability

Traditional and improved implements and machines available for different unit operations of agriculture

Unit Operation	Traditional	Improved
Seedbed preparation	· Desi Hal & variants (AD) · Moulboard Ploughs (AD) · Spike Tooth Harrow · Spring Tooth Harrow (AD) · Singh Patela (AD) · Bakhar (AD) · Dufan an Tifan (AD) · Wooden Planker (AD) · Mallet, Flail (M) · Scoop/Buck-scraper (AD) · Bund Former (AD) · Floats (AD) · Spade, Pick Axe, Crowbar	· Single Action/Reversible MB Ploughs · Disc Ploughs (TM) · Sub-Soiler (TM) · Tandem/Offset Disc Harrow (TD/TM) · Rigid/Spring Tyne Tillers (TM) · Tiller with Crushing Roller (TM) · Puddlers (AD &TM) · Scraper/Leveller (TM) · Laser Land Leveller (TM) · Raised Bed Former, Ridger, Furrower (TM) · Post Hole Digger/Auger (TM)
Seeding & Planting:		
Rice	· Broadcasting, Lehi, Bayasi · Manual transplanting · Zero-Till Drill (TM)	· 8-row Mechanical Rice Transplanter (SP) · Pre-germinated Paddy Seeder
Wheat	· Broadcasting · Desi Hal with Seeding Funnel · Dufan and Tifan	· Raised Bed Seeder (TM) · Seed/Seed-cum-Fertilizer Drill (TM) · Zero-Till Drill (TM) · Strip-Till Drill/Roto-Till Drill (TM)
Maize, Cotton	· Manual Seedling/Dibbling · Desi Hal with Seeding Funnel	· Seed-cum Fertilizer Drill (TM/AD) · Seed-cum-Fert Planter (TM/AD)
Vegetable	· Dibbler	· Planter (M, TM) · Garlic planter (M, TM) · Veg. Transplanter (TM)

Potato Sugarcane	· Manual on flat bed or furrow · Karaha to cover (M) · Manual	· Automatic Potato Planter · Semi-automatic Potato Planter (TM) · Set-Cutter Planter (TM) · Stubble Shaver (TM)
Weeding & Interculture	· Physical · Manual with Khurpi/ Khurpa · Dora (AD) · Datari (AD) · Ridger (AD) for earthing	· Wheel-hoes (M) · Cultivator with Full & Half Sweeps (TM) · Rotary Power Weeder · Power Tiller for Alley Management · Ridger (TM) for earthing
Plant-Protection	· Hand Compression Sprayer · Rocking/Pedal Operated Sprayer · Hand Rotary Duster	· Knap Sack Sprayer with long boom (M) · Knap Sack Power Sprayer (M) · Tractor/PT operated Sprayers (TM, PT) · Aero-Blast Sprayers (TM)
Irrigation	· Swing Basket (M) · Dhekuli (M) · Mhote/Charas (AD) · Rahat/Vasher Rahat (M) · Flooding, Basin, Furrow Irrigation · Ponds, streams, reservoirs · Dugwells, Baulis	· Centrifugal Pumps · Submersible Turbine Pumps · Axial Flow Pumps · Ponds, Reservoirs · Dugwells · Tubewells · Streams · Flooding, Basin, Furrow irrigation · Drip-surface, sub-surface · Sprinkler, Micro-sprinklers
Harvesting & Threshing	· Sickle-plain/serrated (M) · Fruit Plucker (M) · Sythe, Dao, Gandas (M) · Animal Treading, Beating with flail · Olpad Thresher (AD) · Winnowing Fan (M, P)	· Vertical conveyor Reaper (Walking) · Vertical Conveyor Reaper (SP) · Vertical Conveyor Reaper (TM, PT) · Power Thresher (R, W, Sorghum etc) · Power Multi-crop Thresher · Maize Dehusker · Maize Dehusker-Sheller · Potato Digger/Digger-Shaker · Grain Combine · Straw Combine · Sugarcane Harvester

Cleaning and Grading	· Supa, cleaning basket · Chhalna, Screen · Hand picking · Winnowing/Winnower · Pedal Operated Screen Cleaner · Fruit Graders	· Power Operated Pre-cleaner (P) · Air Screen Cleaner (M) · Vibratory Separator/ Gravity Separator (P) · Oscillating Multi-screen Cleaner/ Grader (P) · Spiral Separator (M) · Disc Separator (P) · Fruit & Vegetable Washer (P) · Fruit & Vegetable Packaging Line (P), etc.
Drying	· Drying in Standing Crop · Sun Drying · Shade Drying	· Solar Dryers · Heated Sand Dryers · Heated Air Batch/ Circulatory Dryers (Oil, crop residue fired) · Heated Air Tray Dryers · Vacuum Dryer, etc.

AD = animal drawn, TD = tractor drawn, TM =tractor mounted, PT = power tiller operated, M = manual, P = power-engine or motor, R = rice, W = wheat.

Table 1.1.1 Traditional and improved implements and machines available for different unit operations of agriculture

Recently Developed Equipment for Production and Post-harvest Sector

Several useful machines, processes and products have been developed in the field of mechanisation and post-harvest engineering in the recent past, such as Coconut tree climber, straw reaper with trailer overhead, plastics mulch laying machine, pneumatic planters, intra-canopy sprayer, aloevera gel extractor, pomegranate aril extractor, banana comb cutter, dynapod (pedal operated system to convert human energy into mechanical energy), mechanical pot filling machine, fruit graders, mechanization of nursery operations are some of the important developments which have also been commercialized.

Profitability of Mechanized Agriculture

A number of tools/equipment has been developed to mechanize the different agricultural operations. A few examples are given below to illustrate the benefits that accrue on account of their use.

Manually operated low land rice seeder

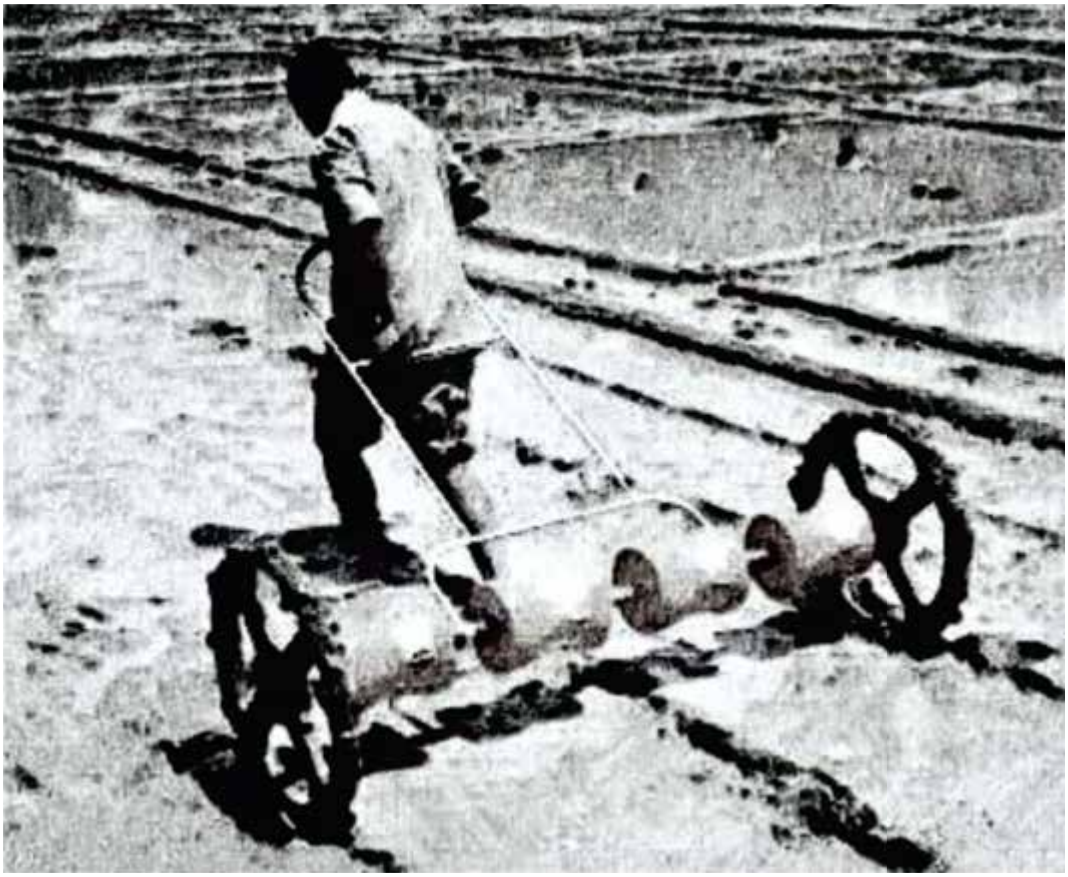


Fig 1.1.1 Manually operated low land rice seeder

During peak transplanting season, labour availability is scarce resulting in delayed transplanting with aged seedlings, which in turn affects productivity. To overcome this problem, farmers in many regions have been practising broadcasting for sowing rice. In order to mechanize this operation pre-germinated low land rice seeders have been developed. The device is designed for sowing pre-germinated rice in puddled field. The field capacity varies from 0.1 to 0.14 ha/h with labour requirement of 15-20 man-h/ha. The cost of operation of the machine is Rs 135/ha and additional income/benefit over conventional system with one machine in one year is Rs. 17,600/-

Animal drawn Tool Carrier

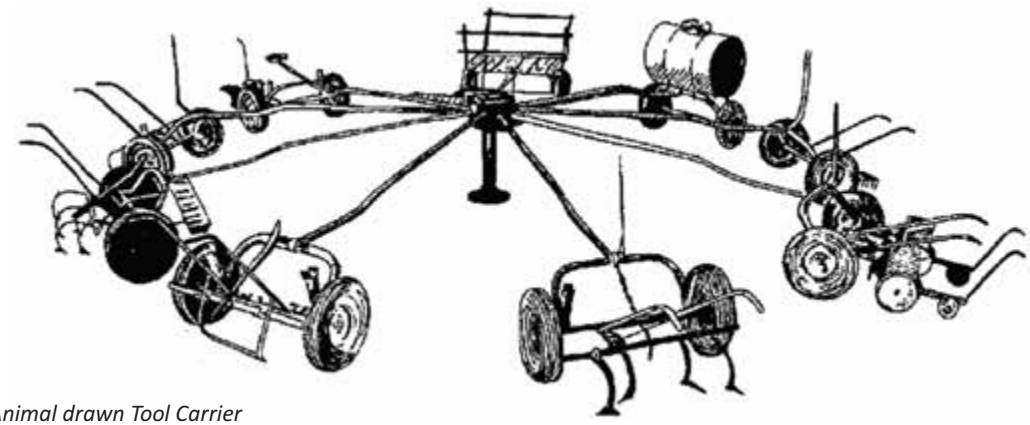


Fig 1.1.1 Animal drawn Tool Carrier

The animal drawn tool carrier with attachment of tools for tillage, seeding and weeding developed at CIAE Bhopal and MPUA&T Udaipur has been found to be advantageous in terms of 100% increased command area per season at 60% reduced cost of cultivation compared traditional implements. The animal drawn tool carrier is useful for faster cultivation operations in dry land/rainfed farming. Benefit from adoption of animal drawn tool carrier has been estimated to be Rs. 21,000 per year.

Pneumatic wheels bullock cart

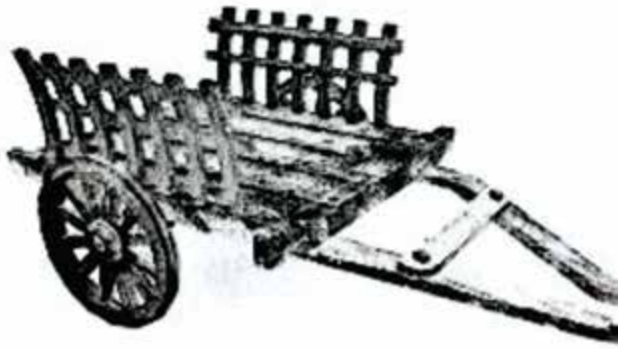


Fig 1.1.1 Pneumatic wheels bullock cart

Improved pneumatic wheel bullock cart developed at CIAE, Bhopal is suitable for carrying higher load (2 t) on tar/Kachha road compared to the carrying capacity of 1 t with traditional wooden wheel carts. The improved cart has been designed with standard components for longer life (10 years) compared to the traditional carts (Life = 3-5 years) Benefit from adoption of pneumatic wheels bullock cart is estimated to be Rs. 12,750 per year.

Tractor Operated Rotary Tiller (also called Rotavator)

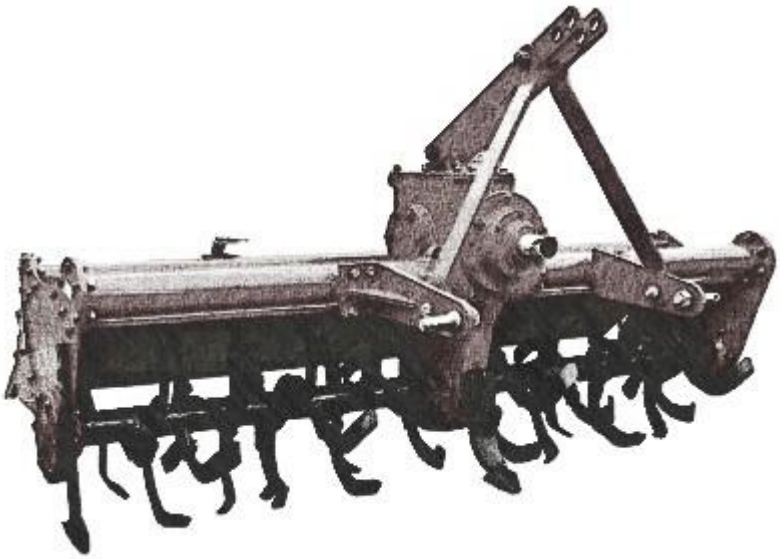


Fig 1.1.1 Rotavator

It is suitable for preparing seedbed in a single operation both in dry and wetland conditions. It is also suitable for incorporating straw and green manuring. Pulverizing of soil is more uniform and better because impact of revolving blades of rotavator sheared the soil and made the soil fine. It gives highly

satisfactory performances while using it under combine harvested wheat and paddy fields as compared to conventional tillage equipment and saves about 40-60% of time. There is a saving of Rs. 1000-1500/ha in cost of operation. Additional income/benefit over conventional system with one machine in one year is Rs. 1.0 lakh

Tractor operated zero-till seed-cum-fertilizer drill

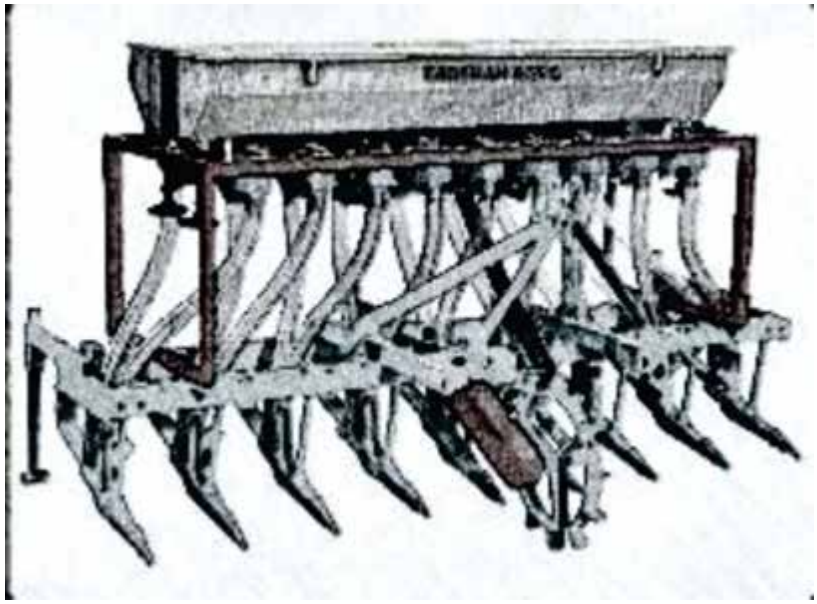


Fig 1.1.1 Tractor operated zero-till seed-cum-fertilizer drill

The zero-till seed-fertilizer drill permits sowing wheat directly in rice harvested fields without preparing the seedbed. The field capacity of the machine is 0.3 ha/h. The machine saves Rs 2000-2500/ha. The use of machine resultes in 5-6% increase in yield due to faster emergence. The country is saving about Rs. 1000 crore annually due to the large scale use of this machine

Self-propelled walking type vertical conveyor reaper

Self-propelled vertical conveyor reaper is mounted in the front of a power source and is used for harvesting cereal crops like wheat and paddy. It cuts the crop, conveys it vertically to one side and drops in a windrow for easy collection. The field

Fig 1.1.1 Self-propelled walking type vertical conveyor reaper

capacity of the machine is 0.15 - 0.17 ha /h. There is a saving of 90 –95% in labour, time and cost of operation as compared to conventional method of manual harvesting with sickle. The cost of operation is Rs. 650/ha. Additional income/benefit over conventional system with one machine in one year is about Rs 54,000.

High capacity multi-crop thresher

The thresher saves 80% labour as compared to conventional practice of animal treading. The performance of the thresher is good since capacity (8 – 12 q/h) is much higher than that of conventional threshers and also the threshing as well as grain losses are very low. The cost of operation of this machine is Rs. 450/- per hour. Additional income/benefit over conventional system with one machine in one year is about Rs. 70,000

Fig 1.1.1 High capacity multi-crop thresher

Tractor operated straw combine

Straw combine is used to recover wheat straw after combine operation and is operated by a tractor. Straw collected by straw combine is cut into pieces and collected in the trolley. Also some grains are collected along with straw. The capacity of machine on an average is 0.4 ha/h and straw recovery is about 55-60%. The cost of operation is Rs. 1200/ha. The quality of bhusa is comparable with mechanical thresher. There is an additional grain recovery of 50-100 kg/ha. The cost of grain recovered is almost equal to the amount paid for hiring the machine. Additional income/benefit with one machine in one year is about Rs 2.30 lakh

Global Trends in Farm Machinery & Power

There is rising trend towards farm mechanization world over. Developed nations have succeeded mechanizing most of the unit operations of agriculture. They are using single run machine that can prepare seedbed, apply seed and fertilizers, pesticides in a single pass. Such machines are of very high

horsepower – 100 to 500hp range on pneumatic wheels for greater floatation. Rising wages have forced them to develop radio controlled machines for automatic dispensing of feed and fodder to the livestock. Cows are milked in hygienic conditions using automated milking and milk handling system. Robotics is in use in agriculture. There is a shift towards precision farming particularly on large farms where GPSs are being utilized and variable rate applicators are being used based on sensors that monitor levels of nutrients and soil moisture and actuate the applicator for delivery. However, many developing economies still rely on animate power sources using appropriate tools and implements. Energy intensive unit operations are increasingly being mechanized. Countries like China, Japan and Korea that favoured walking/riding type power tillers and matching equipments are moving towards 4-wheel small hp tractors and matching equipment and self propelled machinery. Where 4-wheel tractors were in greater use, trend is towards higher horsepower tractors and matching implements. Quality of farm implements and machines are being improved, designs are being standardized and critical components in conformity with ISO standards. Jobs that used to be done by hand are now being executed with power operated equipment or power operated manually guided equipment. High quality, durable tools and equipment have come in the market but are expensive.. Some Indian firms have taken advantage of some of these design and started indigenous manufacture.

Conservation agriculture is in vogue, farming under mulched condition, raised bed farming maintaining aerobic conditions, laser land leveller, protective farming under plastic mulch and in poly houses, low tunnels are in use. These practices have been introduced in India and required machines are progressively being manufactured indigenously. These need promotional ef forts. Extension workers and farmers need to be trained for wider adaptation.

Mechanized nursery raising, transplanting, vegetable and fruit harvesters are in use employing colour sensors. Fruit and vegetable handling in vogue avoids mechanical injury, har vest is washed, graded, dried, waxed and packed on packaging lines. Farm power availability is high but specific energy consumption per unit area and produce is low because of very high productivity which makes them more competitive. Fruits and vegetables are handled through cold chain, cold stored, or stored in controlled atmosphere storage.

Foodgrains are combine harvested and stored in RCC silos and steel bins. Resultant combining losses are low. Maize is harvested by corn pickers or combine harvested. F odder crops are harvested and chopped, loaded in trolleys for feeding and ensilaging. Cotton pickers and strippers are widely used. Sugarcane harvesters are there that harvest row sown cane, strip and cut into billets and load in trailers or trucks for delivery to the sugar mills.

Pesticide application is advanced, mostly power sprayed. Aerial spraying is practiced on large farms. Electrostatic pesticide formulations are there that efficiently deposit pesticides on targeted sites with least environment pollution. Imaging technology is employed for targeted application of pesticides.

Concluding Remarks

The farm mechanization status of the country has been presented. Farm mechanization leads to improved productivity, input savings (seeds and fertilizers by 15 -20 %), increased cropping intensity (5-20%), increased operational efficiencies, timeliness of farm operations, reduction in drudgery and post harvest losses and enhanced social respectability. The level of farm mechanization is increasing in India and the market of agricultural machinery is growing at CAGR of about 10%.

The discussions above suggest that the present farm mechanization level of the country is still very low and fragmented as compared to the level commensurate with its needs. Fragmented land holdings and low productivity lead to low paying capacity of farmers. The mechanization model for India needs to be different than the western model where each farmer has adequate land holding and owns farm machinery independently. Custom hiring services with credit support need to be strengthened. The service providers should be encouraged rather than individual farmers to own farm implements. Wherever feasible for individuals, strengthen the utilization of smaller implements with better input use efficiency. Large scale vocational training of rural youths is required to be organized backed with institutional credit to improve the facilities of custom hiring centres and machinery maintenance. The mechanization policy must be linked to off-farm activities such as rural godown, agro-processing centre, agri-clinics, input supply system to ensure the availability of sustained employment for the farm workers obviating their compulsory displacement.

Notes

UNIT 1.2: History of Tractors

Unit Objectives

At the end of this unit, you will be able to:

- Understand the history of Tractor and farm mechanization

1.2.1 History of Tractors

Agriculture evolved after the mankind settled down in groups and villages. Human labour was the source of power and stones/wood were used as tools for tilling and sowing operations. Subsequent developments saw the use of animals as power source and metallic tools to facilitate farm operations. Population growth and the need to grow more and better food led the search for more powerful prime-movers on farm.

Tractors have remained as the main mechanical power source for all types of farm operations for more than a century. The word tractor is derived from the Latin word *trahere* which means 'to pull' and its first recorded use was reported in the year 1901. Earlier, such machines used for pulling purpose were known as 'traction engines'. A tractor is a vehicle capable of delivering a sufficiently high tractive effort (or torque) at a given speed, being able to increase the tractive effort by reducing the speed, to carry out a field operation. Thus, a tractor is a multipurpose vehicle for farm operations to provide traction and/or power.

Development of Steam Powered Tractors

Initially, steam-driven tractors came into existence and this phase lasted a few decades. Steam was soon replaced by gasoline (petrol) as the fuel. At present, most tractors run on diesel. Future tractors may switch over to one or a combination of renewable energy sources.

Although the first patent for a steam engine was filed way back in 1606, the first commercial steam engine came into market in 1712 for pumping. James Watt was an English man who patented in 1781 a steam engine for continuous rotary motion which became the agent of industrial revolution in the world. A steam engine on wheels was developed in 1812, called a barn engine, for threshing purposes. It was not until 1850s that John Fowler developed a vehicle based on steam engine for plouging and digging drainage channels. The first self-propelled traction engine was developed in 1859 by Thomas Aveling, a British engineer.

Fig 1.2.1 - Steam-powered traction engine

Steam-powered traction engine (Harrison Machine Works, 1882)

These steam powered engines and tractors remained in use well into 20th century till internal combustion engines came into existence. Steam engine based tractors were heavy and required a lot of power for moving them. The most popular steam tractor was the Garrett 4CD.

Development of Petrol Tractors

John Froelich is credited to have invented and built the first petrol operated tractor in Iowa, USA in the year 1892. The tractor consisted of a single -cylinder petrol engine mounted on a chassis along with a gear box. This effort, however, was not very successful. Effort s for developing petro-fuel based tractors were also going on in Britain. A 20 hp oil traction engine was made in 1896 and was recognized by the Royal Agricultural Society of England in 1897.

Dan Albone with his 1902 prototype Ivel Agricultural Motor, the first successful gasoline-powered tractor.

A light weight petrol powered general purpose tractor was built in 1901by Dan Albone. Charles W. Hart and Charles H Parr in Iowa, USA built the first successful two-cylinder petrol engine based tractor in 1903. Hart and Parr are credited to have coined the word tractor as a combination of the words 'traction' and 'power'. The weight of this historical tractor was about 6500 kg. and produced 18 hp at drawbar.

An early Fordson discing a field in 1925.

It was soon realized that the weight of the tractor would need to be reduced for more efficient operations. Henry Ford built a light weight design and introduced Fordson model of tractor in 1917. The tractor revolution finally occurred in 1920s with petrol IC engine.

Tractor Cassani model 40HP, at the Museo nazionale della scienza e della tecnologia Leonardo da Vinci of Milan.

Almost around the same time, Harry Fergusan in Britain developed the three point hitch and filed for a patent in 1926. Model A Fergusan-Brown tractor was launched in Britain. The two tractor pioneers, Ford and Ferguson collaborated in 1938 to produce Ford-Ferguson 9N tractor which included three-point hitch as well as rear Power Take Off (PTO).

Fuels

As apparent from the foregoing discussion, tractors first used steam as the fuel and later switched over to petrol. Petrol continued to be the predominant tractor fuel till 1960. Kerosene and ethanol were also tried as alternatives with a small auxiliary tank for petrol to help in case of cold starting situations. Diesel became the choicest fuel in the 1960s for all sizes of tractors. LPG, Biodiesel, propane and greener fuels are now been seriously being considered for powering tractors on environmental sustainability considerations. Electric tractors are also on the horizon.

Classification of Tractors

There are different ways to classify tractors such as number of axles, number of wheels, utility, etc. There are two wheel (single axle) tractors and four wheel (two axle) tractors. Among the four wheel tractors, there are two wheel drive (real wheels usually) and four wheel drive models. There are track tractors with steel or rubber tracks.

Traditionally, a typical farm tractor has two very large real wheals, a single seat, and a steering wheel in front of the driver seat. There are two wheel in front and below the engine compartment. This arrangement continues to be retained. There are now added features for driver safety and comfort such as enclosed air conditioned cabs, roll over protection (ROP), and control panel.

Fig 1.2.1 Volvo T25, 1956, gasoline tractor

Fig 1.2.1 A modern 4-wheel drive farm tractor

A modern 4-wheel drive farmtractor

Now, there is a trend for higher hp tractors capable of carrying out multiple farm operations in a single pass to save on time and other resources. In a recent development, the wheels and steel type tracks are being replaced with flexible, steel reinforced rubber tracks, powered by hydrostatic or completely hydraulic drive mechanism.

Fig 1.2.1 A modern steerable all-tracked power unit planning wheat

A modern steerable all-tracked power unit planting wheat

Transmission

Manual transmission with several gear ratios was the method of regulating tractor speed on the older tractors. The gear ratios coupled with varying throttle settings permitted speeds from less than 1.0 kmph to about 40 kmph; lower speeds for soil working and higher speeds on road. Lower speeds permit higher availability of torque and drawbar power. Some modern tractors permit speeds upto 80 kmph.

Fig 1.2.1 An older model European farm tractor, of the type still common in Eastern Europe

Older tractors had unsynchronized transmission systems which required the tractor driver to stop the tractor to change gears. To avoid stopping the tractors, cltches came into existence. Recent tractor models incorporate synchronized gear systems or continuously variable transmission (CVT)

Fig 1.2.1 Cutaway of modern tractor

Hitches and power applications

A tractor is a prime mover and appropriate implements/ machines need to be attached with the tractor to carry out the farm operations. For these reasons, the hitching systems such as three-point linkage, drawbar or PTO have been developed.

Drawbars

The ploughs and other tillage implements were attached to the rear of a tractor through a drawbar. A drawbar is simply a steel bar attached to a tractor to which the implements are attached with the help of a pin or a loop or a clevis. A swinging drawbar permitted an offset from centre to let the tractor run outside the path of the implement. Trailing type implements are operated using drawbars. However, in order to exercise greater degree of control including depth control, during farm operations, three-point link system was developed.

Fig 1.2.1 Cutaway of modern tractor

A large, modern John Deere model 9400 four-wheel drive tractor with tripled wheels and a drawbar-towed tool chain, including one-pass tillage equipment, planter and fertilizer applicator with tanks

Fixed Links

Some equipment were directly mounted on tractors such as front end loaders, row crop cultivators, corn pickers and corn planters. Being proprietary and unique for a tractor, it was not possible to use an equipment of another make. Mounting and dismounting required a considerable idle time. As a resul t, a tractor and the mounted equipment continued for one whole season. This constraint prompted Harry Ferguson to developm the three point hitch. An equipment attached to tractor through the three-point linkage can be lowered or raised hydraulically with a control lever. A single person can attach or detach the equipment easily with the three point hitch.

Three-point hitches and quick hitches

At about the same time when Ferguson developed the three-point hitch, International Harvestor developed a two-point hitch and John Deere developed the power lift. However, the three-point hitch on tractors has become the universal mechanism for mounted type implements. Now, compact tractors also fitted with quick-connect attachments for front end loaders.

Fig 1.2.1 Cutaway of modern tractor

A modern three-point hitch

Power take-off systems and hydraulics

Tractors are also required to transfer power to an attached machine such as a baler or mower. Earlier, tractors had belts wrapped around the flywheel to power stationary equipment such as threshers, silage blower or stationary baler. Today, tractors use PTO shaft to provide rotary power to machinery that may be stationary or pulled.

Fig 1.2.1 A PTO shaft connected to a tractor

The PTO shaft generally is at the rear of the tractor, and can be connected to an implement that is either towed by a drawbar or a three-point hitch. This eliminates the need for a separate, implement-mounted power source, which is almost never seen in modern farm equipment. Today, tractors are also capable of supplying hydraulic control and electrical power to the attached equipment.

.

A farm tractor is also known by the application for which it is used. A row crop tractor has adjustable tread for adjusting to different row spacings. High crop tractors have adjustable tread and ground clearance for high growing row crops. Utility tractors are small tractors with a low centre of gravity and short turning radius for gerneral purpose use around the farm. Lawn tractors are designed for suburban and semirural gardening and landscaping.

History of Tractors in India

At the time of independence in 1947, agricultural mechanization in India was low. Some war-surplus tractors were imported in mid 1940s essentially for land reclamation. Up to 1960, the demand for tractors in India was met through imports by the Central and State tractor organizations. Only 8500 tractors were in use in India by 1951; the figure rose to 20,000 by 1955 and 37,000 by 1960.Five companies, i.e., Eicher, Gujarat Tractors, TAFE, Escorts and M&M began their tractor manufacturing in 1961 with annual production of 880 tractors. By 1965, the annual production increased to 5000 units and the tractor population increased to 52,000. By 1970, the number of tractors in India increased to 146,000 and the annual production increased to 20,000 units. The tractor production increased to 33,000 units in 1975-76. Newer tractor manufacturers joined to meet the growing demand and production increased to 75,000 units by 1985. The tractor population in 1990 was 1.2 million and India began exporting the tractors, mainly to Africa .By 1997, the production rose to 255,000 tractors

annually. In 2006, after the implementation of Mahatma Gandhi National Rural employment Guaranty Act (MNREGA), farm labor shortage caused sharp growth in agricultural mechanization and sales of tractors. In 2013, India produced 619,000 tractors constituting 29% of the global output. There are 16 domestic and four multinational tractor manufacturers in India now. Volume growth in the past 4 decades shows a CAGR of 7.5%, despite seasonal vagaries, plummeting and boosting, tractor demand and consequentially the Industry volumes.

Fig 1.2.1 Mahindra tractor has the largest share of Indian tractor market.

Tractors are getting widespread acceptance in India. Kotaks and ICRA reports estimate that nearly 4.3 million tractors were in operation, and 1 in 20 rural households owned a tractor in 2011. They project that the market will grow at 7% to 8% per year, and only 19% of Indian rural farming households that can afford a tractor have as yet purchased a unit. Designs that allow multifunctional use, adapted to local needs and rural constraints, are experiencing higher demands. Five companies account for over 80% of the market share - Mahindra and Mahindra (largest at 40% share), TAFE, Escorts, ITL-Sonalika, and John Deere.

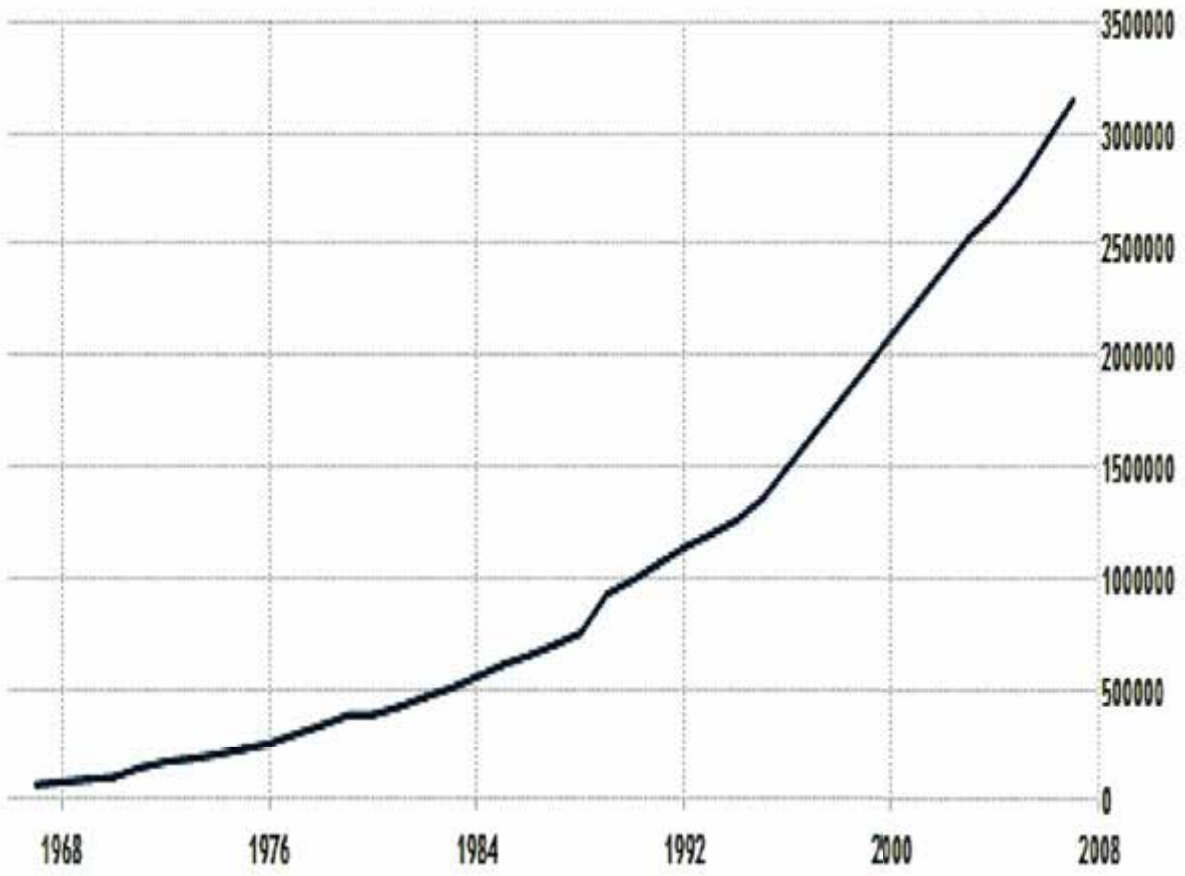


Fig 1.2.1 Tractor Market Trend

Engineering tractors are employed for non agricultural purposes such as construction, maintenance, shop floors of manufacturing industries. A compact utility (CUT) is a smaller farm tractor primarily for landscaping and estate management

Two wheel tractors or walk behind tractors or power tillers have been more affordable and could be useful a whole range of farm operations. These two wheel tractors are more popular in India, China, Thailand, Bangladesh and other Southeast Asian countries.

Orchard tractor is designed to carry out operations in an orchard. Pushback tractors are used on airports for moving aircrafts on the ground.

Notes

UNIT 1.3: Tractor market in India and abroad

Unit Objectives

At the end of this unit, you will be able to:

- Understand the Tractor market in India and abroad

1.3.1 Tractor market in India and abroad

India accounts for 2.4 percent of the world's total area and 4.3 percent of its water resources. India is home to about 17 percent of world's human population and 15 percent of the livestock. The country has seen a steady growth in the population, averaging an annual growth of 1.3 percent between 2011 and 2014, reaching 1.39 billion in 2016. Feeding India with the constrained natural resources has been a daunting task. It is, however, a story of development worth inking in gold. Agriculture in India at the time of independence was miserable in spite of the fact that natural resources were unpolluted and farmers were hard working. Since then and till a decade ago, more emphasis was placed on seed, fertilizers, water, and pesticides to increase production and productivities. Introduction of engineering inputs to Indian agriculture got delayed leading to second generation problems of sick soils, over-exploitation of ground water, pollution, post harvest losses, agro-wate disposal, and others.

India did not produce any tractor before 1960. After World War II, some second hand tractors began to be imported through Central and State Tractor Organizations essentially for land reclamation purposes. As indicated earlier, the total number of tractors in India in 1961 was merely 8500. Today, the tractor population in India is about five million; as many as the USA.

It is not that India did not need tractors earlier. But non-availability of technology, resources, skills, and policy prevented introduction of farm mechanization in India until mid-seventies. Although the first agricultural engineering education programme began in early forties the real expansion occurred in mid sixties. Indian Council of Agricultural Research (ICAR) initiated the All India Coordinated Research Programme (AICRP) on Farm Implements and Machinery to provide the necessary R&D support for a sustainable mechanization promotion in the country. Tractor manufacturing and testing infrastructure received considerable boost in the eighties and nineties.

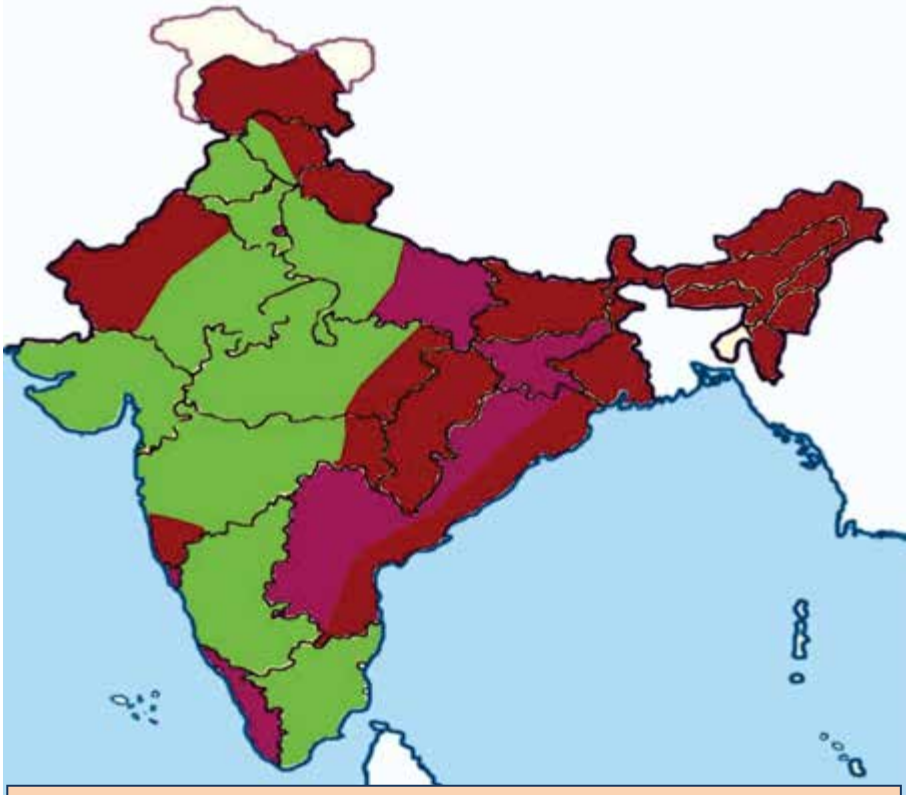
Resource poor farmers were unable to acquire farm implements and machinery. Moreover, individual land holdings were not large enough to permit adequate utilization of the individually owned farm machinery. There was generally a belief that if farm machinery could be made affordable to an average farmer, agricultural mechanization could pick up. Neither the machinery cost could be reduced beyond a certain level, nor farmers could individually afford the tractors and a set of implements until 2006 when MGNREGA came into existence. Availability of cheap labour competed against the mechanization.

It was in 2005 that the Government of India decided to ensure 100 days of assured employment to each willing rural household in a year. While the prime reason for MGNREGA was to create purchasing capacity among those at the bottom of the economic pyramid, it influenced Indian agriculture very much. All of a sudden, there was labour scarcity in the farm sector and mechanization was the only

Goa and Kerala also indicate high potential for farm mechanization. The information serves the purpose of indicating the yet unexlored opportunities for tractor market in India

solution to tide over the labour shortage. The growth of farm mechanization in India got accelerated after the promulgation of MGNREGA. Considering the urgency of expanding the penetration of farm mechanization in India, Government of launch a Sub-Mission on Agricultural Mechanization (SMAM) in 12th five year plan with an outlay of Rs. 2000 crore.

The following map of India vividly shows the farm mechanization spread. The eastern and north eastern regions show minimal or no presence of farm mechanization. Rajasthan, J&K, part of Himachal Pradesh,



The colours given in the map are Green, Pink and Red. Green colour indicates availability of manufacturers in LARGE numbers. Pink colour indicates availability of manufacturers in MEDIUM numbers. Red colour indicates little availability of manufacturers

Fig 1.3.1 farm mechanization spread in India

It is, therefore no surprise that tractor market in India is growing at almost double digit rate. Increasing awareness, financial incentives from Governments, credit from financial institutions, aggressive marketing by manufacturers, and skill development programmes are propelling agricultural mechanization and, hence, tractor sales in India

Country	Production	Sale
Brazil	64,794	55,623
USA	1,57,870	2,07,833
Italy[3]	N/A	18,176
Germany	51,349	34,611
France	24,000	33,127
Turkey > 30 hp	64,342 61,000	59,458 56,500
China > 30 hp	N/A 5,25,000	18,58,000 5,15,000
India[1] > 30 hp	6,12,994 5,51,721	6,26,839 5,65,649
South Korea	49,515	10,548
Japan > 30 hp	1,48,226 N/A	46,157 20,944

Table 1.3.1 Tractor production and sales in selected countries (year 2014)

Crop	Seedbed	Sowing/	Weed and	Harvesting
threshing	preparation	planting/ transplanting	pest control	And threshing
Paddy	85-90	5-10	80-90	70-80
Wheat	90-95	80-90	70-80	80-90
Potato	90-95	80-90	80-90	70-80
Cotton	90-95	50-60	50-60	0
Maize	90-95	80-90	70-80	50-60
Gram	90-95	50-60	60-70	30-40
Sorghum	80-90	30-50	60-70	20-30
Millets	80-90	30-40	60-70	20-30
Oilseeds	80-90	30-40	60-80	20-30
Sunflower	80-90	40-50	80-90	60-70
Fodder crop	80-90	20-40	80-90	10-20
Vegetable crops	70-80	5=10	80-90	< 1
Horticulture crops	60-70	30-40	40-50	< 1

Table 1.3.1 Intercultural operations during crop production

Source: VDMA AGRICULTURAL MACHINERY REPORT 2015

Equipment	Annual Market Size (units	Year of reporting
Tractor	600,000 - 700,000	2014
Thresher	100,000	2014
Rotavator	60,000 - 80,000	2014
Power Tiller	50,000 - 60,000	2014
Zero-Till Drill	25,000 - 30,000	2014
Power Weeder	25,000	2014
Combine Harvester	4000 - 5000	2014
Self-Propelled Vertical Conveyor Reaper	4000 - 5000	2014
Laser Land Leveller	3000 - 4000	2014
Rice Transplanter	1500 - 1600	2013
Multi-Crop Planter	1000 - 2000	2014

Table 1.3.1 Farm equipment annual market size

Farm power availability in India is estimated at 2.02 kw/hectare. Mechanisation level in India is about 40 - 45 percent with states such as UP, Haryana and Punjab having very high mechanisation levels but north - eastern states having negligible mechanisation. Overall industry estimated at approximately US$ 6.5billion, tractor is the largest segment with approximately 627,000units sold in FY'15 (including exports).India is the largest tractor market in the world. Other major segments are threshers, rotavators and power tillers.

In India, the level of mechanisation varies greatly by region. States in the north such as Punjab, Haryana and Uttar Pradesh have high level of mechanisation due to the highly productive land in the region as

well as a declining labour force. The state governments in these states have also provided timely support in promoting mechanisation of farms. The western and southern states in the country have a lower level of mechanisation due to the smaller land holdings prevalent in these regions as well as the land holding being more scattered. As a result, in many cases, mechanisation has been uneconomical leading to the lower development.

In north-eastern states, the level of mechanisation is extremely low. There are a number of reasons behind this. Factors such as hilly topography, high transportation cost, lack of state financing and other financial constraints due

to socio-economic conditions and dearth of agricultural machinery anufacturing industries have hindered the growth of farm equipment sector within these states. Operation-wise, the level of mechanisation varies from

42 percent for soil working and seed bed preparation, 29 percent for seeding and planting, 34 percent for plant protection and 37 percent for irrigation.

Tractor is, by far, the largest segment in the equipment category with an annual sale of 600,000-700,000 units. FY'14witnessed sales of 697,675 (including exports) tractor units. Despite a sales slowdown in FY'15 (to 626,839 including exports), the tractor market (including exports) is expected to grow at a CAGR of 8-9 percent7 in the next five years as longterm industry drivers remain favourable. Within the tractor market, the 41-50 HP segment is the largest selling unit, registering about 44 percent of the total tractor sales (domestic + exports) in FY'15. Next largest segment is the 31-40 HP segment, which has gained 2.2 share points in share of volume, which has been sourced mainly from the > 50 HP segment.

Global farm tractor market is projected to reach 4.6 mil units by 2020 valued at USD 71.7 billion. Growth rate in Asia-Pacific region is the highest at 6.4% in value terms and 4.1% in terms of units. Key players globally are AGCO Corp., Argo tractors SpA, Class, CNH Industrial N.V., Deere & Co., Escorts, Mahindra Rise, TAFE, Same Deutz Fahr, International Tractors Ltd, Kubota Corp, Caterpillar.

The volume of production and sales of agricultural machines worldwide was USD 137 billion in 2013 and it is likely to reach USD 200 billion by 2020. European Union holds about 26% share of all agricultural machinery and is declining. NAFTA (USA, Canada & Mexico) accounts for another 22 percent and is also declining. China and India have 15% and 6% shares, respectively. By 2020, the share of Asia would increase to about 60%. Agrican continent is gaining greater importance as a market for agricultural machinery with an annual size of about USD 2.5 billion. India's farm equipment sector is estimated at about USD 6.5 billion with growth at 10% CAGR during 2013-18.

Level of mechanization in China is fast improving and is estimated to be 61% at present from mere 34% a decade ago. The level of mechanization in India is estimated at about 40%.

Country	Level of Mechanization	Agricultural GDP as percent of national GDP
USA	95%	1.6
Western Europe	95%	<5.0
Russia	80%	4.0
Brazil	75%	5.0
India	40%	13.9
China	61%	9.2

Table 1.3.1 Level of Farm Mechanization and Agricultural GDP in selected Countries

Farm Operation	Level of Mechanization
Soil working and seed bed preparation	40%
Seeding and Planting	29%
Plant protection	34%
Irrigation	37%
Harvesting and threshing	60%-70%

Table 1.3.1 Extent of Mechanization of various Farm Operations in India

Country	Crop Productivity
USA	7340
France	7074
Japan	6105
Canada	4170
China	5891

India	2961

Table 1.3.1 Relative Crop Productivity in different Countries

Indian tractor industry grew at 8% CAGR during the past 43 years since 1973. Tractor industry is likely to grow at 10% during FY 17 and 13% during FY 18. India is the largest tractor market globally. The country is now producing 600,000 to 700,000 tractors annually and exporting about 10% of them essentially to ASEAN countries and African continent. The outlook for the industry suggests BRICS (Brazil, Russia, India, China, and South Africa) nations along with Japan and Turkey becoming major agricultural machinery markets.

Today, Indian farmers are preferring higher hp tractors for greater versatility.

Of all the tractors sold in India today, 78% are in 31-50 hp range. The share of <30 hp tractors has shrunk to about 10% and the share of >50 hp tractors is 12%.

A tractor should work for 50 hrs per hectare in a year. Thus, the command area of a tractor would be 20 ha considering that it should be used for 1000 hrs in a year. Considering utilization efficiency to be 75%, the number of tractors required for 190 million ha gross cropped area in India is estimated to be 12.7 million. However, about 30% of the tractors today are finding their use in construction industry. Therefore, the total number of tractors in India could be 16.5 million. The tractor population at present in India is about 5.0 million. Clearly, there is a great potential for tractor absor ption in India.

Factors driving growth of agricultural machinery include increasing demand for agricultural produce due to a rapidly expanding global population, and the advent of sophisticated and technologically advanced machinery.

Growth in the global market for agricultural equipment is dependent on varied factors including economic scenario, weather and demand. Population growth is expected to fuel demand for agriculture produce, which in turn would lead to increase in demand for farm equipment. Rising standard of living and increasing personal disposable incomes are expected to boost the demand for agricultural products and enhance the demand for protein rich foods. Furthermore, increased utilization of agricultural products in petroleum and pharmaceutical industry is also contributing to increased demand for agricultural machinery.

Economies of scale dictate the production of agricultural machinery sizes and models in locations where the highest volume of such machinery is used. While the US and Canada dominate the global market in the production of high horsepower tractors (100hp and above), Europe and a few emerging Latin American nations predominantly manufacture tractors in the medium range (40-100hp). Japan remains

a major supplier of tractors in the below 40 horsepower segment. Manufacturers of high horsepower machines are incorporating the latest advancements in technology to suit the demands of the farmers. High horsepower is required to power the tractors to handle larger farm equipment such as nutrient applicators, air seeders, tillage machinery, and planters. Technological advancements such as engine controllers, high-pressure common rail fuel systems and variable geometry turbochargers contribute to enhanced power of tractors.

Asia- Pacific represents the largest as well as the fastest growing regional market. The region is projected to register a CAGR of 7.9% in the near future. The market would be driven by greater farm mechanization in highly populous markets of India and China, which hold enormous potential due to the relatively lower levels of mechanization and inefficient farm equipment. Growing incomes and mechanization of agricultural sectors across developing economies is expected to bestow significant growth and profits for the agricultural implements and machinery industry in the near future. In addition, countries such as Indonesia, Thailand, Brazil and Russia are expected to post robust growth due to increased use of machinery. Further, governments in these countries are increasingl y placing greater emphasis on enhancing productivity through automation or mechanizing traditional processes.

Farm tractors represent the largest segment in the global agricultural implements and machinery market. Considered as the 'workhorse' of agriculture, tractors are the most versatile of equipment used in farming. Advanced tractor technologies coupled with adoption of GPS have led to development of highly efficient and productive machinery that can perform multiple tasks. Ploughing and cultivation machinery is expected to register the fastest CAGR of 6.6% over the analysis period.

Major players in the marketplace include AGCO Corp., Claas KGaA mbH, CNH Global NV, Deere & Company (John Deere), Escorts Group, Iseki & Co. Ltd., Kubota Corp., Kuhn Group, Kverneland ASA, Mahindra Group, Same Deutz-Fahr Group, and Tractors and Farm Equipment Ltd.

Agriculture Equipment Industry: SWOT analysis

A SWOT analysis to promote mechanisation of Indian Agriculture is presented below.

Strengths

• Large infrastructure of over 20,000 manufacturers in small scale industry; vast network of academic and R&D institutions including AICRPs under NARS for human resource development and R&D.

• Trained manpower for R&D in agricultural engineering.

• Over 100 cooperating centres of AICRPs is the area of agricultural engineering.

• Computer aided design adopted by the institutes for high pace of R&D.

Weaknesses

• Unreliable after sales service of agricultural equipment.

• Poor liaison with industries for R&D and commercialisation.

• Non effective feedback system.

• Absence of non-land economic activities.

• Non-systematic marketing of agricultural equipment

Opportunities

• Development of entrepreneurship for custom hiring of farm machinery and agro-processing equipment.

• Post-harvest loss reduction and value addition at the production catchments through rural level agro-processing centres.

• Establishment of value chain for commercial supply, transport and marketing of agricultural produce.

• Opportunity to increase the irrigated area by introducing micro-irrigation.

• Reducing yield gaps and increasing productivity through precision farming technologies.

Threats

• Migration of farmers from agriculture to other industries.

• Fragmentation and continuous reduction of operational holdings.

• Slow pace of R&D and commercialisation.

• Inadequate infrastructure back up, for after sales support of farming equipment.

• Renewable energy technology is still subsidy dependent.

FICCI. 2015.Transforming Agriculture Through Mechanisation. Agriculture Division, Federation House, Tansen Marg, New Delhi 110001, India

Usage of tractors, and farm mechanisation in the USA suggest that the US took over 40 years to totally shift from horses/mules to tractors for their farm power needs, and 84% of farmers in USA didn't own a tractor in 1920 – this number in India is 94%.

India has one of the lowest agricultural yields in the world currently, and increased mechanisation is one of the key ways to improve yields. As seen from the chart below, average yields in India are 30% lower than the world average. India's yields are also inferior to most of its neighbouring countries.

Agriculture and allied sectors in India contribute approximately 14 percent to GDP and employ 49.6 percent of labour force. With 57 percent of rural population employed in the sector and 60 percent of the households dependent on it, agriculture sector is facing a number of challenges including

- Small farm holdings, which are continuing to decrease in size.
- Low to very low income from farming
- Decreasing farm labour (estimated to drop to approximately 26 percent of labour force by 2050).
- Future water scarcity crisis.

Notes

UNIT 1.4: Knowing An Agricultural Tractor

Unit Objectives

At the end of this unit, you will be able to:

- Understand the Tractor Machine and its implements will be used in the Farm

1.4.1 Knowing An Agricultural Tractor

Tractor is a self-propelled power unit having wheels or tracks for operating agricultural implements and machines including trailers. Tractor engine is used as a prime mover for active tools and stationary farm machinery through power take-off shaft (PTO) or belt pulley.

DIFFERENT TYPES OF TRACTORS

There are three types of tractors on the basis of structural-design:

(i) Wheel tractor: Four wheel tractors are more versatile and popular everywhere.

(ii) Crawler tractor: Aalso called *track type tractor* or *chain type tractor,* such tractors have endless chain or track in place of pneumatic wheels.

(iii) Walking tractor (Power tiller): This is a two wheel power unit which is called as Power tiller or a walking type tractor. The direction of travel and its controls for field operation is performed by the operator, walking behind the tractor.

On the basis of their use, wheeled tractors are classified into three groups:

(a) General purpose tractor: Such a tractor is used for major farm operations such as ploughing, harrowing, sowing, harvesting and transporting work. General purpose tractors have (i) low ground clearance (ii) increased engine power (iii) good adhesion and (iv) wide tyres.

(b) Row crop tractor: Such tractors are provided with replaceable driving wheels of different tread widths. Adjustable ground clearance is one of the features to save damage of crops. Wheel track can also be adjusted to suit inter row distance.

(c) Special purpose tractor: These tractors are used for definite jobs like cotton fields, marshy land, hillsides, garden etc

MAJOR COMPONENTS

The following are the main components:

1. Engine

2. Clutch

3. Transmission gears

4. Differential unit

5. Final drive Rear wheels

6. Front wheels

7. Steering mechanism

8. Hydraulic control and hitch system

9. Brakes

10. Power take -off unit

11. Tractor pulley and

12. Control panel.

Nowadays almost all the tractors are diesel tractors.

Fig 1.4.1 Tractor

CONTROL OR DASH BOARD OF A TRACTOR

The driver has access to the following controls on the dash board.

1. Main switch
2. Throttle lever
3. Decompression lever
4. Hour meter light switch
5. Horn button
6. Battery charging indicator
7. Oil pressure indicator and
8. Water temperature gauge.

TRACTOR TYRES

The tyres are available in many sizes with the ply ratings as 4, 6 or 8. The ply rating of tyres indicates the comparative strength of tyres. The higher the rating, the stronger are the tyres. The tyres

size 12—38 means, that the sectional diameter of tyres is 25 cm (12") and it is mounted on a rim of 96.5 cm (38") diameter. The inflation pressure in the rear wheels of the tractor varies between 0.8 to 1.5 kg/cm^2. The

inflation pressure of the front wheel varies from 1.5to2.5kg/ cm^2. Useful life of the pneumatic tyres

under normal operating condition may be about 6000 working hours for drawbar work.

FRONT AXLE

Front axle is the one on which front wheels are mounted. These wheels are idler wheels

by which tractor is steered in various directions. There are various adjustments of front wheel.

Hitching system of Tractor Drawn Implements

Tractor drawn implements possess higher working capacity, are operated at higher speeds and be one of the following three types.

a) Trailed type implement: This type of implement is pulled and guided from single hitch point but its weight is not supported by the tractor.

b) Semi-mounted type implement: These implements are attached to the tractor along a hinge axis and not at a single hitch point. Such an implement is controlled directly by tractor steering unit and its weight is partly supported by the tractor.

1. Front wheel
2. Fuel tank cap
3. Accelerator pedal
4. Brake pedal
5. Steering wheel
6. Hydraulic control lever
7. Turn signal lamp
8. Lift arm
9. Rear tire
10. Instrument panel
11. Clutch pedal
12. Step
13. Seat
14. Rear axle housing
15. Side clearance
16. Engine hood
17. Fan cover
18. Muffler
19. Fuel tank
20. Throttle lever
21. Main speed change lever
22. Fender

c) Mounted type implement: An implement of mounted type is attached to the tractor, such that it can be controlled directly by the tractor steering unit. The implement is carried fully by the tractor when out of work.

SOME IMPORTANT TERMS CONNECTED WITH TRACTORS

Wheelbase: Wheel base is the horizontal distance between the front and rear wheels of a tractor, measured at the ground contact.

Ground clearance: It is the height of the lowest point of die tractor from the ground surface, the tractor being loaded to its maximum permissible weight.

Track: Track is the distance between the two wheels of the tractor on the same axle, measured at the point of ground contact.

Turning space: It is the diameter of the smallest circle, described by the outermost point of the tractor, while moving at a speed, not exceeding 2 km/hr with the steering wheels in full lock.

Cage wheel: It is a wheel or an attachment to a wheel with spaced cross bars for improving the traction of the tractor in a wet field. It is generally used in paddy fields.

Notes

UNIT 1.5: Tractor Operated Machines and Equipment

Unit Objectives

At the end of this unit, you will be able to:

- Understand the Tractor operated machines and its necessary equipments

1.5.1 Tractor Operated Machines and Equipment

Agricultural operations need to be carried out efficiently to achieve the intended productivity and profitability. These tools and machines are specific to the commodities and operating conditions. Included in this section are a few important machines and equipment that have been developed.

Lug Wheel Puddler

Lug wheel puddler is used for shallow puddling and leveling of rice fields. It consists of a rectangular frame, pegs and three point hitch system. The square pegs are mounted on three bars and uniformly staggered to partial helical configuration for better dispersion of soil. The puddler is operated in criss-cross fashion in 50-100 mm of standing water. As the puddler moves, the pegs tear the soil, uproot the weeds, disperse the soil in water and level the field. The unit weights about 90 kg and requires a 26 kW (35 hp) tractor to operate it. It has a field capacity of about 0.4 ha/h.

Fig 1.5.1 Lug Wheel Puddler

Six-row Inclined Planter

The planter is used for planting of small, medium and bold size seeds including intercrop planting along with fertilizer drilling. The machine consists of a main frame of box section. On the rear tool bar of the frame, shoe type furrow openers with modular units of seed boxed are clamped. Each seed box (capacity 15 kg) is provided with inclined plate type seed metering mechanism. A common fertilizer box with fluted roller metering mechanism is fixed on the main frame. Planting of different crops could be carried out by selecting suitable plate and changing the transmission ration. Row to row spacing can be changed from 225 to 450 mm by sliding the furrow opener on the rear tool bar. The field capacity of the machine varies from 0.45 to 0.60 ha/h. The machine saves about 10-15 % seed. It is also used for simultaneous planting of two or more crops for intercrop planting. The planter needs a 26 kW (35 hp) tractor to operate it.

Fig 1.5.1 Six-row Inclined Planter

Pneumatic Planter

The planter permits precision planting of seeds including cotton and vegetables. It consists of the main frame, modular pneumatic seed metering units, aspirator blower which is operated by pto driven shaft and ground drive wheel and drive system for seed metering discs. It is a six row (2,3 & 4 optional) tractor drawn unit. The machine works on the air suction principle. Air is sucked through a rotating plate having seed pick up holes provided at fixed distance from the centre of the disc. The seed is retained on the hole till it is over the suction chamber and is released as it comes in chamber open to atmosphere. Seed to seed spacing is regulated by speed of the seed disc and distance between the holes on the seed plate. The machine could be operated by a 26 kW (35hp) tractor. The hopper can accommodate 8kg groundnut and 10-15 kg cotton and okra seeds. For wide row crops, number of modular units could be 2, 3 or 4 to achieve the row spacing of 45, 60 and 90-100 cm. Field capacities for planting of okra, cotton and groundnut are respectively, 0.30, 0.40 and 0.40 ha/h

Fig 1.5.1 Pneumatic Planter

Nine row Groundnut Planter

The planter is meant for sowing groundnut and other seeds in rainfed areas to achieve high precision. It consists of a rigid frame on which the seed and fertilizer box is mounted. The seed metering arrangement with inclined plate mechanism is provided to drop the seed at fixed distance followed by the fertilizer through the fertilizer box metered by rubber auger in to the fertilizer tubes. The row spacing is adjusted based on the crop need. Similarly metering plates are different for each crop. It has the furrow openings specially designed to suit the rainfed soils. A 26 kW (35 hp) tractor is required to operate the equipment and has a capacity of 1.0 ha/h.

Fig 1.5.1 Nine row Groundnut Planter

Two-row vegetable transplanter

The equipment is meant for transplanting bare root seedlings of vegetables. It consists of special fingers with flexible rubber sapling holders driven by a standard roller chain. The drive is taken from a ground wheel which forms an integral part of a similar flanged and inclined press wheel for compacting the soil after the seedlings are placed in the soil. There is a specially designed shoe type furrow opener which pens a small slit in the well prepared soil bed for placing the seeds. Power requirement is met by a 26 kW (35 hp) tractor and the field capacity varies from 0.2 ha/h to 0.3 ha/h depending on the crop.

Fig 1.5.1 Two-row vegetable transplanter

Orchard sprayer

The equipment is meant for insecticide and pesticide application in orchards. It consists of fibre reinforced plastic (FRP) blower assembly, pump, nozzles, nozzle adaptor, spray liquid tank, power transmission system and mounting frame. Overall dimensions of the unit are 150 x 65 x 120 cm. It is driven by tractor PTO. Air enters the impeller axially and leaves the impeller at relatively high velocity through which it forces the small droplets to come out of the nozzles in to the atmosphere like a mist. The equipment is operated with a 26 kW (35 hp) tractor and has a capacity of 2 ha/h with a total discharge of about 160 litres per hour.

Fig 1.5.1 Orchard sprayer

Aero Blast Orchard Sprayer

The sprayer permits efficient application of pesticide in tall crops and orchards. The sprayer consists of one plastic chemical tank of 300 litre capacity, ASPEE triplex pump, one centrifugal blower of 1 m^3/ s capacity: one main by pass valve and two flow rate control valves to regulate the flow rate of chemicals in two spouts of the sprayer, two pressure vessels, one pressure gauge fitted on the outlet of the pump, two funnel type nozzles fitted in two spouts and pipes and fittings. The power to the blower and pump is transmitted by V - belts and pulleys from PTO shaft of a 26 kW (35 hp) tractor. Average field capacity of the sprayer is about 0.8 ha/h.

Fig 1.5.1 Aero Blast Orchard Sprayer

Groundnut/Potato Digger

The equipment is used for Digging of groundnut and potato crops

The digger consists of soil cutting blade, lifter rod attachment, two curved shanks, a head piece and depth gauge wheels. The cutting blade is fitted at lower ends of curved shanks. The digger is provided with gauge wheel for easy transport and uniform depth of operation. The lifter rods are provided to facilitate the separation of soil and groundnut/potato. It requires a 33 kW (45 hp) tractor and has a field capacity of about 0.3 - 0.4 ha/h.

Fig 1.5.1 Groundnut/Potato Digger

Laser land leveler

It is trailed type equipment used for achieving precise fine leveling with desired grade. It has four basic units' viz. laser emitter/transmitting unit, laser-receiving unit with soil bucket having double actuating hydraulic valve and level control box. The laser emitter unit sends continuous self-leveled laser beam signal with 360° laser reference up to a command radius of 300-400 m for auto-guidance of the receiving unit. This unit actuates the hydraulic control for moving up/down the leveling bucket for the desired cut/fill operation. Prior to operating the machine the area requiring fine leveling has to be surveyed using a grade rod.

Fig 1.5.1 Laser land leveler

Then based on the survey observations a mean grade should be found. The bucket blade is then placed at the average grade and synchronized with the control unit. After this the operator operates the machine and to achieve the desired grade in the field the machine automatically controls the necessary cuts and fills. The capacity of the machine depends upon the amount of soil cut and fill required in the field and field geometry. A tractor of 45 hp and above operates the machine. It takes about 4-6 hour to level about one hectare.

Rotavator

It is suitable for preparing seedbed in a single operation both in dry and wetland conditions. Also it is suitable for incorporating straw and green manuring. Pulverizing of soil is more uniform and better because impact of revolving blades of rotavator sheares the soil and made the soil fine. The mean clod size varies between 1.6 - 2.3 mm for rotavator at 210 rpm rotor speed whereas it varies from 4.32 to 5.76 mm for tractor-drawn tiller and harrow. The extent of residue incorporation is above 97 percent for rotavator and only 65-85% when conventional tillage equipment like tiller and harrow is used. The use of a rotavator leads to about 25-40% and 15-25% saving in the fuel consumption for paddy and wheat harvested fields respectively as compared to the conventional tillage implements. It gives highly satisfactory performances while using it under combine harvested wheat and paddy fields as compared to conventional tillage equipment and saves about 40-60% of time. There is a saving of Rs. 1000-1500/ha in cost of operation.

Fig 1.5.1 Rotavator

and paddy. It consists of a 2.2 m wide conventional cutter bar assembly, 7 crop row dividers with star wheels, pressure springs and two vertical conveyer belts. The cutter bar is given a reciprocating motion by the pitman rod. The machine cuts the crop, conveys it vertically to one side and drops in a windrow for easy collection. The field capacity of the machine is 0.4 ha/h when operated at forward speed of 2.5-3.5 km/h.

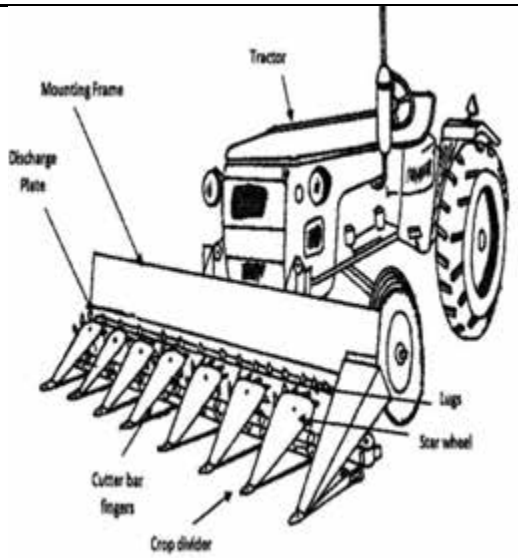


Fig 1.5.1 Vertical Conveyer Reaper Windrower:

High capacity multi-crop thresher:

Commercially available spike tooth type thresher has been used after incorporating few modifications based on preliminary testing. The diameter of threshing cylinder is 580 mm and length 326 mm. The threshing cylinder has thirty-six spikes placed six in each row. For threshing pulses six spikes are retained on cylinder in 6 rows i.e. 1 in each row. These spikes are made of 16 mm studs. The arrangement of spikes on cylinder periphery is axial. Aspirator I & II are centrifugal type and having 4 & 3 blades respectively. Aspirator I separate the major chunk of chaff from sieve falling directly below the concave. Aspirator II accomplishes the stage II cleaning. It picks chaff from screen just prior to discharge of grain from main outlet. Reciprocating sieve system consists of replaceable set of sieve and screen mounted on oscillating frame. The amplitude of oscillations could also be varied. Upper sieve separates chaff bigger than grain while lower screen let the dust, smaller particles than grain pass through thus help in delivering clean grain at main outlet. The thresher is provided with four wheels made of cast iron for transportation and motor stand to fit the motor on it. It also has provision for attaching

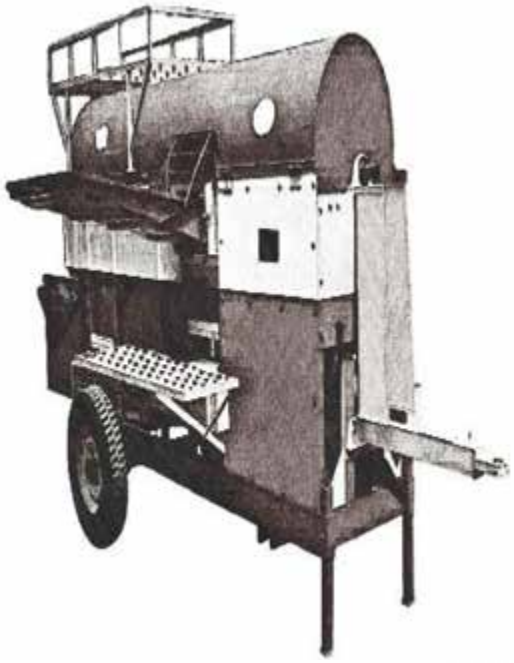


Fig 1.5.1 High capacity multi-crop thresher

Zero-till seed-cum-fertilizer drill: The zero-till seed-fertilizer drill has been developed to sow wheat directly in rice-harvested fields without preparing the seedbed. It is a 9/11/13-row unit consisting of fluted rollers for seed metering and agitators over adjustable openings for fertilizer metering. The ground drive wheel supplies power through sprockets and chain for metering of seed and fertilizer. The furrow openers are of inverted 'T' type, spaced at 200 mm (adjustable). The field capacity of the machine is 0.3-0.4 ha/h with about 75% efficiency.

Fig 1.5.1 Zero-till seed-cum-fertilizer drill

Raised bed planter:

A bed-former-cum-seeder has been developed for sowing wheat. The machine can make three beds in single run and the width of each bed is adjustable (35 to 45 cm). A Planting attachment has also been made with the machine for sowing maize, groundnut, cotton etc on the beds. The field capacity of machine is 0.26 ha/h. The cost of operation is about Rs. 4500/ha as compared to conventional method (Rs. 3400/ha). The crop being sown on beds, it saves about 20-30% water and 20% seeds.

Fig 1.5.1 Raised bed planter

Three-row rotary weeder: Manual weeding is laborious and time consuming and hence efficient mechanical weeders are being developed to obtain good yields from the farm. The field capacity of machine is 0.25 ha/h with weeding efficiency of 80-90%.

Fig 1.5.1 Three-row rotary weeder

Vertical Conveyer Reaper Windrower: The machine is mounted in the front of tractor and is used for harvesting cereal crops like wheat

universal shaft for operating the thresher by tractor PTO. The grain output capacity is 16-20 q/h for wheat, 8-10 q/h for raya, 6-8 q/h for gram and 4-5 q/h for green gram. Threshing efficiency, un-threshed grain and visible damage are 98-99%, 1.5-2.0% and 1.0% respectively. Average total losses are about 5%. The machine is operated at the lowest cylinder speed of 300 rpm for moong to minimize the breakage while for guar crop; it is operated at 500 rpm. In moong crop, two cutting blades (out of four) are removed to reduce the damage. The average capacity of thresher is 4.0 q/h for moong and 5.0 q/h for guar crop. The breakage is less than 5.0% for moong and 0.5 to 2.0% for guar. Threshing efficiency and cleaning efficiency were observed to be with in the prescribed limit. The expenditure involved in operating the machine is Rs. 250-300/h. The net saving per year is estimated to be Rs. 86,000/- and the pay back period of machine is one year.	
Straw Combine: Straw combines are used to recover wheat straw after combines operation and is operated by a tractor. This machine cuts and gathers the left over straw from the field chops in to fine straw and transfers this in to the trolley. It is mostly 2 m wide and is operated with tractor of about 35 hp or above. Straw recovery is about 55-60%. The straw is used as animal feed. It consists of a cutting mechanism, conveying mechanism and a bruising unit and a blower. Traditional trolley having net or wire mesh is used for collecting the straw. The capacity of the machine varies from 0.4 -0.5 ha/h and is operated at 3.0-4.0 km/h. There is also a recovery of 75-100 kg of grain per hectare. One person operates the machine and 3-4 persons are needed to unload the trolleys of straw.	

Automatic Potato Planter

- Used for planting potato on the ridges without involving laborers.
- Saves about 70 % labour and 40-60% cost of operation
- Field capacity = 0.3 ha/h

Fig 1.5.1 Automatic Potato Planter

Air assisted sprayer

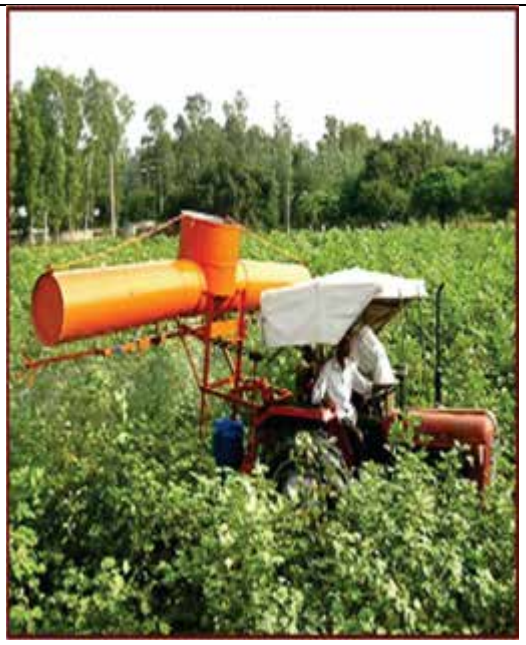


Fig 1.5.1 Air assisted sprayer

Disc Plough

Fig 1.5.1 Disc Plough

Tyne cultivator

Fig 1.5.1 Tyne cultivator

Groundnut digger	 *Fig 1.5.1 Groundnut digger*
Pit Digger	 *Fig 1.5.1 Pit Digger*

Post hole digger

Fig 1.5.1 Post hole digger

Boom sprayer

Fig 1.5.1 Boom Sprayer

Roto-Till-Drill	 *Fig 1.5.1 Roto-Till-Drill*

Notes

UNIT 1.6: Glossary of terms and symbols

Unit Objectives

At the end of this unit, you will be able to:

- Read and understand the warning symbols for safe operation of the Tractor.
- Understand the Universal symbols and other terms which are commonly used in Tractor Operation.

1.6.1 Glossary of terms and symbols

The following warning symbols draw additional attention to items of importance for the safe and correct operation of the tractor.

Symbol	Description
 DANGER	Serious hazard with a very high level of risk of either serious injury or death
 WARNING	Hazard or unsafe practice that can lead to severe injury or death.
 CAUTION	Hazard or unsafe practice that can lead in injury or death.
 IMPORTANT	Instructions for the correct operation of the machine which, if followed, will ensure that it performs at its best

Fig 1.6.1 Warning symbols

Some of the universal symbols have been shown below with an indication of their meaning

Symbol	Description
	Engine speed rev/minX100)
	Pressured open slowly
	Corrosive substance
	Hours, Continuous
	"Tortoise" recorded variable Slow or minimum Setting
	Engine coolant Temperature
	Transmission oil pressure
	Fuel level
	Hazard warning
	"Hare" fast or Maximum setting
	Warning
	Engine Oil Pressure
N	Neutral
	Fan

	Transmission Oil Temperature
	Horn
	PTO engaged
	PTO Disengaged
	Head Lamp
	Engine Stop Control
	Air Filter
	Differential Lock
	Lift arm/raise
	Lift arm/lower
	See Operator's manual
	**Battery Charge**

Fig 1.6.1 Universal symbols

Air-fuel ratio	Air–fuel ratio (AFR) is the mass ratio of air to fuel present in a combustion process such as in an IC engine
Alloy	A metal made by combining two or more metallic elements, especially, to give greater strength or resistance to corrosion.
Air Filter (Inner)	Provides safety filter for outer filter- (should never get dirty)
Air Filter(Outer)	Provides air cleaning(filtration) for engine- removed dust and dirt(will get dirty)
Attachment	A piece of farm equipment that is pulled behind or mounted on to a tractor or other self-propelled farm equipment. Examples include ploughs, discs, wagons and cultivators.
Ballast	Application of additional weight on the body of the tractor to provide better traction
Brake	A device for slowing or stopping a moving vehicle, typically by applying pressure to the wheels.
Brake horse power	It is the horsepower available on the crankshaft and is measured by a suitable dynamometer
Bush	An independent plain bearing that is inserted into a housing to provide a bearing surface for rotary applications;
Brake Fluid	A fluid used in a hydraulic brake system.
Bio-diesel 1. 2.	A biofuel intended as a substitute for diesel.
Battery	Provides power for operation of electrical parts
Battery Caps	Provides access to fill battery-protection when on
Belt Pully	A pulley driven by a power unit to transmit power to another machine or machines by means of a belt
Belt Power	Power transmitted through a belt with the governor control in the position recommended by the tractor manufacturer for belt-pulley work.
Cage wheel	A wheel or an attachment to a wheel with space cross-bars for reducing ground pressure and/or improving traction of a tractor, generally used in wet-land seed-bed preparation.
Cage Wheel, Half	A cage wheel which is used in conjunction with pneumatic wheel.
Compression Ratio	The compression ratio (CR) of an engine is a measure of how much the air/air-fuel mixture is compressed in the cylinder. It is the volume of air when the piston is at BDC divided by its volume of air when the piston is at TDC.

Clutch pedal	Engages / disengages clutch for starting / stopping tractor motion
Centre of gravity	The point on the body of the tractor or implement through which the entire mass is supposed to be acting in the direction of the force of gravity
Clutch	The disk operated with a foot pedal to engage or disengage the engine
Cultivator	An implement to be operated by tractor for land preparation
Coefficient of Traction	Ratio of the total force output of the tractor in the direction of travel to the dynamic weight (normal force) of the traction device.
Compression ignition	A type of IC engine where no spark plugs are present and the heat of compression is sufficient to ignite the fuel in the cylinder
Cylinder	It is the hollow cylindrical body through which the piston moves and power is produced
Chassis	It is the metallic base on which the tractor engine and other attachments are fixed
Centrifugal force	is a force that tends to resist a change in direction. If a tractor was traveling in a straight line then suddenly turned, there would be a tendency for the tractor to want to continue in that straight line. This is centrifugal force. By doubling the tractor's speed, the centrifugal force is increased four times.
Chassis number	The unique number engraved by the manufacturer on the body of the chassis
Check nut	A nut put on another nut so that it does not loosen for any reason
Carburetor (Gasoline)	Provides mixing of air and fuel for gasoline engine
Coolant pump (water pump)	Circulates coolant through engine and radiator
Drag	The resistance caused by a trailed or mounted piece of equipment
Drawbar	Implement hook-up
Diesel	One of the fuels derived from crude oil
Dash board	Place for A. Air Filter Restriction- Indicates air filter needs cleaning/ changing B. Coolant Temperature- Indicates Engine operating temperature C. Hour Meter -Indicates hours of operation of tractor D. Fuel Gauge- Indicates amount of fuel in tractor tank E. Oil Pressure- Indicates engine oil pressure F. Alternator/ Battery -Indicates battery charge G. Tachometer- Indicates engine speed in Revolutions per minute (RPM)
Drawbar horsepower	Power obtained at the drawbar with the governor control in the position recommended by the tractor manufacturer for drawbar work and the tractor moving on a horizontal surface, with the drawbar pull applied horizontally.

Drawbar pull, Maximum	The maximum horizontal drawbar pull at a drawbar height recommended by the manufacturer which a tractor is able to sustain in the line of its longitudinal axis.
Driver seat	The place on tractor where the driver sits and operates the tractor
Drive Tire (rear)	Power Tractor
Differential Lock Pedal	Engage to lock drive axles together(positive traction)
Differential	A device to enable two wheels, driven from a single shaft, to rotate at different speeds
Draft Control lever	Controls lift arms when implement is in working position
Distributor (Gasoline)	Provides ignition (fire) to spark plugs
Displacement	The total volume of air/ fuel mixture an engine can draw in during one complete engine cycle.
Draft Control	A mechanical linkage that adjusts the lifting and depth characteristics of an implement on the 3-point-hitch (3PH). The draft control allows for more accurate usage of three point hitch implements
Drawbar	A flat horizontal bar attached to the rear of the tractor, used for dragging or towing. May be attached to the frame at a fixed height, allowing for variation in the distance between the tractor and implement to be towed
Differential Lock	A device for temporarily locking the rear differential to achieve better traction. Easily controlled from the operators position
Dynamometer	Dynamometers are used to measure the horse power. Dynamometers are classified as brake, drawbar or torsion according to the manner in which the work is applied. Also, they may be classed as absorption or transmission, depending on the nature of energy.
Dry Mass of Tractor	The mass of the tractor fitted with all components necessary for its operation, but without water, fuel, oil and operator.
Engine Oil Dipstick	Indicates level of Engine oil
Engine overheating	Unintended rise in engine temperature
Engine horse power	Power measured at the crank shaft of the engine with the governor control lever in the position recommended by the manufacturer.
Engine block	The main body of the tractor engine
Engine Oil	The fluid in the engine that keeps various engine components well lubricated to minimize wear and tear of engine parts

Ethanol	A low viscosity fuel derived from biological materials
Exhaust system	The part of tractor that guides the products of combustion in the engine to be exhausted in the open atmosphere
Efficiency , Tractive	Output power divided by input power, usually expressed in percent
Engine number	A unique identification number marked on the engine block
Ergonomic hazards	are associated with work such as lifting or moving of heavy objects and tasks where there is excessive repetitive motion.
Engine Oil fill Port/ cap	Provides point of access for adding engine oil-protection when on
Engine Bore	The diameter of the cylinder is known as bore
Engine Stroke	The displacement of the piston, i.e. its travel from top dead centre (TDC) to bottom dead centre (BDC) of the cylinder
Flywheel	To smoothen the power delivery from the engine
Four wheel drive	The power is provided to all the four wheels of the tractor for better control
Fuel tank	The tank on the tractor chassis to hold fuel for the tractor operation.
Fuel consumption	The amount of fuel consumed by the tractor per hour while operating
Fuel pipe	The pipe that connects the fuel tank to the tractor engine
Field capacity	The amount of work done by the tractor per unit time. For example, the farm area ploughed by a MB plough per hour.
Fuel injection system	The system for making the fuel available on the piston head for combustion
Field efficiency	T he ratio of the actual field capacity to the theoretical field capacity
Foot Throttle Pedal	Increases tractor RPM (speed) (variable)
4 Wheel Drive Lever -	Engages front wheel assist to let front wheels pull
Fuel Tank	(Gravity feed) Provides fuel storage for tractor engine operation
Fuel Filter	Solid Filters (cleans) solids from fuel
Fuel Filter	(Water separator) Separates water from fuel
Fuel Cap	Provides access to fuel tank when off- protection when on
Fan	Provides air flow through radiator for heat removal

Fan Belt	Connects engine power to auxiliary equipment on front of engine
Floatation	Ability of the traction device to resist sinkage into the medium being traversed.
Fuel Gauge	The meter shows how much fuel is in the tank.
Governor	The controller that regulates the engine speed by controlling the quantity of fuel
Gear Shift Lever	Select Forward/ Reverse Gear
Ground Clearance of Tractor	The height of the lowest point of the tractor chassis from a firm horizontal supporting surface, the tractor being ballasted as used for drawbar test
Happy seeder	A variant of zero till drill capable of working in a field with dense crop residues
Head lights	Light up front of tractor path (white)
Hydraulic Power Lift	A mechanism driven by a tractor's power unit to raise, hold or lower mounted or semi-mounted equipment by hydraulic means.
Hydraulic Power Steering	The hydraulic power steering is intended for controlling the turning of the steerable wheels and reducing the force to be applied to the steering wheel for turning the tractor
Hydraulics	A hydraulic system uses compressed fluid to transfer force applied at one point to another point.
Hydraulic Quick Coupling	Provides connections for remote hydraulic hoses
Hydraulic pressure	The pressure of hydraulic fluid in the tractor hydraulic system
Hand Throttle Lever	Increases Tractor RPM (speed) constant
Hydraulic Filter	Provides filtering(cleaning) of hydraulic fluid
Horsepower (HP)	A rating of the power of the tractor
Hydrostatic Transmission	Most similar to the automatic transmission in a car. It's the most user-friendly, with instant direction and unlimited speed changes.
Hydraulic capacity	Hydraulic performance is important to operate your attachments like loaders, 3-point hitch or front hitch. This ensures you can work at the highest performance level. Flow of hydraulic oil, at pressure, enables Hydraulic power.
Hydraulics remotes	A system of pressurized oil which provides power for raising and lowering the 3PH and which can be used to operate attached or towed implements having hydraulic pistons and cylinders.
HP, Net	Net HP is measured at the engine flywheel in the same manner as the maximum HP. The difference in the two is because the engine is equipped with accessories. Net HP is the basis for rating the HP of industrial and farm tractors.
HP, Brake	Brake Horse Power It is the horsepower available on the crankshaft and is measured by a suitable dynamometer.

HP, SAE	The SAE (Society of Automotive Engineers) horse power rating is used to compare engines on a uniform basis. The formula is HP = 2.52 DN where D - diameter of cylinder in inches N- number of cylinders
Horse Power	It is the rate at which work is done. One HP is equivalent to 4500 kg m per min.
HP, Indicated	Indicated Horse Power The amount of power that can be measured on the flywheel is always less than the power generated in the engine on account of expansion of the combusted fuel. The power that is actually developed in the cylinder is called indicated horse power.
HP, The Maximum	The maximum HP is measured at the engine flywheel without any of the power consuming accessories being attached. This is not a practical rating as it does not represent "usable" HP.
HP, Belt	Belt Horse Power It is the power of the engine measured at the end of a suitable belt, receiving drive from the PTO shaft of the tractor.
Height of Tractor	The distance between a firm horizontal supporting surface and the horizontal plane touching the uppermost part of the tractor.
Inflation Pressure	For air filled tyres, it is the gauge pressure measured with the valve in any position. For tyres containing liquid, it is the gauge pressure measured with the valve in the bottom position.
Ignition key	The key that activates the ignition system of tractor electrical system for starting the tractor
Internal combustion	The power for the tractor is produced by burning of fuel in a closed space
Idling	The engine is running but the vehicle is stationery
Injector Nozzle (Diesel)	Controls(sprays) fuel entering cylinder- for ignition and running
Injector Pump (Diesel)	The purpose is to meter diesel fuel to injectors and controls engine timing
Key & Switch	Engages power to parts from battery (may include solenoid for fuel shut-off)
Length of Tractor	The distance between two vertical planes at right angles to the median plane of the power unit and touching its front and rear extremities.
Lean fuel	When the quantity of air in the air-fuel mixture is more than the desired amount, it is termed as lean fuel
Light Switch	Turns light on/ off
Left Turn Signal	Indicates tractor turning left (amber)
Lubricant	A material to reduce friction between two running surfaces
Live Hydraulics	To maintain oil pressure in the system even when the clutch is disengaged.

Lubrication system	A system of using appropriate lubricants to ensure friction-less operation of tractor-implement system
Left Brake Pedal	Locks Left Drive Tire (rear)
Left Lift Arm	Left hydraulic arm of three point hitch-hooking up implements
	Lug Angle — The angle between the centre line of the lug face and the centre line of the tyre. Lug Base — The projected thickness or width of the lug at the points where the projected planes of the leading and trailing sides meet the projected undertread face. Lug Face — The outermost surface of the lug. Lug Height — Distance measured from the undertread face to the lug face. Lug Length — Distance measured from end to end along the centre line of the lug face. Lug Spacing, Circumferential — The distance from the leading side of a lug to the trailing side of the lug ahead of it, measured parallel to the centre line of the tyre. Lug Spacing, Perpendicular — The distance, measured perpendicularly, from the leading side of a lug to the trailing side of the lug ahead of it. Lug Width — Width of lug face measured perpendicularly to the centre line of the lug face.
Muffler	Provides quieter operation for engine and arrests sparks
Muffler Cap	Provides engine protection from rain/ particles entering engine when not running
Manual Fuel Shut-off	Pull to shut off Diesel Engine
Mounted implements	Those implements operated by a tractor through its three-point hitch
Mud guard	Metallic guards put on tractor wheels to manage the quantity of wet soil sticking to the tractor wheels
Main Transmission	A combination of gears and shafts to transmit the power from the engine of a tractor to its wheels or tracks.
Matching implements	The size of the implements is such that the power from the tractor is just sufficient to meet the requirement of the implement during operation
Negative (ground)	Provides ground to tractor chassis

Oil Filter	Filters (cleans) solids from engine oil
Operational Mass of Tractor	The mass of the tractor in normal working condition with fuel tank and radiator full, lubricants, etc, filled to the specified levels and the mass of the driver (assumed to be 75 kg).
Power, Input	Power input to traction device calculated from input torque and angular velocity of the driving axle.
Power, Output	Power output of a traction device calculated from net traction force and velocity in the direction of motion.
Power, Outlet	Any outlet which transmits the engine power to the tractor in order to make it functional, such as PTO, belt pulley and drawbar.
PTO Power	Power obtained at the main PTO with the governor control in position recommended by the tractor manufacturer for PTO work, the tractor being stationary.
PTO Yoke Boss	An internally splined member which receives a power take-off.
Pulley Power	Power measured by coupling the pulley shaft directly to the dynamometer with the governor control in the position recommended by the tractor manufacturer for pulley work.
PTO Drive Shaft	The assembly from power take-off yoke boss to power input connection yoke boss (inclusive).
PTO Drive Shaft Guard	A safety guard fitted over a power take-off drive shaft.
Power Takeoff (PTO)	A shaft that allows transmission of power from a farm tractor to a piece of equipment attached to it.
PTO Control Lever	Engages / disengages PTO shaft
PTO horse power	PTO horse power is the power available for driving implements after making allowances for propelling the machine

PTO, Independent	Power to operate the transmission and power take off is transmitted through independent transmission and power take-off clutches.
PTO, Live	A live power-take-off (PTO) will continue to rotate independently of the tractor drive train.
Petrol	Also known as gasoline, it is a petroleum based fuel, like diesel, to run vehicles
Power train	The Power train refers to the engine, transmission and axels and covers the components that transfer the power from the engine to the drive wheels and power take off (PTO). Main functions include selecting speed ratios, balancing the power to drive wheels for turning, and allowing the tractor to reverse.
Plough	An implement for ploughing the soil
Ply Rating	Identification of a given tyre with its maximum recommended load when used in a specific type of service. It is an index of the strength and does not necessarily represent the number of cord plies in the tyre.
PISTON DISPLACEMENT (SWEPT VOLUME)	This is the volume that the piston displaces during its movement from BDC to TDC.
Pinch Point (Safety) Labels	Operator Safety (stay clear)
Personal protective equipment(PPE)	is used to reduce or prevent a worker's exposure to health and safety hazards. There are many different types of PPE including respirators, gloves, safety boots, goggles, ear plugs/muffs, hard hats, chaps and fall arrest devices.
PTO Cap	Protects operator from PTO shaft when not in use
PTO Shield-	Protects operator from PTO shaft when in use
PTO Shaft	Provides tractor power to implements and equipment
Parking Brake Lever	Pull to set parking brakes when off tractor
Position Control Lever	Controls lift arms when implement is in transportation position
Power Steering Dipstick	Indicates level of power steering fluid
Pre- Cleaner	Removes large particles from air before they get to the air filter- provides swirling action to air
Power Steering Pump	Provides storage of power steering fluid and pressure for operation
Positive Battery Terminal	Provides power from battery to electrical parts
Power Take Off (PTO)	The PTO connects the tractor's engine to an implement through a rotating shaft at the rear, under or front of the tractor. Can be both 540 and 1000 rpm for differing applications

Pick-up Hitch	A hitch, operated by a power lift, for connecting the drawbar of a trailer or machine to a tractor.
PTO Shield	A rigid guard fitted on a tractor, covering the tractor power take-off as a safety device
PTO Cover	A protective cap enclosing a power take-off
Power Lift	A mechanism driven by a tractor's power unit to raise lower mounted or semi-mounted equipment.
Pneumatic Tyred Wheel	A wheel fitted with a pneumatic tyre.
Quick Hitch	The quick hitch attaches to the tractor 3-point hitch allowing the operator to easily hook onto implements, without leaving the tractor seat
Quick-Release Hydraulic Coupling	A self-sealing coupling providing quick connection and disconnection of a tractor- to-implement hydraulic pipe-line.
Rated Engine Speed	The speed of the engine in rev/min, specified by the manufacturer for continuous operation at full load.
Road Band	A rim fitted to a steel wheel to prevent contact of the lugs or cleats with the road surface.
Roll Over Protective Structure (ROPS)	A structure on a farm tractor or self-propelled machine that limits most equipment roll-overs to 90 degrees and protects the operator within the frame of safety if he/she is wearing the seatbelt.
Reflector -	Reflects headlights from rear traffic (red)(unpowered)
Right Turn Signal	Indicates tractor turning right (amber)
Right Brake Pedal	Locks Right Drive Tire (rear)
Range Lever / Hi-Lo	Select Range (high/ Low) for gears
Remote Hydraulic lever	Controls flow of hydraulic fluid to remote cylinders on implements
Right Lift Arm	Right hydraulic arm of three-point hitch for hooking up implements
Rear End Dipstick -	Indicates level of Rear end oil
Radiator	Provides for removal of heat from engine
Radiator Hoses	Provide connection from radiator to engine
Radiator Cap	- Provides system pressure, access to radiator for fill, protection
Remotes	Hydraulic inlet/outlet pairs at different locations on the tractor for connecting hydraulically operated implements. Remote hydraulics lend greater versatility to the implements on the machine

Specific Fuel Consumption	The mass of the fuel consumed per unit of work.
Self-Propelled Farm Equipment	A self-propelled vehicle manufactured, designed or re-designed for a specific use in farming.
Steering Wheel	Turns steering tires (front usually)
Seat	Operator Comfort
Seat Belt	Keep Operator in Safety Zone
Steering Tire (front)	Directs tractor direction
Shuttle Shift Lever	Shuttle from Forward to reverse with or without clutch dependent on model (power or manual)
Shift Pattern Decal	Provides gear position and speed(speedometer)
Slip	Relative movement in the direction of travel at the mutual contact surface of the traction device and the surface which supports it.
SMV Sign	Required by law on vehicles operating on roads at less than 20 kmph
Spark plugs (Gasoline)	Provides spark to ignite gasoline
Tachometer	The tachometer shows the engine speed in revolutions per minute (RPM).
Tractor, Agricultural	A self-propelled wheeled vehicle having two axles, or a track-laying or semi-track-laying machine, more particularly designed to pull, push, carry and operate implements and machines used for agricultural work (including forestry work) .
Tractor, Semi-track Laying	A tractor in which the means of propulsion in rear consist of an endless track(s) passing round the driving wheel(s) and the pinion(s) and the front wheels consist of pneumatic tyres.
Tractor, Track Laying	A tractor in which the means of propulsion consist of an endless track(s) passing round the driving wheel(s) and the pinion(s)
Tractor, Wheeled	An agricultural tractor, with at least two axles, the means of propulsion of which consist of wheels generally fitted with pneumatic tyres
Tractor, Standard with Rear Wheel Drive	A standard tractor whose engine power is transmitted to the ground exclusively by the rear driving wheels
Tractor, Standard with four-wheel drive	A standard tractor whose engine power is transmitted to the ground both by the rear and the front wheels. The rear and the front wheels need not be of the same diameter.
Tractor, Standard	A wheeled tractor adapted and designed, more particularly by its construction, for working with implements and machines fixed behind or in front and interchangeable.

Tractor, Hillside	A wheeled tractor equipped with manual or automatic means of compensating for sloping ground
Tail Light	Indicated rear of tractor to traffic (red) (powered)
Top Link -	Center hook-up point of three point hitch- adjust level of implement
Transmission Dipstick	Indicates level of transmission fluid
Tool Box	Storage of tools
Thermostat	Keeps coolant in engine until operating temperature has been reached-controls engine temperature
Turning Radius	The distance from the turning centre to the centre of tyre contact with the road. It describes the largest circle made while the machine is executing the sharpest practicable turn.
Three-point hitch:	A 3-point hitch is based on three mounting points for the implement. The lift arms are the two steel or cast arms extending rearward. They provide the lift and are the pull-point for the implement. The top link is the third mounting point that extends from a top middle position at the rear of the tractor. It adjusts the angle/level of the implement.
Turbo Intercooler	A radiator type device for cooling air before it enters the engine. Cool air is more dense allowing more oxygen density and therefore better performance.
Turbo	A system that gives greater power to the tractor engine, by using waste exhaust gasses to compress the air fuel mixture into the engine
Torque	Torque is the ability of the tractor's drive wheels to turn. It's measured in N-m. (Technically speaking, it's force multiplied by the distance from a specific point.) The greater a tractor's torque, the easier it will be to pull through tough patches.
Thrust	Net traction plus rolling resistance of traction device while pulling
Travel Ratio	Ratio of distance travelled per revolution of the traction device while pulling to the distance travelled per revolution of the traction device with zero drawbar pull of vehicle or zero net traction of traction device only.
Traction Device	A device for propelling a vehicle using the reaction forces from the supporting surface.
Travel Reduction	One (1) minus travel ratio.
Traction, Net	Force in direction of travel developed by the traction device and

Traction Ratio, Dynamic	Ratio of drawbar pull to actual force on traction device normal to traction surface while pulling.
Traction Ratio, Gross	Ratio of drawbar pull to total weight of vehicle.
Theoretical Travelling Speed	The speed of the tractor determined at the rated engine speed for drawbar use, having regard to the total gear ratio and the effective radius of the driving wheels or tracks.
Three-Point Linkage Check Chain	A chain connected between each lower link and the tractor to control the lateral movement* of mounted equipment.
Three-Point Linkage Stabilizer	A link connected between ends of one or both lower links and the tractor to hold mounted equipment in fixed lateral position in relation to the tractor.
Track	A series of jointed track links or a flexible band forming an endless weight carrying rail to transmit and drive to the ground.
Track of Wheeled Tractor	The distance at the ground level between the median planes of the wheels on the same axle of the tractor when stationary and with the wheels in position for travelling in a straight line. The track may be thus defined both for front and rear wheels. In case of twin wheels, the track shall be taken as the distance between two planes, each being the median plane of the pairs of wheels.
Turning Diameter	The diameter of the circular path described by the centre of tyre of the outermost wheel of the tractor while executing its sharpest practical turn.
Utility (work) Lights	Light up rear of tractor (equipment)
Volumetric Efficiency	The amount of air entering the cylinder due to the vacuum created by the downward motion of the piston is always less than the actual displacement of the piston because of the constriction of the air intake system. Therefore, the actual air taken into the cylinder divided by the swept volume is known as volumetric efficiency.
Variable Speed Governor	A mechanism to maintain the speed of a power unit at any selected value within a given range.
Warning Flashers	Warns others of tractor in operation (amber)
Wheel base	The horizontal distance between the front and the rear wheels in the same plane measured at the centre of their ground contact.

Weights	Ballast added to the tractor or implement to improve balance, traction, stability or digging force.
Wet Disc Brakes	An internal low maintenance braking system for machines that has the brake discs sitting in fluid that acts as a coolant, allowing continual use.
Weight, Dynamic	Total force exerted by the traction device normal to the supporting surface under operating conditions
Weight, Static	Total vertical force exerted by the traction device when stationary, on a level surface, and with zero drawbar pull.
Weight Transfer	The change in normal forces on the supporting devices (traction and transporting) on a vehicle under operating conditions, as compared to a static vehicle on a level surface.
Zero Turning Radius	The ability for a mower to turn within its own length especially useful for out-front and zero turn mowers

Table 1.6.1 Glossary of terms

Exercise

1. Write a note on Role of agricultural mechanization in India and abroad

Answer: ----------

---

2. Brief the History of Tractor in Farm Mechanization Sector

Answer: ----------

---

3. What is the status of Tractor market in India and abroad. Explain.

Answer: ----------

---

4. What are the major components of Tractor

Answer: ----------

---

5. Write a note on Tractor and its importance in Agriculture sector.

Answer: ----------

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

2. Operation of the Tractor

Unit 2.1 - Pre-operation checks

Unit 2.2 - Check the displays and notice any abnormal noise and smoke

Unit 2.3 - Tractor for agricultural field operations

Unit 2.4 - Tractor hitching with implements and machines

AGR/N1101

Key Learning Outcomes

At the end of this module, you will be able to:

- Perform daily checks.
- Check replenish/top up lubricating oil, brake fluid, engine coolant, battery electrolyte transmission/hydraulic oil.
- Adjusting Tractor Implements- hitching & unhitching, lateral & horizontal adjustments.
- Operate the Tractor with and without implement.

UNIT 2.1: Pre operations checks

Unit Objectives

At the end of this unit, you will be able to:

- Understand and practice the pre operations checks
- Undertake the tractor operation

2.1.1 Pre operations checks

Before starting your tractor for the first time and before each operating period after that, make the following checks.

1. Make sure all persons that operate or do maintenance on the tractor understand that clean fuel is important.
2. Check all lubrication fittings for grease as given in the Lubrication Chart.
3. Check the oil level in the engine crankcase. Check the fluid level in the transmission.
4. Check that the tractor fuel tank is filled with clean fuel that has the specifications given in this manual.
5. Clean around the fuel tank cap before you remove the cap.
6. Check the fuel system, cooling system and engine oil pan for leaks.
7. Check the fan belt is adjusted correctly.
8. Remove any water or sediment from the fuel filter cup.
9. Check the air pressure of the tires.
10. Make sure the PTO safety guard is installed.
11. Check the coolant level in the radiator and reservoir bottle. Add water and ethylene glycol coolant as needed.

2.1.2 Start the tractor

RUN-IN PROCEDURE

If run-in instructions for a new engine are not followed, you can cause damage to piston rings and cylinder walls.

LOAD

Never operate an engine immediately under full load. Allow the engine to warm up before operating it at full load. Run-in the engine carefully as shown in the table below.

Period	Engine Speed Control Lever Position	Load
1st Hour	Fully advanced	Maintain engine speed 100 RPM above full load governed speed.
2nd Through 5th Hour	Fully advanced	Full load governed speed with occasional short periods of lighter load.

Table 2.1.2 Start the Tractor

NO LOAD

Do not run the engine at idle speed. When not operating the engine with a load, you can keep the correct engine operating temperature if you run the engine at approximately 1500 RPM.

REAR WHEEL BOLTS

After the first 10 hours of operation, check the rear wheel bolts. Tighten all wheel bolts to the torque given in the Wheel Mounting Torques in the manual.

FRONT WHEEL BOLTS

After the first 10 hours of operation, check the front wheel bolts. Tighten the bolts to the torques shown in the Wheel Mounting Torques in the manual.

FRONT FRAME BOLTS

After the first 10 hours of operation, check the front frame bolts. Tighten the bolts to the torque shown below.
Front Frame Mounting Torques Side (M12x35), 8 Bolts (4LH and 4RH)... 83 to 93 Nm (61 to 69 lb ft)

LOWER LINK BRACKET BOLTS

After the first 10 hours of operation, check the lower link bracket bolts. Tighten the bolts to the correct tightening torque 39 to 44 Nm (29 to 33 lb ft)

NORMAL STARTING PROCEDURE

It is very important that enough lubricant reaches the engine parts before operating the engine at rated speed. Operate controls only when seated in the operators seat.
Before starting the engine, be sure all operating controls are in neutral or park lock position. This will eliminate accidental movement of the machine or start up of power driven equipment.
Put the gear shift lever in the Neutral position (Gear Drive).
Engine can start with transmission in gear when neutral or safety start switch is by-passed:

1. Do not connect across terminals on starter.
2. Attach a booster battery by connecting the positive terminal of the booster battery to the "positive terminal" provided or to the positive terminal of the machine battery. Connect the negative terminal of the booster battery to the "negative terminal" provided or to the chassis of the machine. Then use recommended starting procedures from operator's seat.
3. When necessary, repair electrical system components promptly so that "jump starting" will not be attempted.

Machine run-away can cause injury or death to operator and bystanders. Make sure the fuel shut-off valve is open. The valve is located at the bottom RH side of the fuel tank.

Steps

Step 1: Sit on the operator seat. Adjust seat and seat belt.
① Lift the adjust lever at the front of the seat
② Slide the seat forward or backward to desired position.
③ Release the lever. Then the seat will lock automatically in position

Step 2: Put the gear shift lever in the Neutral position (Gear Drive) and Put the REAR PTO and MID PTO control levers in the OFF (Engine start) slot.

Step 3: Put the range shift lever in the N (Engine start) slot.

Step 4: Put the engine speed control lever at the low idle position.
The hand throttle lever is used to change engine speed. Pulling the throttle lever toward the operator decreases engine speed. Pushing it away from the operator increases engine speed.

Step 5: Turn the starter key switch to the heat & ON position. Wait until the glow plug indicator lamp is put out. (Approximately 1 to 3 seconds.)

Step 6: Push the clutch pedal down.

Step 7: Depress the master brake pedal fully or make sure the parking brake is engaged.
① Depress the brake fully.
② Pull up the parking brake lever to engage.
③ Depress the brake again to release the parking brake.

Step 8: Turn key switch to start position until engine starts, but no more than 10 seconds, then release the key. Run engine for two minutes at 1500 RPM.

Step 9: When the engine starts, check the oil pressure indicator and charge indicator. If the indicators stay on, stop the engine and find out what is wrong.

NOTE:

If the oil pressure indicator stays on after the engine starts, stop the engine and check the oil level in the crankcase. Add oil if necessary. Start the engine, if the indicator is still on, do not operate the engine. Operating the engine without oil pressure will damage engine bearings an d other engine parts. See your dealer.

IMPORTANT:

1. If high idle position is used for starting, adjust the engine speed control lever to obtain about 1500 RPM as soon as the engine starts.
2. If the engine starts and then stops, wait for the starting motor to stop turning before you turn the key switch to START position again.
3. Do not use the starter motor for more than 10 seconds without stopping. Wait one minute between starts so the starter motor can cool.
4. If the engine stops when operating with a load, immediately start the engine again to prevent overheating caused by stopping the flow of oil for cooling and lubrication.
5. If the charge indicator comes on during operation, determine and correct the cause to avoid complete discharge of the battery and possible damage to other components of the electrical system. See your Dealer.
6. If the coolant temperature indicator comes on, remove the load and allow the engine to run at 1500 rpm until the indicator goes out. If the indicator does not go out within one minute, stop the engine and determine the cause.

COLD TEMPERATURE OPERATION

To start and operate the tractor during cold ambient temperatures, use the following procedure:

1. Ensure that the BATTERY has a full charge.
2. The FUEL must be clean and with no water. See fuel Specifications in the manual.
3. The ENGINE OIL must have the correct viscosity for the ambient temperature range.
4. The HYDRAULIC FLUID in the transmission section should be chosen correctly.
5. The COOLING SYSTEM must have ethylene glycol solution for protection.
6. Before STOPPING THE ENGINE , run the engine at idle speed for a short period of time to permit the engine temperature to decrease before stopping.
7. CONDENSATION IN FUEL TANK needs to be prevented. To prevent condensation in the fuel tank and water entering the fuel system, fill the fuel tank after each operating day.
8. During cold ambient temperatures, make sure you remove water from the fuel filter cup each day.

To start engine during cold ambient temperatures, put the engine control level at the low idle position. After starting the engine, run at 1500 rpm for approximately 5 minutes to warm the engine.
NT: During cold ambient temperatures, never run the engine at low idle speed for long periods of time.
During cold ambient temperatures, the engine will not heat to or keep the rated operating temperature at slow engine speeds. Slow engine speeds in cold temperatures can cause damage to the engine. Use the following procedures to warm the engine and transmission fluids, and to keep the correct operating temperatures.

1. WARMING THE ENGINE AND TRANSMISSION.

A. To heat the transmission fluid to operating temperature, run the engine at 1500 RPM for approximately five minutes.

IMPORTANT: Operating the tractor with cold transmission fluid can cause rough tractor operation with possible injury to the operator.

2. KEEP ENGINE AT CORRECT OPERATING TEMPERATURE.

A. Never run the engine below 1500 RPM.
B. Put a cover in front of the grille to control the amount of air going through the radiator.

3. STOPPING THE ENGINE.

A. Run the engine at slow speed for a short period of time. This will permit the engine temperature to decrease gradually before stopping the engine.

Notes

UNIT 2.2: Check the displays and notice

Unit Objectives

At the end of this unit, you will be able to:

- Understand and identify the trouble shoot in Tractor
- Understand the check lists and follow

2.2.1 Check the displays and notice any abnormal noise and smoke

Constantly monitor the warning lamps on the instrument panel and if any comes on stop the tractor to determine the cause.

If the oil pressure lamp turns on check the oil level first of all. If the oil level is OK ask a qualified dealer to check the reason for the light coming on.

If the charge lamp turns on, check all connections and ensure that the fan belt is not broken. If all connections and the fan belt are intact, consult your dealer to determine the cause of the problem.

Fuel Gauge

To avoid excessive condensation in the fuel tank, refill at the end of each day's work and ensure during the day that it does not drop to a low level where the fuel system will require bleeding to expel air in the system after refilling the tank.

Engine Coolant

If the gauge indicates that the engine is running hot, stop the tractor and check the coolant in the radiator.

Also check to ensure that the fins in the radiator core are not clogged or that the tractor has a broken or stretched fan belt

DANGER

Allow the engine to cool down before opening radiator cap as serious burns may result due to hot steam & boiling water.

When traveling on public or farm roads connect both brake pedals and allow for the weight of any mounted implement to ensure that the unit is not unbalanced.

Also allow for the width when passing other road users. Where fitted use the hazard lights provided. Strictly follow the local traffic regulations. When operating near others with an implement attached take particular care to allow for the width of the implement and avoid accidents.

PTO

Both of the rear and mid PTO are provided for variable utility. They can be engaged simultaneously or separately at same time. The engine will not start if PTO switch is ON position. The engine will shut-off if the operator leaves the seat with parking brake released and PTO engaged

REAR PTO

Use the PTO lever to engage. The PTO switch must be OFF before PTO is engaged.
1. Decrease engine speed to near idle.
2. Make sure that PTO switch is OFF.
3. Engage rear PTO using the PTO lever.
4. Turn on the PTO switch.
5. Increase engine speed to desired speed.

If operator turns off PTO switch, rear PTO and mid PTO are off at once.

CAUTION

Do not operate any implement at a high speed than is specified for it. When making adjustments to the implement, stop the engine to avoid serious injury. When leaving the tractor stop the engine, and remove the key. Set the parking brake.

HYDRAULICS

The hydraulics are powered with an engine driven hydraulic pump and controlled with a position control lever mounted beside the driver.

POSITION CONTROL

Implements can be raised and lowered with the hydraulic position control lever and can be stopped at any position by stopping the lever.
To ensure a consistent working depth the adjustable stop can be set to ensure that the implement returns to the same depth every time.
To raise the implement : Pull the lever back
To lower the implement : Push the lever forward

CAUTION

After finishing the work, always lower the implement to the ground and switch off the engine, set the parking brake to avoid injuries and accidents

Notes

UNIT 2.3: Tractor for agricultural field operations

Unit Objectives

At the end of this unit, you will be able to:

- Understand the Tractor Operation
- Understand the control systems (Stopping, Lever, shifts etc)

2.3.1 Tractor for agricultural field operations

When the engine warms up correctly, the tractor is ready for operating.

DRIVING

1. Make sure that all conditions have been fulfilled of field operations ready.
- Adjustments of the operator seat, the seat belt, and the steering wheel.
- Sufficient engine warm up
- Fasten seat belt
2. Raise the implement using the position control lever.
3. Select speed range with the range shift lever.
4. Range Shift Lever

The range shift lever is used to select the speed range of tractor. The lever can be shifted only when the tractor stops completely.
The lever is linear and has three positions, a neutral and two range gears. A neutral is located between L and H range gear
5. Release the parking brake by depressing the brake.
6. Select the driving direction and depress speed control pedal.
7. Speed Control Pedals
   - Depress the forward speed control pedal to move forward.
   - Depress the reverse control pedal to move backward.
   - The speed control pedal will return in neutral position and the tractor will stop when the speed control pedal is released.

STOPPING AND PARKING

1 Release speed control pedals Depress the brake pedal to stop the tractor if necessary.
2. Decrease the engine speed using hand throttle.
3. Move the range shift lever to neutral position.
4. Lower any implement to the ground.
5. Apply the parking brake.
6. Turn the key to OFF position to stop the engine.
7. Remove the key.

CAUTION

Always apply the parking brake when parking.
Failure to do so can cause accidents and damage.
As an extra precaution when parking on a slope, chock the rear wheels.

Cruise Control

The cruise control function is provided for comfortable and efficient operation. When the cruise control is engaged the cruise control lamp on instrument panel will turn on.

1.Engaging the cruise control.

① Depress the forward speed control pedal till getting desired speed.
② Push the cruise control switch to engage cruise control engaged, on.
③ Release the speed control pedal

2. Disengaging the cruise control

There are two methods to disengage the cruise control.
① Push cruise control switch "OFF" or,
② Depress the brake pedal.

Diff-lock Pedal

In case of wheel slippage, use the diff-lock by pushing down on the diff lock pedal.
To release it remove the foot from the pedal.

Front Wheel Drive (4WD)

The front wheel drive is used to increase traction performance greatly by engaging the front wheel. The front wheel drive can be engaged when the tractor is stopped.

In the ON position of the front wheel drive lever, the front wheels are engaged and in the OFF position, they are disengaged.

CAUTION

Do not use front wheel drive at high speed or on the road as premature wear of components will result.

Tight Turns in the Field

To make a tight turn at low speed, use both the steering wheel and the turn brake pedal at the same time. For left turn, use the left turn brake pedal and for right turn, use the right turn brake pedal.

CAUTION

Perform tight turns only at a slow safe speed. Doing so at a high speed can cause rollovers and very serious injury or death.

Uphill Start on a Steep Slope

1. Depress the brake pedal.
2. Set the range shift lever to Low and the hand throttle to medium engine speed.
3. Release the brake pedal.
4. Depress the speed control pedal slowly.
5. Adjust the hand throttle to the desired speed.

Driving Downhill

Use the engine's ability to brake when traveling downhill. Never rely on the brakes only and never travel downhill with the gears in neutral.

CAUTION

When operating in hilly terrain the risk of the rollover is increased substantially, please drive with extra care. When towing trailers in hilly terrain ensure that they are equipped with brakes, use a lower gear to get maximum engine braking and do not change gears on a downhill run.

Towing

The following steps are observed when towing a tractor.
1. Do not pull the tractor faster than a ground speed of 16 km/h.
2. Ensure that all controls are in the neutral or OFF position.
3. Use only a rigid towing bar and safety chains to pull the tractor because there may be loss of steering and brakes when the tractor engine is not running.

SAFETY CHAIN

When towing equipment on a highway, use a safety chain as an auxiliary connection between the tractor and the towed equipment. The safety chain must have a rating greater than the gross load of the towed equipment. Connect the chain to the tractor drawbar support and the towed equipment as shown in the illustration. Check the adjustment of the safety chain by turning the tractor completely to the right and left. Adjust the chain as necessary.

Warning

Keep in mind that the weight of a trailed vehicle that is not equipped with brakes, NEVER EXCEEDS the weight of the machine that is being used for towing the vehicle. Stopping distance increases with increasing speed as the weight of the towed load increases, more so when towing on hills and slopes.

HOW TO TRANSPORT TRACTOR

When you transport the tractor by truck or rail, follow these rules:
1. Block the wheels and hold the tractor with tie downs.
2. Move the Speed Lock lever to OFF position and put the range shift lever in the L position for hydrostatic drive.
3. Ensure that the brake pedals are locked together and the brake pedals pushed down. Move the park brake lever up to engage the park brake.

FUEL SAVING TIPS

Following points should always be kept in mind to save fuel & oil in your tractor,

A) Air cleaning system

1) Clean the air cleaner regularly so that dust does not get deposited.
2) Carry out the following for every 50 hours & everyday in sandy/dusty conditions.
   (a) Clean the air cleaner filter element with compressed air.
   (b) Change the rubber ring if it is cut or expanded. Fix the rubber at the proper location & check for leakages if any.
   (c) If air is leaking through the hose connection, check & rectify other leakages, too.

Note : Faulty air cleaning system leads to early wear of piston rings

B) Engine

1) The engine oil is put on load after the engine is heated & the water temperature gauge indicates the needle to be in the green zone.
2) In case of excessive black smoke, check the paper element of air cleaner, fuel injection pump or nozzles.
3) Do not idle the engine for more than 2 minutes. It is better to stop the engine rather than run it idle.

C) Clutch & Brakes.

1) Do not reduce the power of the engine by depressing the clutch halfway. It is better to use low gear.
2) If the Tractor needs to be stopped for a long period, bring the transmission in neutral position & release the clutch pedal.
3) Do not over ride the clutch & brake pedals.
4)While coming down a slope, reduce the engine throttle and use low gear.

D) Fuel system

1) Use filtered diesel for the fuel system
2) It is preferable to fill the diesel tank at the end of the day's working so that it may prevent condensation.
3) In case the system gets choked change the filter. It is not advisable to change both the filters at the same time. Otherwise , the fuel injection pump & injection nozzle would wear out fast. Besides, it would lead to excessive black smoke & excessive diesel consumption.

E) Lubrication system

1) Always use recommended grade of oil.
2) Check the oil level with a dipstick every day before starting the engine & refill to maintain the level between the minimum and the maximum levels.
3) Change the engine oil, replace filter & "O" ring, as and when required.

F) Cooling system

1) Check the fan belt tension regularly and adjust if needed.
2) Check the coolant level in the radiator and keep the fins clean.
3) If it is needed to replace the radiator cap, use a genuine cap only.
4) If needed, the thermostat may be replaced with a new one..
5) Do not change the radiator water frequently.

Note:

1) No leakage of either fuel or oil is tolerable.
2) Regular maintenance is capable of reducing the fuel consumption by 25%.
3) Check the torque of cylinder head bolt and adjustment of valve clearance regularly.
4) Maintain the tire pressure as recommended.
5) Only genuine spares from the authorized dealer/distributor should be used.
6) Tractor servicing by only authorized dealer/distributor should be carried out.

Notes

UNIT 2.4: Tractor hitching with implements and machines

Unit Objectives

At the end of this unit, you will be able to:

- Understand and practice the Tractor hitching with implements and machines

2.4.1 Tractor Hitching

The correct connection of the implement to the drawbar will prevent stress on both the tractor and the implement. To assure proper tractor operation and optimum implement performance, the implement must be connected to the drawbar correctly.

1. Connect pull-behind implements to the drawbar only.
2. Use a hardened steel hitch pin to connect the implement to the drawbar. Make sure the pin is held securely in place with a lock pin.
3. When working with the drawbar, raise the lower links as high as possible to prevent interference between the lower links and the implement.
4. The drawbar provides the standard hitch distance from the end of the PTO shaft to the centerline of the rear hole in the drawbar. This is necessary for safe PTO operation of trailing type equipment.

Drawbar Connecting Implements

1. Connect the implement hitch to the drawbar with a hardened steel pin. Make sure the pin is securely held in place with a cotter pin or lock pin and does not make contact with the implement driveline.
2. Connect the implement hitch to the tractor drawbar before connecting the implement driveline to the PTO.
3. Connect the implement driveline to the tractor. Check the driveline for correct length and for free telescopic movement. The correct length is important to prevent the driveline from hitting bottom or from separating in any tractor or implement operating position.

IMPORTANT: The maximum fixed drawbar vertical load should be checked with the tractor specifications.

Hitching Implements to Three Point Hitch System

Three Point Hitch System

The three point hitch system gives position control and draft control (If equipped) of implements. This tractor is equipped with a category I hitch. The three-point hitch dimensions are shown in the following table.

Implement Identification Dimensions	Cat I Implement
A – Gap in top of implement mast	44.5 mm (1-3/4 inch)
B – Diameter of holes in top of implement mast	19.1 mm (3/4 inch)
C – Diameter of hitch pins	22.2 mm (7/8 inch)
D – Lower Hitch Pin Inner Shoulder Spread	682.6 mm (26-7/8 inch)

Table 2.4.1 Tractor Hitching implements

Connecting Implement to Hitch

To connect an implement to the hitch, use the following procedure:

NOTE: Be sure the tractor and implement are on level ground.

1. Put the draw bar in the storage position.
2. Slowly move the tractor backwards to the implement.
3. When the hitch points on the tractor and implement are in the correct position, stop the tractor.
4. Apply the park brake and stop the engine.
5. Connect the implement to the Upper and Lower Links.
6. Adjust the Upper and Lower Links as necessary. See Hitch System Adjustments in this manual.

Disconnecting Implement from Hitch

To disconnect an implement from the hitch, use the following procedure:
NOTE: Be sure the tractor and implement are on level ground.

1. Stop the tractor completely and apply the park brake.
2. Disengage the PTO; lower the implement to the ground.
3. Gear Drive: Place the gear shift and range shift levers in Neutral.
Hydrostatic Drive: Release the speed lock lever, and place the range shift lever in Neutral.
4. Stop the engine and remove the key from the key switch before leaving the tractor.
5. Disconnect the implement from the hitch.

NOTE: Be sure the tractor and implement are stable and free from any tendency to roll over.

HITCH SYSTEM ADJUSTMENTS

The upper and lower links must be adjusted correctly so the implement can work at the needed depth and the links are free to move up and down with the shape of the ground.

1. Connect the lift links to the tractor and to the lower links. Make sure the lift links are installed on the proper sides.
2. The RH side lift link is adjustable by turnbuckle to obtain the desired position of the hitch point. Turn the turnbuckle clockwise to shorten the link or counter-clockwise to lengthen the link.

IMPORTANT: After the upper link is correctly adjusted, make sure the lock nut is tightened against the turnbuckle.

Stabilizer

When side movement of the hitch is undesirable or hazardous, the lateral swing is adjusted by the turnbuckle on the stabilizer. Turn the turnbuckle clockwise to lengthen the stabilizer or counter-clockwise to shorten the stabilizer.

IMPORTANT: After making final adjustments, carefully raise the implement to make sure that there is proper clearance between the implement and tractor components.

NOTE: Make sure the lock nut is tightened after adjusting the stabilizer.

HITCH CONTROL LEVER

The hitch control lever is used to raise or lower the implement mounted to the three point hitch. To raise the hitch, move the lever to the rear. To lower the hitch, move the lever forward. Adjustable stops are provided for use whenever it is desirable to return the hitch control lever to the same operating position.

IMPORTANT: Position of the raise stop should not be set so rearward that an insufficient free play of the lift arms is available at the highest position when hitch control lever is moved until the lever is reached to the raise stop.

Draft Control Lever (If Equipped)
Draft control can be used to automatically lift and lower an implement to maintain a constant load through variable soil conditions. The amount of draft can be adjusted for the implement being used. To select the correct position for the draft control lever, the tractor and implement must be operated in a field.

Lower the implement and rotate the stopper located on the top of the upper link bracket. Move the draft control lever rearward to select the correct position of the lever. If the implement is lifting up, move the lever forward. If the engine RPM is decreasing, move the lever rearward. The depth of the implement will be automatically controlled by the draft on the implement. Slowly move the hitch control lever forward until the implement is at the needed depth.

Operating with Draft Control (IF EQUIPPED)

For example, the draft control adjustment for a moldboard plow is as follows:

1. Set the upper link at the 560 mm (22-inches) length, pin to pin.

2. Place the draft control lever at the center of its operating range.

3. Starting at the end of the field, move the hitch control lever fully forward to the LOWER position and drive ahead several feet.

4. Stop the tractor and adjust the length of the upper link to level the plow front to rear.

5. Adjust the lift link turnbuckle to level the plow side to side.

6. After the plow has been levelled, adjust the draft control lever either forward (to go deeper) or rearward (for shallower depth) until the desired depth is reached.

7. If the drop action of the plow is too fast, rotate the hydraulic flow control knob slowly until the plow reacts at the desired speed. See Hitch Lowering Speed Adjustment in this manual.

8. When the control levers are set for the field conditions, set the stop so the hitch control lever is returned to this position each time the plow is lowered into the ground.

9. When reaching the end of the field, move the hitch control lever rearward to lift the plow to transport position.

10. Re-enter the field and lower the plow by moving the hitch control lever forward to the stop.

11. The plow will maintain the desired depth as previously set by the draft control lever.

TRAILER HITCH

The trailer hitch is used for towing implement. Do not exceed maximum vertical load on drawbar.
Maximum Vertical Load : As given in the operator's manual

DANGER

Only use trailer hitch to tow and keep the 3 point linkage in raised position when towing with the drawbar. Position can create unbalance causing the Tractor to roll-over & Result the death or serious injury

Exercise

1. Write a short note on Pre-operation checks in Tractor

Answer: ----------

2. How do you identify the trouble shoot in Tractor?

Answer: ----------

3. Write a short note on Tractor Operation in Agriculture Field and important control systems.

Answer: ----------

4. Write a note on Tractor hitching with implements and machines.

Answer: ----------

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

3.Tractor Maintenance

Unit 3.1 - Signs of trouble during tractor operation
Unit 3.2 - Locating the trouble and the cause of trouble
Unit 3.3 - Actions to be taken for taking care of the trouble
Unit 3.4 - Regular servicing checklists
Unit 3.5 - Log book keeping
Unit 3.6 - Service record maintenance
Unit 3.7 - Storage and maintenance of frequently replaceable parts

AGR/N1102

Key Learning Outcomes

At the end of this module, you will be able to:

- Check and maintain fluids regularly/ lubrication points
- Brake and clutch adjustment
- Check working of all the electrical systems and gauges
- Avoid overloading
- Clean/replace air cleaner filter, oil filter and fuel filters
- Clean check electrical system in petrol engine and adjust spark plug
- Care and maintenance

UNIT 3.1: Signs of trouble during tractor operation

Unit Objectives

At the end of this unit, you will be able to:

- Understand the different types of signs which cause problems in Tractor Operation

3.1.1 Signs of trouble during tractor operation

The signs of trouble may arise from engine, hydraulics, transmission, PTO, or electrical systems The following is a list of such problems.

Engine:

- Turning the master brake switch will not operate the starter
- Starter operates but not enough to turn the engine
- Starter operates OK but does not start the engine
- Engine revolutions are irregular
- The engine stops at low revolution
- The engine revolutions is too high
- The engine stops suddenly
- The engine overheats
- Reduced performance of the engine
- Oil warning light comes on with the engine running
- Alternator light comes on with the engine running

Brakes

- Brake not working
- Brake pedal not returning

Steering Wheel

- Steering wheel shaking
- Excessive play in the steering

Hydraulics

- Hydraulics are not lifting
- Oil leak from pipe
- When lifting relief valve whistles
- Flat Battery
- Headlights not working
- Indicator not working
- Horn not working

Notes

UNIT 3.2: Locating the trouble and the cause of trouble

Unit Objectives

At the end of this unit, you will be able to:

- Understand the possible causes of the troubles

3.2.1 Locating the trouble and the cause of trouble

With reference to the signs of trouble indicated in the preceding section, the following Table summarises the causes of these signs of troubles. It is clear that a sign of trouble may have more than causes. As the operator becomes more experienced, the causes become clearer.

System	Signs of trouble	Possible causes of troubles
Engine	Turning the master brake, switch will not operate the starter	Master brake not pushed in Battery flat Switch faulty
	Starter operates but not enough to turn the engine	Low battery Bad earth Thick oil
	Starter operates OK but does not start the engine	Air in fuel system Clogged fuel filter No fuel being supplied Glow plug disconnected or not working
	Engine revolutions are irregular	Air in the fuel system Bleed the system Faulty injector Fuel pipe leak
	The engine stops at low revolution	Poor fuel injection Faulty injection pump Wrong valve clearance Wrong idle setting Faulty injector
	The engine revs. is too high	Faulty governor
	The engine stops suddenly	Lack of fuel Faulty injectors Seized engine due to lack of oil, the wrong oil or lack of coolant Sensitivity of safety device is too high

	The engine overheats	Lack of coolant Broken or misadjusted fan belt Clogged air filter element Clogged radiator Low oil
	Reduced performance of the engine	The injectors are clogged, carbon coated and sticking Low compression Leaking valve seat Incorrect valve gap Faulty timing Fuel shortage Clogged air cleaner
	Oil warning light comes on with the engine running	Low oil level Wrong oil Faulty light or switch Clogged oil filter
	Alternator light comes on with the engine running	Wiring fault Faulty alternator Low water level or faulty battery Broken or loose fan belt
Brake	Brake not working	Incorrect free play Worm or burnt lining Left and right gap different
	Brake pedal not returning	Faulty return spring
Steering Wheel	Steering wheel shaking	Wrong toe in Unequal tire pressure Loose components
	Excessive play in the steering	Worn steering shaft Worn components
Hydraulics	Hydraulics are not lifting	Engine revs. too low Lack of transmission oil Air leaking in from a pipe system Clogged suction filter Faulty pump Faulty hydraulic valve Faulty cylinder
	Oil leak from pipe	Loose pipe joint Cracked pipe
	When lifting relief valve whistles	The stopper has slipped down
	Flat battery	Faulty wiring Faulty alternator or Faulty regulator Broken or loose fan belt
	Headlights not working	Blown bulb Blown fuse Faulty contact
	Horn not working	Faulty horn button Faulty wiring Faulty horn
	Indicator not working	Blown bulb Faulty flasher unit Faulty wiring

Table 3.1.1 Tractor Maintenance

Notes

UNIT 3.3: Fixing the trouble shoot

Unit Objectives

At the end of this unit, you will be able to:

- Understand and practice the actions against the problems occur

3.3.1 Actions to be taken for taking care of the trouble

The following Table is the summary of the signs of trouble, their possible causes and suggested remedial measures.

System	Signs of trouble	Possible causes of troubles	Suggested remedy
Engine	Turning the master brake switch will not operate the starter	Master brake not pushed in Battery flat Switch faulty	Push the clutch in Charge or replace the battery Dealer to repair or replace Contact dealer for repair or replace
	Starter operates but not enough to turn the engine	Low battery Bad earth Thick oil	Charge the battery Clean the earth lead and tighten Drain and replace with correct oil
	Starter operates OK but does not start the engine	Air in fuel system Clogged fuel filter No fuel being supplied Glow plug disconnected or not working	Bleed the system Clean or replace both filters Fill tank or turn tap on Contact dealer for repair.
	Engine revolutions are irregular	Air in the fuel system Bleed the system Faulty injector Fuel pipe leak	Contact dealer for repair.
	The engine stops at low revolution	Poor fuel injection Faulty injection pump Wrong valve clearance Wrong idle setting Faulty injector	Contact dealer for repair Contact dealer for repair Contact dealer for repair Contact dealer for repair Contact dealer for repair

	The engine revs. is too high	Faulty governor	Contact dealer for repair
	The engine stops suddenly	Lack of fuel Faulty injectors Seized engine due to lack of oil, the wrong oil or lack of coolant Sensitivity of safety device is too high	Fill the tank and bleed the fuel system Contact dealer for repair Contact dealer for repair Check safety device or Contact
	The engine overheats	Lack of coolant Broken or misadjusted fan belt Clogged air filter element Clogged radiator Low oil	Refill with coolant Adjust or replace Clean or replace air filter Clean the core Replace the oil to correct grade
	Reduced performance of the engine	The injectors are clogged, carbon coated and sticking Low compression Leaking valve seat Incorrect valve gap Faulty timing Fuel shortage Clogged air cleaner	Contact dealer for repair Contact dealer for repair Contact dealer for repair Contact dealer for repair Contact dealer for repair Fill the tank and check fuel quality Clean the element

	Oil warning light comes on with the engine running	Low oil level Wrong oil Faulty light or switch Clogged oil filter	Contact dealer for repair Top up or replace Contact dealer for repair Replace or adjust
	Alternator light comes on with the engine running	Wiring fault Faulty alternator Low water level or faulty battery Broken or loose fan belt	Contact dealer for repair Contact dealer for repair Top up or replace Replace or adjust
Brake	Brake not working	Incorrect free play Worm or burnt lining Left and right gap different	Adjust to correct free play Contact dealer for repair Equalize
	Brake pedal not returning	Faulty return spring	Replace spring
Steering Wheel	Steering wheel shaking	Wrong toe in Unequal tire pressure Loose components	Adjust toe in Inflate both to correct pressure Tighten or replace if worn
	Excessive play in the steering	Worn steering shaft Worn components	Contact dealer for repair Contact dealer for repair

Hydraulics	Hydraulics are not lifting	Engine revs. too low Lack of transmission oil Air leaking in from a pipe system Clogged suction filter Faulty pump Faulty hydraulic valve Faulty cylinder	Increase engine revs. Top up the oil to the correct level Repair or replace pipe or replace O ring on joint and tighten Clean and change oil Contact dealer for repair Contact dealer for repair Contact dealer for repair
	Oil leak from pipe	Loose pipe joint Cracked pipe	Tighten joint Replace or repair pipe
	When lifting relief valve whistles	The stopper has slipped down	Adjust the stopper
	Flat battery	Faulty wiring Faulty alternator or Faulty regulator Broken or loose fan belt	Repair, reconnect or tighten as needed. Contact dealer for replace or adjust Contact dealer for repair
	Headlights not working	Blown bulb Blown fuse Faulty contact	Replace bulb Replace fuse Repair or replace and check the earth
	Horn not working	Faulty horn button Faulty wiring Faulty horn	Replace button Repair or replace Replace
	Indicator not working	Blown bulb Faulty flasher unit Faulty wiring	Replace bulb Replace unit Repair or replace

Table 3.3.1 Tractor Maintenance

The following list of important Dos and Don'ts needs to be kept in mind by the tractor operator for better performance.

DO – Ensure that safety shields are in place and in good condition.
DO – Read all operating instructions before commencing to operate Tractor.
DO – Carry out all maintenance tasks without fail.
DO – Keep the air cleaner clean.
DO – Ensure that the correct grade of lubricating oils is used and that they are replenished and changed at the recommended intervals.
DO – Fit new sealing rings when the filter elements are changed.
DO –Watch the oil pressure gauge or warning light and investigate any abnormality immediately.
DO – Keep the radiator filled with clean water and in cold weather use anti-freeze mixture. Drain the system only in an emergency and fill before starting the engine.
DO – Ensure that the transmission is in neutral before starting the engine.
DO – Keep all fuel in clean storage and use a filter when filling the tank.
DO – Attend to minor adjustments and repairs as soon as necessity is apparent.
DO – Allow the engine to cool before removing the radiator filler cap and adding water, remove the radiator cap slowly.
DO – Shift into low gear when driving down steeps hills.
DO – Latch the brake pedals together when driving on a highway.
DO – Keep draft control lever fully down when not in use.

DON'T – Run the engine with the air cleaner disconnected.
DON'T – Start the tractor in an enclosed building unless the doors and windows are open for proper ventilation.
DON'T – Operate the tractor or engine while lubricating or cleaning.
DON'T – Allow the tractor to run out of diesel fuel otherwise it will be necessary to vent the system.
DON'T – Temper the fuel injection pump, If seal is broken the warranty becomes void.
DON'T – Allow the engine to run idle for a long period.
DON'T – Run the engine if it is not firing on all cylinders.
DON'T – Ride the brake or clutch pedal. This will result in excessive wear of the brake lining, clutch driven member and clutch release bearing.
DON'T – Use the independent brakes for making turns on the highway or at high speeds.
DON'T – Refuel the tractor with the engine running.
DON'T – Mount or dismount from the right side of the tractor.
DON'T – Temper the hydraulic control levers' upper limit stops.
DON'T – Use draft control lever for lifting of implements.
DON'T – Start the engine with the PTO engaged.
DON'T – Use the governor Control Lever (Hand throttle) while driving on roads.
DON'T – Move the hydraulic levers rearward.

Notes

UNIT 3.4: Regular servicing checklists

Unit Objectives

At the end of this unit, you will be able to:

- Understand the regular service checklists for Tractor maintenance

3.4.1 Regular servicing checklists

Service Hour Interval

Service your tractor at the intervals and locations given on the Lubrication and Service Chart. When you service your tractor, use only high quality lubricants.
Engine Hour meter

The engine hour meter shows the amount of actual hours of the tractor has operated at an average RPM. The first number to the right displays tenths of an hour and is a black number on a white surface. The remaining numbers are white on black. Use the hour meter along with the Lubrication Chart to service your tractor at the correct time periods.

Service after First 50 Hours

1. Engine Oil

Drain all the oil from the crankcase while the engine is warm and refill with new oil to the upper Notch (full) on the engine oil dipstick. See Engine Oil Change in this manual.

2. Engine Oil Filter

Replace the engine oil filter. See Engine Oil Filter in this manual.

3. Transmission & Hydraulic System

(1) Transmission Oil
Check the level of the transmission oil. Add the specified fluid as needed to maintain proper level. See Transmission Oil Level in this manual.
(2) Hydraulic filter
Replace filter with a new one. See Hydraulic Filter in this manual.

4. Front Axle Lubricant (MFD)

Change the oil. See FRONT AXLE LUBRICATION (MFD) in the manual.

5. Radiator Core

Inspect the radiator core and clean if necessary. See COOLING SYSTEM in the manual.

6. Hoses and Connections between Air Cleaner and Manifold.
Inspect for loose fit or leakage. See AIR INDUCTION SYSTEM in the manual.

7. Water Pump, Fan and Alternator Belt Tension
Check the belt for tension, replace if necessary. See Fan Belt Adjustment in the manual.

SYSTEM CAPACITIES

System	Amount (Consult the operator's manual for your specific model)
Engine Oil no filter change	3.7 Litres
with filter change	4.2 Litres
Fuel tank	30 Litres
Coolant engine and radiator coolant bottle	 6.7 Litres 0.4 Litres
Transmission Oil gear drive	24 Litres
Front Axle MFD	4.0 Litres

Table 3.3.1 System Capacities

SERVICE FREQUENCY

Service Point	No. Of Points	Frequency in hours				
		Clean	Change	Check	Grease	Drain
Engine Oil Level	1			10		
Front Axle Tie Rod	2				10	
Front Axle Pivot Pin	1				10	
Power Steering Cylinder End					10	
Brake Pedal Boss	2				10	
Transmission Oil Level	1			10		
Radiator Coolant Level	1			10		
Fuel Filter Cup	1	10		10		
Air Cleaner	1	10		10		
Fan Belt Tension	1			10		
Grill and Radiator Area	1	50		50		
Tire Pressure	4			50		
Fuel Tank Water Drain Plug	1					50
Engine Oil			100			

Wheel Retaining Bolts and Nuts				100		
Engine Oil Filter	1		200			
Transmission Oil	1		200			
Hydraulic Fllter	1		200			
MFD Front Axle Lubricant	1		200			
Clutch Pedal	1			200		
Brake Pedal	2			200		
Air Induction System	1			200		
Engine Valve Clearance (See Note 1)	B			200		
ROPS Equipment				200		
Cooling System		Y	Y			Y
Air Cleaner Filter Element (See Note2)	1		AY			
All Linkage Pivot Points (See Note 3)	8	AY				
Threads of 3-Point Hitch Links	2				AY	
Fuel Filter	1		AY			
Hydraulic System				AY		
Battery Terminals		AY		AY		

Table 3.3.1 Service Frequency

MARK Y : Yearly or 1000 Hours, whichever occurs first.

AY : Yearly or as needed.

Note 1: Consult your Dealer.

Note 2: Replace element after 10 cleanings or yearly.

Note 3: Apply Gear Oil.

Notes

UNIT 3.5: Log book keeping

Unit Objectives

At the end of this unit, you will be able to:

- Maintain the log book for Tractor Maintenance

3.5.1 Log book keeping

One of the important records necessary for efficient operation and maintenance is the log-book. This log book indicates the history of tractor operation to undertake preventive maintenance and for troubleshooting. The entries in a log book are indicated in the following proforma. Printed and bound log books for tractors can be purchased.

DAILY OPERATION LOG

Date	Job Done	MACHINE HOURS		FUEL CONSUMPTION	ENGINE OIL TOPPED UP	REMARKS
		Start	End			

Table 3.5.1 Operation Log

Notes

UNIT 3.6: Service record maintenance

Unit Objectives

At the end of this unit, you will be able to:

- Maintain the service record in Tractor Operation

3.6.1 Service record maintenance

Service records are vital to maintain the tractor in perfect working condition. These records clearly indicate whether certain components are wearing too fast or whether it is time to replace a particular part.

We need to not only maintain the service record of the tractor but also the record of components replaced. The following proformas indicate the formats of such record keeping.

TRACTOR HISTORY CARD

DATE	JOB CARD NO.	NATURE OF DEFECT	PARTS REPLACEMENT	W/CLAIM NO. AND DATE	REMARKS

Table 3.6.1 Tractor History Card

SERVICE RECORD

DATE	TRACTOR HOURS	NATURE/TYPE OF REPAIR/SERVICE CARRIED OUT

Table 3.6.1 Service Record

Notes

UNIT 3.7: Storage and maintenance

Unit Objectives

At the end of this unit, you will be able to:

- Understand the storage condition for Tractor when it is not used

3.7.1 Storage and maintenance

Storing the Tractor

When the tractor is not to be used for some time, it should be stored in a dry and protected place. Leaving your tractor outdoors, exposed to the elements, will shorten its life. Follow the procedure outlined below when the tractor is placed in storage for periods up to approximately six months. See your Dealer for the procedure for longer storage periods.

A. Store the tractor so the tires are protected from light. Before storing the tractor, clean the tires thoroughly, Jack up the tractor, when it is to be out of service for a long period. If not jacked up, inflate the tires at regular intervals.

B. Run the engine long enough to thoroughly warm the oil in the crankcase, then drain the oil. Change the oil filter as instructed in Engine Oil Filter. Refill the crankcase with a new oil as specified in Engine Oil Selection in this manual and run the engine for five minutes.

C. Fill the fuel tank with a good grade of Number Two diesel engine fuel. If this grade has not been used regularly, drain the fuel and refill. Run the engine for about five minutes to circulate the fuel through the injection system.

D. Drain, flush and fill the cooling system with an antifreeze mixture ratio to protect the engine to the lowest anticipated temperature or a minimum of 50% antifreeze and add cooling system conditioner. See COOLING SYSTEM in the manual.

E. Do not remove the battery from the tractor, except for prolonged storage at below freezing temperature. The battery should be fully charged to prevent freezing of electrolyte. Disconnect the negative ground cable at the battery to prevent possible discharge.

F. Clutch assembly may become bound together if a tractor is not used for an extended period of time. A clutch lock latch is provided on the tractor to lock the clutch in the disengaged position and should be used to prevent this condition if your tractor is not used for an extended period of time.

REMOVING FROM STORAGE

Be sure that the grade of oil in the engine crankcase is as specified in Engine Oil Selection in the manual.

A. Loosen the fuel tank drain plug and fuel filter cup, and be sure all water and sediment has drained from the fuel system before closing. Tighten the drain plug and replace the filter cup.

B. Check the level of the coolant in the radiator.

C. Check engine oil level.

D. Check hydraulic fluid level.

E. See that the battery is fully charged and that the terminal connections are clamped tightly.

F. On hydrostatic drive tractors, follow the same procedure for starting as Starting Procedure for Hydrostatic Drive Tractors after Transporting on Truck or flat car in this manual.

G. Start the engine and let it run slowly.

IMPORTANT: Keep the doors wide open and move the machine outside of the storage room immediately to avoid danger from exhaust fumes. Do not accelerate the engine rapidly or operate it at high speed immediately after starting.It is necessary to maintain a record of the replacement of tractor parts with a view to know whether the parts are wearing out as indicated in the manual or the replacements are more frequent. Also, to reduce the down time, an inventory of such parts should be maintained.

To obtain spare parts, please, contact your nearest dealer and give the following details.

1. Tractor model
2. Tractor serial number
3. Tractor engine number
4. Part number and description
5. Quantity required.

PART REPLACEMENT RECORD

DATE	PART DESCRIPTION	QTY	COST	DATE	PART DESCRIPTION	QTY	COST

Table 3.7.1 Part Replacement Record

Exercise

1. What are the Signs of trouble occur during tractor operation ?

Answer: ----------

2. What are Regular servicing check lists? Explain.

Answer: ----------

3. What do you mean by Tractor maintenance?

Answer: ----------

4. Write a short note on Storage and maintenance of frequently replaceable parts in Tractor

Answer: ----------

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

4. Maintain Health & Safety at the work place

Unit 4.1 - Operator's health and clothing
Unit 4.2 - Adjustments in the work place
Unit 4.3 - Hazards, risk and risk controls when using tractors
Unit 4.4 - Safety when operating on public roads
Unit 4.5 - Safety when using PTO
Unit 4.6 - Proper work-rest cycle
Unit 4.7 - People at special risk
Unit 4.8 - Emergency preparedness
Unit 4.9 - Hazard checklist – Tractors and Machinery

AGR/N9903

Key Learning Outcomes

At the end of this module, you will be able to:

- Maintain a clean & efficient workplace
- Render appropriate emergency procedures
- Reporting time to time to appropriate person
- Practice General safety and first aid

UNIT 4.1: Operator's Health & Clothing

Unit Objectives

At the end of this unit, you will be able to:

- Understand the health of the Operator to operate the Tractor

4.1.1 Introduction

Level of mechanization in Indian agriculture is increasing faster for the reasons of improving the profitability of Indian agriculture, coping up with the reducing labour availability, improving the timeliness of farm operations, and reducing the drudgery in farm operations. However, increasing mechanization level also leads to higher incidence of farm accidents, some of them even fatal.

As per survey data available for India, the overall accident incidence rate per year is 333 accidents per 100,000 workers whereas the fatality rate per year is 18.3 per 100,000 workers with a higher fatality rate of 22% for powered machinery including tractors Of the total accidents reported 30.5% accidents were due to farm machines, 34.2% accidents were due to hand tools and the remaining 35.3% were due other sources (like snake bites, drowning in wells/ponds, animal bites, lighting, etc.). Under the farm machinery category about 31% of accidents were due to tractors and tractor operated equipment, 22% due to animal drawn equipment, 14% due to threshers, 12% due to electric motor/pump sets, 9% due to chaff cutters, 6% due to power tillers, 4% due to sprayers and 2% due to other machines. The data suggests that fatalities in Indian agriculture are 11.4/lakh workers/kW farm power. In comparison, the fatalities in US agriculture are 6.5/lakh workers/kW farm power. The total cost due to these agricultural accidents is estimated to be Rs. 5,400 crore per year.

These farm accidents generally occur, in case of tractors, due to the lack of awareness and training of the tractor operator. Maintaining the tractor and associated equipment in good condition and observing the instructions related to the safe operation would minimize the accidents.

Essential Instructions:

Fig 4.1.1 Health & Safety

- Conduct pre-operational safety check and get the necessary repairs done. Take special precaution on rough terrain and slopes.
- The tractor and the attached equipment must have been properly maintained.
- The operator must have gone through an accredited training.
- To fuel/refuel shut off engine, let engine cool, and fuel in an open area.
- A copy of the operator's manual should be readily available to the operator.

Before starting a tractor

The following checks are required, while an operator proceeds to a tractor for its operation, whether

my clothes and shoes are appropriate?

I have read the relevant operational manual for the task

I understand the method of performing the task

I have made the machinery checks required for its operation

I have made sure that the tractor fuel tank has adequate fuel

I have understood the safety steps needed for the task at hand

Start and run tractor in open well ventilated areas only. Carbon monoxide poisoning can occur in a few minutes inside a building or enclosed structure.

Safety on stopping the Tractor

An operator must ensure the following compliances before disembarking the tractor or stopping for anyone approaching him/her.

1. Hand brakes should be fully applied

2. The controls and the attached equipment should be brought back to safe stages

3.The ignition key should be removed

Notes

UNIT 4.2: Adjustments in the work place

Unit Objectives

At the end of this unit, you will be able to:

- Understand the adjustments in the Tractor at the work place

4.2.1 Adjustments in the work place

Seat, the controls, levers, and mirrors on a tractor constitute the work place of a tractor operator. The work place should provide the necessary comfort, safety and ease of operation at all times to an operator for various jobs. Check the seat position with a view to operate all controls comfortably. A tractor operator should adjust the seat according to his/her convenience and sit comfortably in the operator's seat to ensure that his/her movements of hands, head and legs are not constrained in any way. Replace the seat if needed.

Make sure mirrors are properly adjusted and cleaned to give full visibility. Look in the operator's manual to find out how to recognize controls so that he/she is always in control of the tractor. There are some controls mounted externally, such as rear mudguard, to aid hitching. The operator will need to take different precautions when operating these controls. Before carrying out any adjustments ensure the tractor is in safe stop position. The operator must know how to get in and get out safely from the work area. Keep floors, pedals and the shoes clean and mud-free to avoid slippage. The operator should get out facing inwards so that he/she has a good grip while stepping down.

Never get on or off a moving tractor.

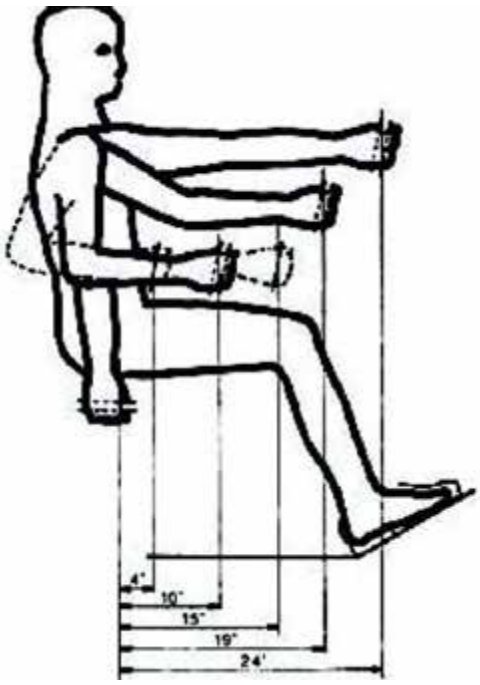


Fig 4.2.1 Tractor Control System

Frequently used control need to be placed in such that they allow the operator to use them without undue exertion or fatigue

The operator must never use any control unless he/she is correctly seated on the tractor. The operator must know where the controls should be before the tractor is started. Different tractors have different controls. One should never use a machine that has not been taught for its use.

Notice the position of the external controls and look in the operator's manual to find out where to stand when using the external controls. Only use external controls to hitched equipment in accordance with the operator's manual. Do not place any part of your body in between the tractor and any mounted implement when operating these controls.

Notes

UNIT 4.3: Hazards, risk and risk controls when using tractors

Unit Objectives

At the end of this unit, you will be able to:

- Understand the risks and hazards at the work place
- Understand the risk controls when using tractor

4.3.1 Hazards, risk and risk controls when using tractors

Finding and fixing safety problems associated with using tractors on farm and off farm need to be put into practice.

Tractor rollover and risk controls

Rollovers and back-flips are a common cause of tractor deaths. Driving on narrow or raised tracks or roads poses a risk of the tractor rolling over embank-ments and injury to the operator.

It is desirable that all un-cabined tractors are fitted with Roll Over Protective Structures (ROPS). ROPS are not provided on tractors sold in India so far. The operator needs to always wear a seatbelt when driving a tractor with a ROPS.

Widen the wheel width of the tractor to the maximum to increase stability of the tractor.

Plan and check routes before transporting tractors to make sure that there is no risk of tractors rolling over embankments. Check the Safe Working Load (SWL) of each tractor. Under no circumstances should the SWL be exceeded.

When working on steep slopes:

- Always travel slowly
- If there is not enough room for a gradual turn, use a slow three point turn
- Reverse up the hill and when coming down, drive slowly forwards in low gear
- Add front end weights to a tractor pulling a heavy load up a hill

When driving:

- Always travel with a front end loader as close as possible to the ground
- Always reverse out of a bog or use another tractor to pull it out.
- Only use the drawbar when towing.

Fig 4.3.1 Hazards at the work place

Fig 4.3.1 Sideways rollover

Tractor rollover

Why do tractors rollover?

Sideways rollover* and *back flips account for most of all rollovers. Gravity and centrifugal force are the two major forces involved in a sideways rollover. *Back flips* are produced through rear axle torque and drawbar leverage.

1. *Sideways rollover*

Sideways rollovers occur most commonly when traversing a steep slope or cornering too sharply at speed. To understand sideways rollover we need to understand the relationship between the *tipping axis* of the tractor and its *centre of gravity* together with the amount of *centrifugal force* developed during cornering. The *tipping axis* is the line that a tractor will pivot about during tipping if driven over a steep enough slope. Once the *centre of gravity*, usually located in the vicinity of the gearbox in the midline of the tractor, lies outside the tipping axis, a rollover is inevitable. *Centrifugal force* is introduced when a tractor is cornering. This force tends to pivot the tractor on its outside wheels during cornering. This predisposes the tractor to roll over. The centrifugal force varies according to the weight of the tractor, the speed and the turning angle. When a tractor is turning on a slope its centre of gravity may be approaching its tipping axis and it may only require a small amount of centrifugal force to cause a rollover.

Fig 4.3.1 Back flips

Sideways rollover

2. *Back flips*

For a back flip to occur there needs to be two forces in action *rear-axle torque* and *drawbar leverage. Rear-axle torque* is the transfer of energy between the engine and rear wheels of a tractor. It may be described as the rear axle rotating with respect to the chassis. If axle rotation is prevented as in the case where the tyres are stuck (eg if bogged, frozen to the ground or if the load is very heavy), the rotational force moves the tractor backwards around the rear axle, lifting the front wheels off the ground and a back flip can result.

Fig 4.3.1 Tractor run over

Back flips

Practices which involve rear-axle torque reactive force acting to cause a back flip include driving off in low gear but with high engine speed, driving the tractor forward when the wheels are unable to move forward, rapid engagement of the clutch of the tractor, and rapid acceleration, particularly when driving uphill or pulling a heavy load. Four wheel drive tractors are less likely to back flips as they have more weight over the front axle than a 2WD and the torque is applied to both front and rear axles. *Drawbar leverage* describes the force which tends to pull the tractor rearwards when it is towing or pulling an object. The magnitude and its effect on tractor stability will vary according to a number of factors including the weight, draft, hitching point used, resistance to movement and angle of pull.

Tractor run over

The risk of tractor run over is always present wherever tractors are working. Injuries associated with tractor run over are generally severe. This is due to the weight of the tractor and the nature of associated implements by which the victim is also frequently run over. Examples of associated equipment include rotary hoes, trailers, chisel and disk ploughs. Deaths from tractor run over are becoming more common and often result from crush injury to the head and upper body. People may be run over by the rear wheel of a tractor or by an implement when they slip, trip or fall on the ground in front of a tractor. Standing next to a tractor in front of the rear wheel or a trailing implement may result in being run over.

- The tractor should be started using the normal key.
- Always lower 3-point linkage and auxiliary equipment when parking the tractor.
- Take frequent short breaks when driving the tractor for long periods of time to help reduce fatigue.
- When having tea or lunch breaks, stop and get off the tractor for a break, don't eat and drive on the run.

Fig 4.3.1 Accident due to entangle with PTO

Tractor run over

Tractor power take offs (PTOs)

The tractor's power take-off (PTO) provides the power source for many implements and equipment used in production farming. Examples include the thresher, post-hole digger, fertilizer spreader and many others. The power take-off is a rotating stub shaft at the rear of the tractor. The power take-off and its attachments are a series of high speed shafts that move in a circle 88 mm from the centre of a shaft revolving at 540 RPM at a speed of 5 linear metres per second. This rotating shaft assembly poses a severe hazard. The rotational force of the shaft is the source of the hazard. It is present wherever implements are power-driven by the tractor power take-off shaft. There is a risk of entanglement of body parts with the shaft. It usually occurs when hair, clothes or jewellery become caught in the rotating shaft. Working near an inadequately guarded PTO shaft runs the risk of entanglement. Bystanders, helpers and children are at risk of injury or death due to their curiosity and limited understanding of hazards.

Fig 4.3.1 Hydraulics

Accident due to entangle with PTO

Stepping over an operating PTO increases the risk of entanglement. Wearing loose clothing, clothing with drawstrings, jewellery or having long hair increases the risk of entanglement. Fatigue may increase the risk of entanglement in a PTO as operator reflex times may be slowed and concentration lost.

Fit and ensure that all PTO assembly and shaft guards are in good order and functional before tractors are operated. Replace missing master guards on tractors.

Only people who are absolutely necessary to do the job should be present while the power take-off is in operation. Guards should only be removed for repair or maintenance. If removed, guards should be refitted before further operation. When undertaking these activities, the power takeoff should always be disengaged and the tractor shut off beforehand. Reduce power take-off shaft damage by observing the following:

- Avoid tight turns that pinch rotating shafts between the tractor and machine.
- Keep excessive telescoping to a minimum.
- Engage the power take-off gradually and avoid over-tightening of slip clutches on power take-off driven machines.

Disengage the power take-off before dismounting. It is especially important when working with power take-off equipment that clothing be of a snug fit, buttons done up and sturdy boots are worn. Jackets should be buttoned or zipped up. Rolled up shirt sleeves should be avoided. Pants or overalls with straight legs which don't drag on the ground are preferable to reduce the risk of entanglement. Frequent short breaks when operating the tractor for long periods of time will help reduce fatigue.

Hydraulics

Working with hydraulics involves the risk of injury from oil under pressure. Many hand injuries are associated with oil under pressure and these injuries are difficult to treat effectively due to the oil penetrating may tissue layers under the skin. Hydraulic fluid under pressure poses risk of penetrating injury. If hydraulics fail, there is a risk of serious crush injury is the rig falls.

Check and replace leaking hydraulic hoses and fittings. Before working under raised hydraulic implements, ensure that hydraulic and ram locks have been fitted and that machinery is chocked and supported.

Fig 4.3.1 Operating an equipment

Fig 4.3.1 Trailer breaks

Accident due to hydraulic system

Hitching an equipment

Accidents could occur when hitching or unhitching tractor-mounted machines. To prevent these accidents, follow the instructions given below.

- Stop the tractor in the safe manner.
- Operate controls from the correct position.
- The operator must realize that the helper (s) could also get injured.

Important points

- Ensure that the correct hitch system is being used.
- Only use controls from the operating position.
- Take extra care when using external controls.
- The helper (s) must never stand between the tractor and other machines, or behind them, unless the tractor is stationary and the operator is aware of his/her presence.
- No one must stand with one's feet under, on or near drawbars.
- Ensure that jacks, skids and other relevant tools are used and maintained.

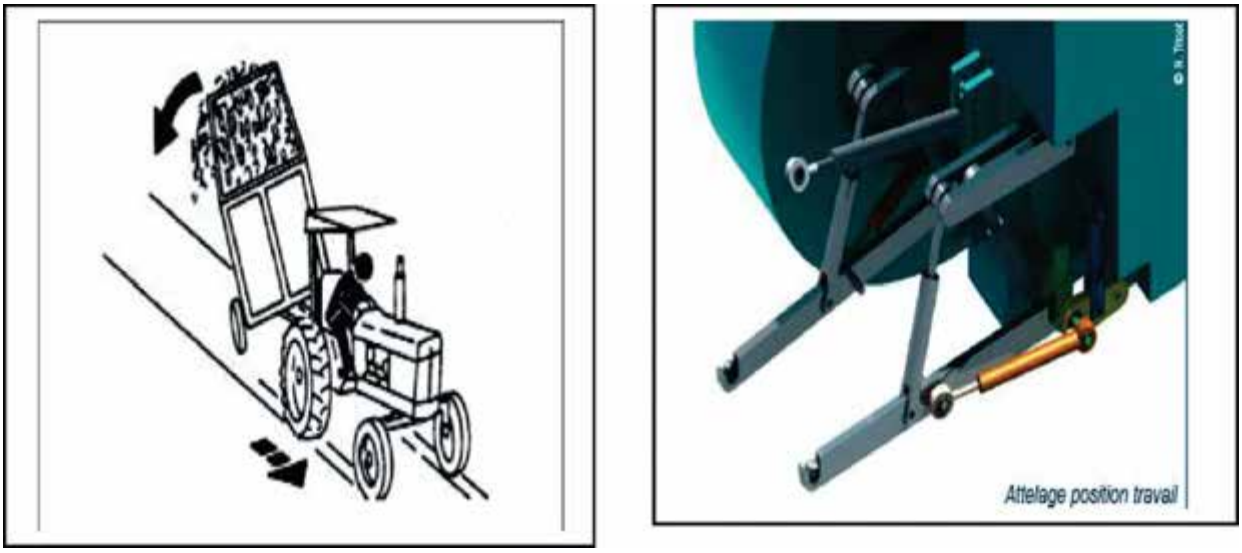


Fig 4.3.1 Hitching an equipment

Operating an equipment

This step is about getting the engine started and making sure it is safe to begin the work. Check the brakes, the steering and other controls. Also check that no one else is in danger from your tractor.

Unless the operator has been trained to operate the equipment with the tractor, he/she must not try it. The operator must make sure that he/she understands the controls before operating the tractor.

Before moving off, the independent brakes must be locked together. They should always be locked together for road and transport use. Make sure no one is near before starting the engine. Check the brakes and steering. Operate correctly.

Working with other machines and trailers

Unguarded power take-offs, power take-off shafts, machine blockages and maintenance activities could be the cause of many serious injuries.

Correct guarding is essential and the instructions about safe stop must be observed. Only then will the operation of other machines could be safe.

Trailer Brakes

- Using tractors and trailers without an adequate braking system leads to serious accidents including overturning.
- Tractors and trailers used on or off the road need to stop safely within a reasonable distance under all conditions.
- Properly maintain and adjust braking systems for tractor-trailer combinations to ensure efficiency and safety. Testing on the move may be necessary after maintenance.
- Keep hydraulic and air brake couplings clean and avoid contamination.
- Make sure linkages are properly lubricated and operate freely and keep them maintained.
- Check the parking brake works properly.
- After use, clean mud and contamination from brakes (including parking brakes). Make sure the cleaning method does not lead to deterioration of the brakes (eg rusting caused by pressure washing). Tractors which are not fitted with a self-balancing braking system require more frequent checks to make sure the brakes are evenly balanced.
- Follow the manufacturer's recommendations for frequency and detail of inspection.
- Some older brake linings may contain asbestos. Take appropriate precautions to avoid breathing dust and when disposing of waste material.
- Make sure operators are familiar with the operation of air brake systems (if fitted) so they know how to attach and detach trailers safely.

Fig 4.3.1 Accident caused due to absence of braking system in trailer

Other machinery

- Check the machine is properly guarded and the guards have no defects.
- Check the machine for defects.
- Check the brakes are connected.
- Make sure the operator is trained and competent to use the machine
- Always use safe stop practice
- Don't use the machine unless it is properly maintained.
- Always lower machines to a safe position before leaving the seat.

Presence of overhead electricity power lines

Overhead electricity power lines (OHPL) exist on many farms. This step is about dealing with the dangers they present.

- Contact with any OHPL can kill, so plan to avoid working near them if possible.
- Be aware of minimum line heights and the maximum height/reach of tractors and machines passing below or near OHPLs.
- Consider the height and reach of machinery when buying or hiring replacements.
- As far as possible, use alternative access points and routes to avoid the lines.
- Always look out for warning signs and try using safe tipping areas away from OHPLs.
- One should look for ways to reduce the risk of contact with OHPLs

A safe working system

- Always plan work in advance so that the work methods are safe at all stages.
- Drive slowly where the ground surface is not easily seen, e.g., in fields with dense vegetation.
- Ensure you use a large enough tractor for the machine or trailer you are using, taking account of the weight of the machine, trailer and any load.

Driving across and turning on slopes

- Always try descending straight down the gentlest possible gradient of a slope, rather than driving diagonally across it.
- Do not take the hazardous step of turning down a slope.
- Plan work across slopes so that turns are made uphill rather than downhill.
- Use the widest practicable wheel track setting to reduce the likelihood of the tractor overturning.

Turning with rear-mounted equipment on a slope

- Add enough front ballast to counterbalance rear-mounted equipment, particularly when working on slopes. Use of such ballast may reduce safety when travelling downhill.
- Remember, when using rear-mounted fertilizer spreaders or sprayers the tractor rear-wheel grip reduces as the load is discharged.
- Remember, the steady weight reduction reduces traction and increases the possibility of sliding, especially when coming down the slope.
- The higher the mounted equipment is on the tractor's rear linkage, the less stable the tractor becomes.
- Keep mounted equipment as low as possible (within the constraints of effective use).
- Select the correct gear for the ground conditions and turn slowly, so that the tractor is under complete control during the maneuver.

Tractor with raised load on the front end

- Ensure enough ballast weight is fitted to the rear.
- Make sure the loader is not overloaded (consult the manufacturer's handbook)
- Whenever possible, lower the loader for travel.
- Do not drive at high speed, make abrupt turns, or suddenly stop with the loader raised.
- Plan fore-end loader work to minimize travel with the loader raised.

Clutch use

- The operator should select the correct gear at the beginning of the slope, and avoid changing the gear while traversing the slope.
- Engaging four-wheel drive (if available) before working on slopes is recommended.
- Remember that suddenly engaging the clutch can cause a rearward overturn. Therefore, let the clutch in slowly and avoid snatching. This is particularly important when driving up slopes.
- Keep the pedals, footwear and tractor floor/footplates as dry and free from mud as possible.
- Be aware that electro-hydraulically operated clutches may engage more suddenly than mechanically operated clutches.

Parking

- Ensure that the tractor engine is stopped and the parking brakes are fully applied before dismounting.
- Avoid parking on a steep slope with a heavy load.
- Parking on level ground is preferable, especially, when carrying out loading/unloading activity.

Driving near a ditch or bank

- The operator needs to take notice of the depression or the water body while operating the tractor and keep a safe distance from banks and ditches, especially, when turning.
- If driving near the ditches or banks is unavoidable, be extremely careful and keep the speed low to maintain tractor control, particularly where the surface is loose or wet or where the edge is concealed by undergrowth.
- Make headlands wide enough for safe turning.

Tractors and Machinery Guarding

- Are all tractors fitted with approved rollover protection structures ROPS)?
- Do all tractors fitted with a frontend loader or forklift, have approved rollover protection structure with falling object protection (FOPS)?

- Is the PTO master shield in place on all tractors?
- Are all Power Take-Off (PTO) and drive shafts and PIC shaft guarded?
- Are all appropriate guards including manufacturer's guards in place, in good condition and well maintained on all tractors?
- Are steps and handrails in good condition?
- Do tractor access steps prevent the operator being run-over by the rear wheel? (Access to many older tractors allows the operator to be run over when standing or falling in front of the rear wheel).
- Do all exhaust systems function properly and in good condition?
- Are lights, reflectors, and mirrors, clean and functional?
- Are all brakes, including handbrakes properly adjusted and in good working condition?

Noise

- Hearing injury occurs where the operator is exposed to damaging levels of noise.
- When operating tractors always wear ear muffs or ear plugs.

Operator skills

All workers who operate tractors must undertake tractor safety training, which includes:

• Information regarding the risks associated with various processes undertaken and general tractor operation

• Specific rules that have been developed to minimize the risk of injury and illness

• How to report hazards that they identify when working with tractors

Notes

UNIT 4.4: Safety when operating on public roads

Unit Objectives

At the end of this unit, you will be able to:

- Understand the safety procedures while operating the Tractor

4.4.1 Safety when operating on public roads

A tractor with or without an implement or a trolley requires due care and protocol to avoid any injuries and damages while driving on public roads. Any mechanical system including a tractor, if not operated with care, would be a potential danger to human beings as well as property. The following safety instructions must be observed in letter and spirit.

A tractor operator needs to be a competent driver before he/she can operate tractors and other machinery safely. Above all, watch out for other people and keep your speed down.

- Put the slow moving vehicle sign at the back of the tractor or the equipment in such a way that it is clearly visible to the approaching vehicles.
- Don't drive tractors unless they are properly maintained and safe.
- Fix or get the defects fixed as soon as possible.
- Never rush when operating tractors.
- Watch out for obstacles and blind spots.
- Follow and comply with warning signs.
- Look for unexpected presence of other people and children around.
- Visibility may be reduced due to equipment, loads, bad weather or bright sunshine.
- Help may be sought if visibility is reduced, especially when reversing.
- Use mirrors, horns and any other reversing aids that may be fitted to the tractor.
- Watch for rear-end swing when travelling with long implements such as ploughs.

Notes

UNIT 4.5: Safety when using PTO

Unit Objectives

At the end of this unit, you will be able to:

- Understand the safety procedures while using PTO

4.5.1 Safety when using PTO

- Follow the safe stop procedure whenever possible – it makes sure nothing will move.
- Take extra care when using a PTO-driven machine in a stationary position.
- Ensure guards are in place – check they are properly chained, lubricated and free from defects.
- Repair or get repaired any faults immediately.
- Do not use a machine with a damaged PTO shaft guard.
- Ensure the tractor is chocked or that there is a mechanical connection between the tractor and a stationary PTO-driven machine to ensure the tractor or machine does not move, causing the PTO shaft to separate.
- Ensure to check the PTO is guarded where the PTO shaft attaches to the tractor.

Notes

UNIT 4.6: Proper work-rest cycle

Unit Objectives

At the end of this unit, you will be able to:

- Understand the proper work rest cycle of the Tractor machine

4.6.1 Proper work-rest cycle

- Operating a tractor with or without equipment is a very strenuous job and requires ergonomic considerations.
- Ergonomics is the relationship of the body to the work that is being done. It involves changing the environment to better fit the worker. Operating tractors for long hours can be associated with back, shoulder and other pain and injury – especially with poorly designed seats and controls.
- Check that seats are in good condition and fit the purpose. Adjust mirrors to give good vision and reduce the need to look backwards.
- Make sure that controls are adjusted where possible to fit the person doing the work.
- Take regular breaks to exercise the neck and back to prevent neck, shoulder and back pain.

Notes

UNIT 4.7: People at special risk

Unit Objectives

At the end of this unit, you will be able to:

- Understand the different risk situations at the work place

4.7.1 People at special risk

The safety of all, including children and family visitors must be ensured A person standing in front of a tractor may be crushed against a post, gate or building by the front of the tractor. Small children may be run over by tractors because they are difficult to see when the tractor is reversed or driven away.

Passengers are at risk of tractor run over if there is not a designated passenger seat.

Children are particularly at risk as they lack the strength to hold on especially when travelling over rough ground. Mounting and dismounting a moving tractor may result in being run over by the rear wheels or implement.

Starting the tractor from the ground may result in tractor run over if the tractor is in gear. Fatigue may increase the risk of run over as operator reflex times may be slowed and concentration lost

- Every time a tractor is used, the operator should look out for other people, especially, when other workers are engaged nearby.
- Check for bystanders before starting tractors or machines.
- Check where people are working and make sure they are visible.
- Let these people know that the tractor is going to be operated and make sure instructions can be heard and understood.
- Only carry someone else if a proper passenger seat is fitted.
- Use the horn to warn the people in the vicinity that you are going to start.

Helper of a tractor operator needs to observe the following guidelines:

The operator and the helper need to have clear understanding about their work together.

- In case of the use of hand signals, both need to understand the meanings of these signals

- The tractor operator must clearly see the helper
- The helper should find out the safe places to work or stand when near machines.
- The helper needs to listen to and follow the instructions.
- The helper must not operate any external controls unless instructed to do so.

Warning

- Children are not allowed to drive or ride on a tractor.
- Keep them away from working tractors.
- If any children are nearby, stop work and make sure they move to a safe place.

Notes

UNIT 4.8: Emergency preparedness

Unit Objectives

At the end of this unit, you will be able to:

- Understand the emergency preparedness at the work place

4.8.1 Emergency preparedness

General

- Communication systems should be in place to ensure that tractor operators are in contact with others on the farm, and that emergency activities could be taken up without delay.
- Emergency plans and procedures should be prepared and communicated to all concerned.
- Emergency plans should include plans for dealing with injury, poisoning, fire, explosion, pesticide and spills of hazardous substances.

First aid

- A suitable first aid kit should be accessible to the operator on the tractor.
- The kit should be suitable for management of common farm injuries and snake bite.

Fire

- Fire is a hazard which is often present when using tractors on the farm.
- Fire extinguishers should be available where fire is a hazard.
- The operator needs to be trained in, emergency fire procedures.

In the event of overturning

Accidents happen because drivers misjudge slopes, ignore changing ground conditions and forget the effect of loads on stability – do not drive on slopes until you have received proper training.

- A tractor can overturn anywhere – near field drains and even on the flat.
- Most overturns happen on slopes.
- Although a tractor can be driven up a slope with a hard surface, it cannot necessarily come down the same slope safely.
- Always couple and use trailer and trailed equipment brakes.
- If in doubt, walk the ground before driving over it to check for hollows, hidden logs, tree stumps, rock outcrops, rabbit holes etc.

Rearward overturns

An operator must keep it in mind that with the rear wheels turning at only 3 kmph, the tractor will be vertical in just 1 second if the object it is pulling resists movement. An inexperienced driver may need as much as 1.5 seconds to decide on and carry out remedial action. Therefore, rearward overturns could be prevented by taking remedial measure in a split second only.

Vertical jackknifing of tractor and trailer combination

- Ensure trailers are not overloaded and the load is evenly distributed.
- When tipping, take care to ensure the load slides freely from the trailer.
- Adding rear ballast (eg wheel weights or water ballast) will increase the stability of the tractor.

Hitching chains or tow ropes

- Always hitch as low as possible for stability of the tractor.
- Never hitch above the axle.
- A chain or tow rope hitched too high could cause rearward overturn of the towing tractor even on level ground.

Freeing a bogged-down tractor

- If the tractor gets stuck, try to reverse out.
- If this fails additional help would be needed.
- It is not advisable to chain the wheels or jam them with blocks of wood.
- These wood blocks may, subsequently, be forced into the ground and the tractor may overturn rearwards.

Winching with tractor-mounted winches

To avoid overturning the tractor during winching, always see that it is set straight in line with the pull.

Notes

UNIT 4.9: Hazard checklist–Tractors and Machinery

Unit Objectives

At the end of this unit, you will be able to:

- Understand the Hazards check list – Tractor and Machinery

4.9.1 Hazard checklist–Tractors and Machinery

Tractors - Safe Operation

Are all operator and maintenance manuals available for the tractor and machinery?

Are tractor tyres in good condition?

Are tractor tyre correctly inflated and ballasted to manufacturers' specifications?

Are tractors correctly ballasted when towing implements or using 3 point linkage equipment?

Are all hydraulic hoses in good condition and free of oil leaks from hoses or couplings?

Are all seats on tractors ergonomically designed and in good condition?

Is all electrical wiring in good condition?

Are batteries secure and battery housings and terminals clean?

Do ignition key and starter switches work?

Is a fire extinguisher kept on all tractors?

Is a first aid kit kept near the operating environment or in the tractor?

Do headlights and tail lights work?

Are all mirrors, headlights, and tail lights clean?

Are earmuffs or earplugs available for tractor and machinery operators if they have to raise their voices to be heard over loud noise?

Plant and Machinery

Are all moving exposed belts, pulleys and shafts properly guarded?

Are all manufacturers' guards in good repair?

Are all guards in place before machinery is in use?

Are all steps and handrails in good condition?

Are all Operator Manuals and Service Manuals available for all plant and machinery?

Are exhaust systems in good condition and functional?

Are all hydraulic hoses and fittings free of oil leaks?

Is there a lock-out system to ensure machinery is not engaged or started during maintenance?

Are stands, chocks used to support machinery and implements during maintenance and repair?

Are hydraulics locked and/ or pressure released from hydraulic lines before maintenance or repair?

Tractor Safety Quiz

1. When refueling your tractor, you should always:

a. Shut off engine

b. Let engine cool off

c. Fuel outdoors -good ventilation

d. all of the above

Mark true or False

2. Tractor upsets -overturns are the leading cause of tractor related deaths.

3. A maximum of 2 riders are allowed on our tractors.

4. Making sharp turns at high speeds, especially on a sloped surface can be very dangerous and cause an overturn.

5. It is advised to shut off the engine and set the parking brake when dismounting the tractor.

6. Proper training, safe attitude and safe behavior can prevent almost all tractor related accidents.

7. Which of the following is most likely to cause the mower to rollover?

a. Reducing travel speed

b. Mowing on uneven ground

c. Watching for holes, depressions and ditches while or prior to mowing

d. Driving up and down sloped hills

8. To avoid thrown object hazards, the operator should:

a. Aim the discharge chute slightly upwards

b. Remove the discharge chute/guard to make it easier to trim

c. inspect the area, remove objects and use caution whenever people are nearby.

9. You should clean off the steps/platform to:

a. Help prevent slip/fall injuries

b. so your tractor looks great

c. to utilize time to cool down until your shift is over

10. If an area is too sloped or uneven to operate the mower safely, you should:

a. Increase the speed of the tractor

b. Keep one foot on the ground to help balance and prevent a tip over

c. Use a weed eater in that area

11. You should wear the following protective equipment:

a. Ear plugs or muffs and safety glasses

b. Music players/headsets to drown out the tractor noise

c. Regular sunglasses to keep glare down and look “cool”.

Exercise

1. Write a note on importance of Health and safety maintenance at the farm and Tractor operation.

Answer: ----------

---

2. Write a note on Hazard checklist – Tractors and Machinery

Answer: ----------

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ASCI
Agriculture Skill Council of India

5. Employability & Entrepreneurship Skills

Unit 5.1 – Personal Strengths & Value Systems

Unit 5.2 – Digital Literacy: A Recap

Unit 5.3 – Money Matters

Unit 5.4 – Preparing for Employment & Self Employment

Unit 5.5 – Understanding Entrepreneurship

Unit 5.6 – Preparing to be an Entrepreneur

AGR/N4103

Key Learning Outcomes

At the end of this unit, you will be able to:

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Understand the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Understand motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss how to maintain a positive attitude
15. Discuss the role of attitude in self-analysis
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management
32. Identify the basic parts of a computer
33. Identify the basic parts of a keyboard
34. Recall basic computer terminology
35. Recall basic computer terminology

36. Recall the functions of basic computer keys
37. Discuss the main applications of MS Office
38. Discuss the benefits of Microsoft Outlook
39. Discuss the different types of e-commerce
40. List the benefits of e-commerce for retailers and customers
41. Discuss how the Digital India campaign will help boost e-commerce in India
42. Explain how you will sell a product or service on an e-commerce platform
43. Discuss the importance of saving money
44. Discuss the benefits of saving money
45. Discuss the main types of bank accounts
46. Describe the process of opening a bank account
47. Differentiate between fixed and variable costs
48. Describe the main types of investment options
49. Describe the different types of insurance products
50. Describe the different types of taxes
51. Discuss the uses of online banking
52. Discuss the main types of electronic funds transfers
53. Discuss the steps to prepare for an interview
54. Discuss the steps to create an effective Resume
55. Discuss the most frequently asked interview questions
56. Discuss how to answer the most frequently asked interview questions
57. Discuss basic workplace terminology
58. Discuss the concept of entrepreneurship
59. Discuss the importance of entrepreneurship
60. Describe the characteristics of an entrepreneur
61. Describe the different types of enterprises
62. List the qualities of an effective leader
63. Discuss the benefits of effective leadership
64. List the traits of an effective team
65. Discuss the importance of listening effectively
66. Discuss how to listen effectively
67. Discuss the importance of speaking effectively
68. Discuss how to speak effectively
69. Discuss how to solve problems
70. List important problem solving traits

71. Discuss ways to assess problem solving skills
72. Discuss the importance of negotiation
73. Discuss how to negotiate
74. Discuss how to identify new business opportunities
75. Discuss how to identify business opportunities within your business
76. Understand the meaning of entrepreneur
77. Describe the different types of entrepreneurs
78. List the characteristics of entrepreneurs
79. Recall entrepreneur success stories
80. Discuss the entrepreneurial process
81. Describe the entrepreneurship ecosystem
82. Discuss the government's role in the entrepreneurship ecosystem
83. Discuss the current entrepreneurship ecosystem in India
84. Understand the purpose of the Make in India campaign
85. Discuss the relationship between entrepreneurship and risk appetite
86. Discuss the relationship between entrepreneurship and resilience
87. Describe the characteristics of a resilient entrepreneur
88. Discuss how to deal with failure
89. Discuss how market research is carried out
90. Describe the 4 Ps of marketing
91. Discuss the importance of idea generation
92. Recall basic business terminology
93. Discuss the need for CRM
94. Discuss the benefits of CRM
95. Discuss the need for networking
96. Discuss the benefits of networking
97. Understand the importance of setting goals
98. Differentiate between short-term, medium-term and long-term goals
99. Discuss how to write a business plan
100. Explain the financial planning process
101. Discuss ways to manage your risk
102. Describe the procedure and formalities for applying for bank finance
103. Discuss how to manage your own enterprise
104. List important questions that every entrepreneur should ask before starting an enterprise

UNIT 5.1: Personal Strengths & Value Systems

Unit Objectives

At the end of this unit, you will be able to:

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Understand the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Understand motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss how to maintain a positive attitude
15. Discuss the role of attitude in self-analysis
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management

5.1.1 Health, Habits, Hygiene: What is Health

As per the World Health Organization (WHO), health is a "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." This means being healthy does not simply mean not being unhealthy – it also means you need to be at peace emotionally, and feel fit physically. For example, you cannot say you are healthy simply because you do not have any physical ailments like a cold or cough. You also need to think about whether you are feeling calm, relaxed and happy.

Common Health Issues

Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- Cough, Cold, Sore Throat
- Difficulty Sleeping
- Obesity

Tips to Prevent Health Issues

Taking measures to prevent ill health is always better than curing a disease or sickness. You can stay healthy by:

- Eating healthy foods like fruits, vegetables and nuts
- Cutting back on unhealthy and sugary foods
- Drinking enough water everyday
- Not smoking or drinking alcohol
- Exercising for at least 30 minutes a day, 4-5 times a week
- Taking vaccinations when required
- Practicing yoga exercises and meditation

How many of these health standards do you follow? Tick the ones that apply to you.

1. Get minimum 7-8 hours of sleep every night. ☐
2. Avoid checking email first thing in the morning and right before you go to bed at night. ☐
3. Don't skip meals – eat regular meals at correct meal times. ☐
4. Read a little bit every single day. ☐
5. Eat more home cooked food than junk food. ☐

6. Stand more than you sit. ☐
7. Drink a glass of water first thing in the morning and have at least 8 glasses of water through the day. ☐
8. Go to the doctor and dentist for regular checkups. ☐
9. Exercise for 30 minutes at least 5 days a week. ☐
10. Avoid consuming lots of aerated beverages. ☐

What is Hygiene?

As per the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." In other words, hygiene means ensuring that you do whatever is required to keep your surroundings clean, so that you reduce the chances of spreading germs and diseases.

For instance, think about the kitchen in your home. Good hygiene means ensuring that the kitchen is always spick and span, the food is put away, dishes are washed and dustbins are not overflowing with garbage. Doing all this will reduce the chances of attracting pests like rats or cockroaches, and prevent the growth of fungus and other bacteria, which could spread disease.

How many of these health standards do you follow? Tick the ones that apply to you.

1. Have a bath or shower every day with soap – and wash your hair with shampoo 2-3 times a week. ☐
2. Wear a fresh pair of clean undergarments every day. ☐
3. Brush your teeth in the morning and before going to bed. ☐
4. Cut your fingernails and toenails regularly. ☐
5. Wash your hands with soap after going to the toilet. ☐
6. Use an anti-perspirant deodorant on your underarms if you sweat a lot. ☐
7. Wash your hands with soap before cooking or eating. ☐
8. Stay home when you are sick, so other people don't catch what you have. ☐
9. Wash dirty clothes with laundry soap before wearing them again. ☐
10. Cover your nose with a tissue/your hand when coughing or sneezing. ☐

See how healthy and hygienic you are, by giving yourself 1 point for every ticked statement!

Then take a look at what your score means.

Your Score

0-7/20: You need to work a lot harder to stay fit and fine! Make it a point to practice good habits daily and see how much better you feel!

7-14/20: Not bad, but there is scope for improvement! Try and add a few more good habits to your daily routine.

14-20/20: Great job! Keep up the good work! Your body and mind thank you!

Swachh Bharat Abhiyan

We have already discussed the importance of following good hygiene and health practices for ourselves. But, it is not enough for us to be healthy and hygienic. We must also extend this standard to our homes, our immediate surroundings and to our country as a whole.

The 'Swachh Bharat Abhiyan' (Clean India Mission) launched by Prime Minister Shri Narendra Modi on 2nd October 2014, believes in doing exactly this. The aim of this mission is to clean the streets and roads of India and raise the overall level of cleanliness. Currently this mission covers 4,041 cities and towns across the country. Millions of our people have taken the pledge for a clean India. You should take the pledge too, and do everything possible to keep our country clean!

What are Habits?

A habit is a behaviour that is repeated frequently. All of us have good habits and bad habits. Keep in mind the phrase by John Dryden: "We first make our habits, and then our habits make us." This is why it is so important that you make good habits a way of life, and consciously avoid practicing bad habits.

Some good habits that you should make part of your daily routine are:

- Always having a positive attitude
- Making exercise a part of your daily routine
- Reading motivational and inspirational stories
- Smiling! Make it a habit to smile as often as possible
- Making time for family and friends
- Going to bed early and waking up early

Some bad habits that you should quit immediately are:

- Skipping breakfast
- Snacking frequently even when you are not hungry
- Eating too much fattening and sugary food
- Smoking, drinking alcohol and doing drugs
- Spending more money than you can afford
- Worrying about unimportant issues
- Staying up late and waking up late

Tips

- Following healthy and hygienic practices every day will make you feel good mentally and physically.
- Hygiene is two-thirds of health – so good hygiene will help you stay strong and healthy!

5.1.2: Safety: Tips to Design a Safe Workplace

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Use ergonomically designed furniture and equipment to avoid stooping and twisting
- Provide mechanical aids to avoid lifting or carrying heavy objects
- Have protective equipment on hand for hazardous jobs
- Designate emergency exits and ensure they are easily accessible
- Set down health codes and ensure they are implemented
- Follow the practice of regular safety inspections in and around the workplace
- Ensure regular building inspections are conducted
- Get expert advice on workplace safety and follow it

Non-Negotiable Employee Safety Habits

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Immediately report unsafe conditions to a supervisor
- Recognize and report safety hazards that could lead to slips, trips and falls
- Report all injuries and accidents to a supervisor
- Wear the correct protective equipment when required
- Learn how to correctly use equipment provided for safety purposes
- Be aware of and avoid actions that could endanger other people
- Take rest breaks during the day and some time off from work during the week

Tips

- Be aware of what emergency number to call at the time of a workplace emergency
- Practice evacuation drills regularly to avoid chaotic evacuations

5.1.3 Self Analysis – Attitude, Achievement Motivation: What is Self-Analysis

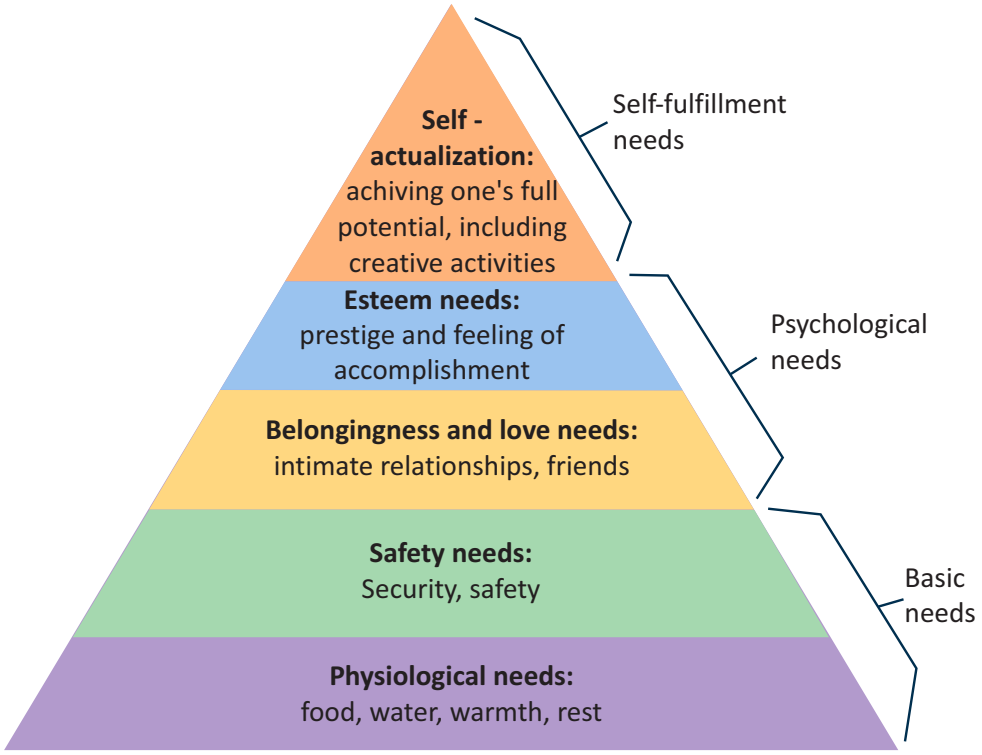
To truly achieve your full potential, you need to take a deep look inside yourself and find out what kind of person you really are. This attempt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to identify areas within yourself that need to be further developed, changed or eliminated. You can better understand yourself by taking a deep look at what motivates you, what your attitude is like, and what your strengths and weaknesses are.

What is Motivation?

Very simply put, motivation is your reason for acting or behaving in a certain manner. It is important to understand that not everyone is motivated by the same desires – people are motivated by many, many different things. We can understand this better by looking at Maslow's Hierarchy of Needs.

Maslow's Hierarchy of Needs

Famous American psychologist Abraham Maslow wanted to understand what motivates people. He believed that people have five types of needs, ranging from very basic needs (called physiological needs) to more important needs that are required for self-growth (called self-actualization needs). Between the physiological and self-actualization needs are three other needs – safety needs, belongingness and love needs, and esteem needs. These needs are usually shown as a pyramid with five levels and are known as Maslow's Hierarchy of Needs.



As you can see from the pyramid, the lowest level depicts the most basic needs. Maslow believed that our behaviour is motivated by our basic needs, until those needs are met. Once they are fulfilled, we move to the next level and are motived by the next level of needs. Let's understand this better with an example.

Rupa comes from a very poor family. She never has enough food, water, warmth or rest. According to Maslow, until Rupa is sure that she will get these basic needs, she will not even think about the next level of needs – her safety needs. But, once Rupa is confident that her basic needs will be met, she will move to the next level, and her behaviour will then be motivated by her need for security and safety. Once these new needs are met, Rupa will once again move to the next level, and be motivated by her need for relationships and friends. Once this need is satisfied, Rupa will then focus on the fourth level of needs – her esteem needs, after which she will move up to the fifth and last level of needs – the desire to achieve her full potential.

Understanding Achievement Motivation

We now know that people are motivated by basic, psychological and self-fulfillment needs. However, certain people are also motivated by the achievement of highly challenging accomplishments. This is known as Achievement Motivation, or 'need for achievement'.

The level of motivation achievement in a person differs from individual to individual. It is important that entrepreneurs have a high level of achievement motivation – a deep desire to accomplish something important and unique. It is equally important that they hire people who are also highly motivated by challenges and success.

What Motivates You?

What are the things that really motivate you? List down five things that really motivate you.

Remember to answer honestly!

I am motivated by:

Characteristics of Entrepreneurs with Achievement Motivation

Entrepreneurs with achievement motivation can be described as follows:

- Unafraid to take risks for personal accomplishment
- Love being challenged
- Future-oriented
- Flexible and adaptive
- Value negative feedback more than positive feedback
- Very persistent when it comes to achieving goals
- Extremely courageous
- Highly creative and innovative
- Restless - constantly looking to achieve more
- Feel personally responsible for solving problems

Think about it:

- How many of these traits do you have?
- Can you think of entrepreneurs who display these traits?

How to Cultivate a Positive Attitude

The good news is attitude is a choice. So it is possible to improve, control and change our attitude, if we decide we want to! The following tips help foster a positive mindset:

- Remember that you control your attitude, not the other way around
- Devote at least 15 minutes a day towards reading, watching or listening to something positive
- Avoid negative people who only complain and stop complaining yourself
- Expand your vocabulary with positive words and delete negative phrases from your mind
- Be appreciative and focus on what's good in yourself, in your life, and in others
- Stop thinking of yourself as a victim and start being proactive
- Imagine yourself succeeding and achieving your goals

What is Attitude?

Now that we understand why motivation is so important for self-analysis, let's look at the role our attitude plays in better understanding ourselves. Attitude can be described as your tendency (positive or negative), to think and feel about someone or something. Attitude is the foundation for success in every aspect of life. Our attitude can be our best friend or our worst enemy. In other words:

"The only disability in life is a bad attitude."

When you start a business, you are sure to encounter a wide variety of emotions, from difficult times and failures to good times and successes. Your attitude is what will see you through the tough times and guide you towards success. Attitude is also infectious. It affects everyone around you, from your customers to your employees to your investors. A positive attitude helps build confidence in the workplace while a negative attitude is likely to result in the demotivation of your people.

What Are Your Strengths and Weaknesses?

Another way to analyze yourself is by honestly identifying your strengths and weaknesses. This will help you use your strengths to your best advantage and reduce your weaknesses.

Note down all your strengths and weaknesses in the two columns below. Remember to be honest with yourself!

Strengths	Weaknesses

Tips

- Achievement motivation can be learned.
- Don’t be afraid to make mistakes.
- Train yourself to finish what you start.
- Dream big.

5.1.4 Honesty & Work Ethics: What is Honesty?

Honesty is the quality of being fair and truthful. It means speaking and acting in a manner that inspires trust. A person who is described as honest is seen as truthful and sincere, and as someone who isn't deceitful or devious and doesn't steal or cheat. There are two dimensions of honesty – one is honesty in communication and the other is honesty in conduct.

Honesty is an extremely important trait because it results in peace of mind and builds relationships that are based on trust. Being dishonest, on the other hand, results in anxiety and leads to relationships full of distrust and conflict.

Qualities of Honest People

Honest individuals have certain distinct characteristics. Some common qualities among honest people are:

1. They don't worry about what others think of them. They believe in being themselves – they don't bother about whether they are liked or disliked for their personalities.
2. They stand up for their beliefs. They won't think twice about giving their honest opinion, even if they are aware that their point of view lies with the minority.
3. They are think skinned. This means they are not affected by others judging them harshly for their honest opinions.
4. They forge trusting, meaningful and healthy friendships. Honest people usually surround themselves with honest friends. They have faith that their friends will be truthful and upfront with them at all times.

They are trusted by their peers. They are seen as people who can be counted on for truthful and objective feedback and advice.

- Honesty and employees: When entrepreneurs build honest relationships with their employees, it leads to more transparency in the workplace, which results in higher work performance and better results.
- Honesty and investors: For entrepreneurs, being honest with investors means not only sharing strengths but also candidly disclosing current and potential weaknesses, problem areas and solution strategies. Keep in mind that investors have a lot of experience with startups and are aware that all new companies have problems. Claiming that everything is perfectly fine and running smoothly is a red flag for most investors.
- Honesty with oneself: The consequences of being dishonest with oneself can lead to dire results, especially in the case of entrepreneurs. For entrepreneurs to succeed, it is critical that they remain realistic about their situation at all times, and accurately judge every aspect of their enterprise for what it truly is.

Importance of Honesty in Entrepreneurs

One of the most important characteristics of entrepreneurs is honesty. When entrepreneurs are honest with their customers, employees and investors, it shows that they respect those that they work with. It is also important that entrepreneurs remain honest with themselves. Let's look at how being honest would lead to great benefits for entrepreneurs.

- Honesty and customers: When entrepreneurs are honest with their customers it leads to stronger relationships, which in turn results in business growth and a stronger customer network.

What are Work Ethics?

Being ethical in the workplace means displaying values like honesty, integrity and respect in all your decisions and communications. It means not displaying negative qualities like lying, cheating and stealing.

Workplace ethics play a big role in the profitability of a company. It is as crucial to an enterprise as high morale and teamwork. This is why most companies lay down specific workplace ethic guidelines that must compulsorily be followed by their employees. These guidelines are typically outlined in a company's employee handbook.

Elements of a Strong Work Ethic

An entrepreneur must display strong work ethics, as well as hire only those individuals who believe in and display the same level of ethical behavior in the workplace. Some elements of a strong work ethic are:

- **Professionalism**: This involves everything from how you present yourself in a corporate setting to the manner in which you treat others in the workplace.
- **Respectfulness**: This means remaining poised and diplomatic regardless of how stressful or volatile a situation is.
- **Dependability**: This means always keeping your word, whether it's arriving on time for a meeting or delivering work on time.
- **Dedication**: This means refusing to quit until the designated work is done, and completing the work at the highest possible level of excellence.
- **Determination**: This means embracing obstacles as challenges rather than letting them stop you, and pushing ahead with purpose and resilience to get the desired results.
- **Accountability**: This means taking responsibility for your actions and the consequences of your actions, and not making excuses for your mistakes.
- **Humility**: This means acknowledging everyone's efforts and had work, and sharing the credit for accomplishments.

How to Foster a Good Work Ethic

As an entrepreneur, it is important that you clearly define the kind of behaviour that you expect from each and every team member in the workplace. You should make it clear that you expect employees to display positive work ethics like:

- **Honesty**: All work assigned to a person should be done with complete honesty, without any deceit or lies.
- **Good attitude**: All team members should be optimistic, energetic, and positive.
- **Reliability**: Employees should show up where they are supposed to be, when they are supposed to be there.
- **Good work habits**: Employees should always be well groomed, never use inappropriate language, conduct themselves professionally at all times, etc.
- **Initiative**: Doing the bare minimum is not enough. Every team member needs to be proactive and show initiative.
- **Trustworthiness**: Trust is non-negotiable. If an employee cannot be trusted, it's time to let that employee go.

- **Respect**: Employees need to respect the company, the law, their work, their colleagues and themselves.
- **Integrity**: Each and every team member should be completely ethical and must display above board behaviour at all times.
- **Efficiency**: Efficient employees help a company grow while inefficient employees result in a waste of time and resources.

Tips 

- Don't get angry when someone tells you the truth and you don't like what you hear.
- Always be willing to accept responsibility for your mistakes.

5.1.5 Creativity & Innovation : What is Creativity

Creativity means thinking outside the box. It means viewing things in new ways or from different perspectives, and then converting these ideas into reality. Creativity involves two parts: thinking and producing. Simply having an idea makes you imaginative, not creative. However, having an idea and acting on it makes you creative.

Characteristics of Highly Creative People

Some characteristics of creative people are:

- They are imaginative and playful
- They see issues from different angles
- They notice small details
- They have very little tolerance for boredom
- They detest rules and routine
- They love to daydream
- They are very curious

What is Innovation?

There are many different definitions of innovation. In simple terms, innovation means turning an idea into a solution that adds value. It can also mean adding value by implementing a new product, service or process, or significantly improving on an existing product, service or process.

Characteristics of Highly Innovative People

Some characteristics of highly innovative people are:

- They embrace doing things differently
- They don't believe in taking shortcuts
- They are not afraid to be unconventional
- They are highly proactive and persistent
- They are organized, cautious and risk-averse

Tips

- Take regular breaks from your creative work to recharge yourself and gain fresh perspective.
- Build prototypes frequently, test them out, get feedback, and make the required changes.

5.1.6 Time Management: What is Time Management?

Time management is the process organizing your time, and deciding how to allocate your time between different activities. Good time management is the difference between working smart (getting more done in less time) and working hard (working for more time to get more done).

Effective time management leads to an efficient work output, even when you are faced with tight deadlines and high pressure situations. On the other hand, not managing your time effectively results in inefficient output and increases stress and anxiety.

Benefits of Time Management

Time management can lead to huge benefits like:

- Greater productivity
- Better professional reputation
- Higher chances for career advancement
- Higher efficiency
- Reduced stress
- Greater opportunities to achieve goals

Not managing time effectively can result in undesirable consequences like:

- Missing deadlines
- Substandard work quality
- Stalled career
- Inefficient work output
- Poor professional reputation
- Increase in stress and anxiety

Traits of Effective Time Managers

Some traits of effective time managers are:

- They begin projects early
- They set daily objectives
- They modify plans if required, to achieve better results
- They are flexible and open-minded
- They inform people in advance if their help will be required
- They know how to say no
- They break tasks into steps with specific deadlines
- They continually review long term goals
- They think of alternate solutions if and when required
- They ask for help when required
- They create backup plans

Effective Time Management Techniques

You can manage your time better by putting into practice certain time management techniques. Some helpful tips are:

- Plan out your day as well as plan for interruptions. Give yourself at least 30 minutes to figure out your time plan. In your plan, schedule some time for interruptions.
- Put up a “Do Not Disturb” sign when you absolutely have to complete a certain amount of work.
- Close your mind to all distractions. Train yourself to ignore ringing phones, don’t reply to chat messages and disconnect from social media sites.

- Delegate your work. This will not only help your work get done faster, but will also show you the unique skills and abilities of those around you.
- Stop procrastinating. Remind yourself that procrastination typically arises due to the fear of failure or the belief that you cannot do things as perfectly as you wish to do them.
- Prioritize. List each task to be completed in order of its urgency or importance level. Then focus on completing each task, one by one.
- Maintain a log of your work activities. Analyze the log to help you understand how efficient you are, and how much time is wasted every day.
  Create time management goals to reduce time wastage.

Tips 

- Always complete the most important tasks first.
- Get at least 7 – 8 hours of sleep every day.
- Start your day early.
- Don’t waste too much time on small, unimportant details.
- Set a time limit for every task that you will undertake.
- Give yourself some time to unwind between tasks.

5.1.7 Anger Management: What is Anger Management

Anger management is the process of:

1. Learning to recognize the signs that you, or someone else, is becoming angry
2. Taking the best course of action to calm down the situation in a positive way

Anger management does not mean suppressing anger.

Importance of Anger Management

Anger is a perfectly normal human emotion. In fact, when managed the right way, anger can be considered a healthy emotion. However, if it is not kept in check, anger can make us act inappropriately and can lead to us saying or doing things that we will likely later regret.
Extreme anger can:

- **Hurt you physically:** It leads to heart disease, diabetes, a weakened immune system, insomnia, and high blood pressure.
- **Hurt you mentally**: It can cloud your thinking and lead to stress, depression and mental health issues.
- **Hurt your career**: It can result in alienating your colleagues, bosses, clients and lead to the loss of respect.
- **Hurt your relationships**: It makes it hard for your family and friends to trust you, be honest with you and feel comfortable around you.
  This is why anger management, or managing anger appropriately, is so important.

Anger Management Strategies

Here are some strategies that can help you control your anger:

Strategy 1: Relaxation

Something as simple as breathing deeply and looking at relaxing images works wonders in calming down angry feelings. Try this simple breathing exercise:

1. Take a deep breath from your diaphragm (don't breathe from your chest)
2. Visualize your breath coming up from your stomach
3. Keep repeating a calming word like 'relax' or 'take it easy' (remember to keep breathing deeply while repeating the word)
4. Picture a relaxing moment (this can be from your memory or your imagination)

Follow this relaxation technique daily, especially when you realize that you're starting to feel angry.

Strategy 2: Cognitive Restructuring

Cognitive restructuring means changing the manner in which you think. Anger can make you curse, swear, exaggerate and act very dramatically. When this happens, force yourself to replace your angry thoughts with more logical ones. For instance, instead of thinking 'Everything is ruined' change your mindset and tell yourself 'It's not the end of the world and getting angry won't solve this'.

Strategy 3: Problem Solving

Getting angry about a problem that you cannot control is a perfectly natural response. Sometimes, try as you may, there may not be a solution to the difficulty you are faced with. In such cases, stop focusing on solving the problem, and instead focus on handling and facing the problem. Remind yourself that you will do your best to deal with the situation, but that you will not blame yourself if you don't get the solution you desire.

Strategy 4: Better Communication

When you're angry, it is very easy to jump to inaccurate conclusions. In this case, you need to force yourself to stop reacting, and think carefully about what you want to say, before saying it. Avoid saying the first thing that enters your head. Force yourself to listen carefully to what the other person is saying. Then think about the conversation before responding.

Strategy 5: Changing Your Environment

If you find that your environment is the cause of your anger, try and give yourself a break from your surroundings. Make an active decision to schedule some personal time for yourself, especially on days that are very hectic and stressful. Having even a brief amount of quiet or alone time is sure to help calm you down.

Tips for Anger Management

- The following tips will help you keep your anger in check:
- Take some time to collect your thoughts before you speak out in anger.
- Express the reason for your anger in an assertive, but non-confrontational manner once you have calmed down.
- Do some form of physical exercise like running or walking briskly when you feel yourself getting angry.
- Make short breaks part of your daily routine, especially during days that are stressful. Focus on how to solve a problem that's making you angry, rather than focusing on the fact that the problem is making you angry.

Tips

- Try to forgive those who anger you, rather than hold a grudge against them.
- Avoid using sarcasm and hurling insults. Instead, try and explain the reason for your frustration in a polite and mature manner.

5.1.8 Stress Management: What is Stress

We say we are 'stressed' when we feel overloaded and unsure of our ability to deal with the pressures placed on us. Anything that challenges or threatens our well-being can be defined as a stress. It is important to note that stress can be good and bad. While good stress keeps us going, negative stress undermines our mental and physical health. This is why it is so important to manage negative stress effectively.

Causes of Stress

Stress can be caused by internal and external factors.

Internal causes of stress

- Constant worry
- Rigid thinking
- Unrealistic expectations
- Pessimism
- Negative self-talk
- All in or all out attitude

External causes of stress

- Major life changes
- Difficulties with relationships
- Having too much to do
- Difficulties at work or in school
- Financial difficulties
- Worrying about one's children and/or family

Symptoms of Stress

Stress can manifest itself in numerous ways. Take a look at the cognitive, emotional, physical and behavioral symptoms of stress.

Cognitive Symptoms	Emotional Symptoms
• Memory problems	• Depression
• Concentration issues	• Agitation
• Lack of judgement	• Irritability
• Pessimism	• Loneliness
• Anxiety	• Anxiety
• Constant worrying	• Anger

Physical Symptoms	Behavioral Symptoms
• Aches and pain	• Increase or decrease in appetite
• Diarrhea or constipation	• Over sleeping or not sleeping enough
• Nausea	• Withdrawing socially
• Dizziness	• Ignoring responsibilities
• Chest pain and/or rapid heartbeat	• Consumption of alcohol or cigarettes
• Frequent cold or flu like feelings	• Nervous habits like nail biting, pacing etc.

Tips to Manage Stress

The following tips can help you manage your stress better:

- Note down the different ways in which you can handle the various sources of your stress.
- Remember that you cannot control everything, but you can control how you respond.
- Discuss your feelings, opinions and beliefs rather than reacting angrily, defensively or passively.
- Practice relaxation techniques like meditation, yoga or tai chi when you start feeling stressed.
- Devote a part of your day towards exercise.
- Eat healthy foods like fruits and vegetables. Avoid unhealthy foods especially those containing large amounts of sugar.
- Plan your day so that you can manage your time better, with less stress.
- Say no to people and things when required.
- Schedule time to pursue your hobbies and interests.
- Ensure you get at least 7-8 hours of sleep.
- Reduce your caffeine intake.
- Increase the time spent with family and friends.

Tips 

- Force yourself to smile even if you feel stressed. Smiling makes us feel relaxed and happy.
- Stop yourself from feeling and thinking like a victim. Change your attiude and focus on being proactive.

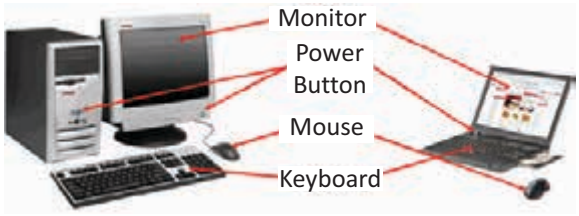
UNIT 5.2. Digital Literacy: A Recap

Unit Objectives

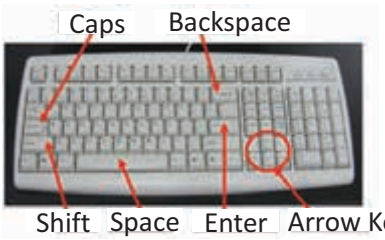
At the end of this unit, you will be able to:

1. Identify the basic parts of a computer
2. Identify the basic parts of a keyboard
3. Recall basic computer terminology
4. Recall basic computer terminology
5. Recall the functions of basic computer keys
6. Discuss the main applications of MS Office
7. Discuss the benefits of Microsoft Outlook
8. Discuss the different types of e-commerce
9. List the benefits of e-commerce for retailers and customers
10. Discuss how the Digital India campaign will help boost e-commerce in India
11. Describe how you will sell a product or service on an e-commerce platform

5.2.1 Computer and Internet basics: Basic Parts of a Computer



Basic Parts of a Keyboard



Basic Parts of a Computer

- **Central Processing Unit (CPU)**: The brain of the computer. It interprets and carries out program instructions.
- **Hard Drive**: A device that stores large amounts of data.
- **Monitor**: The device that contains the computer screen where the information is visually displayed.
- **Desktop**: The first screen displayed after the operating system loads.
- **Background**: The image that fills the background of the desktop.

Basic Parts of a Computer

- **Mouse**: A hand-held device used to point to items on the monitor.
- **Speakers**: Devices that enable you to hear sound from the computer.
- **Printer**: A device that converts output from a computer into printed paper documents.
- **Icon**: A small picture or image that visually represents something on your computer.
- **Cursor**: An arrow which indicates where you are positioned on the screen.
- **Program Menu**: A list of programs on your computer that can be accessed from the Start menu.
- **Taskbar**: The horizontal bar at the bottom of the computer screen that lists applications that are currently in use.
- **Recycle Bin**: A temporary storage for deleted files.

Basic Internet Terms

- **The Internet**: A vast, international collection of computer networks that transfers information.
- **The World Wide Web**: A system that lets you access information on the Internet.
- **Website**: A location on the World Wide Web (and Internet) that contains information about a specific topic.
- **Homepage**: Provides information about a website and directs you to other pages on that website.
- **Link/Hyperlink**: A highlighted or underlined icon, graphic, or text that takes you to another file or object.
- **Web Address/URL**: The address for a website.
- **Address Box**: A box in the browser window where you can type in a web address.

Basic Computer Keys

- **Arrow Keys**: Press these keys to move your cursor.
- **Space bar**: Adds a space.
- **Enter/Return**: Moves your cursor to a new line.
- **Shift**: Press this key if you want to type a capital letter or the upper symbol of a key.
- **Caps Lock**: Press this key if you want all the letters you type to be capital letters. Press it again to revert back to typing lowercase letters.
- **Backspace**: Deletes everything to the left of your cursor.

Tips 

- When visiting a .com address, there no need to type http:// or even www. Just type the name of the website and then press Ctrl + Enter. (Example: Type 'apple' and press Ctrl + Enter to go to www.apple.com)
- Press the Ctrl key and press the + or - to increase and decrease the size of text.
- Press F5 or Ctrl + R to refresh or reload a web page.

5.2.2 MS Office and Email: About MS Office

MS Office or Microsoft Office is a suite of computer programs developed by Microsoft. Although meant for all users, it offers different versions that cater specifically to students, home users and business users. All the programs are compatible with both, Windows and Macintosh.

Most Popular Office Products

Some of the most popular and universally used MS Office applications are:

- **Microsoft Word**: Allows users to type text and add images to a document.
- **Microsoft Excel**: Allows users to enter data into a spreadsheet and create calculations and graphs.
- **Microsoft PowerPoint**: Allows users to add text, pictures and media and create slideshows and presentations.
- **Microsoft Outlook**: Allows users to send and receive email.
- **Microsoft OneNote**: Allows users to make drawings and notes with the feel of a pen on paper.
- **Microsoft Access**: Allows users to store data over many tables.

Why Choose Microsoft Outlook

A popular email management choice especially in the workplace, Microsoft Outlook also includes an address book, notebook, web browser and calendar. Some major benefits of this program are:

- **Integrated search function**: You can use keywords to search for data across all Outlook programs.
- **Enhanced security**: Your email is safe from hackers, junk mail and phishing website email.
- **Email syncing**: Sync your mail with your calendar, contact list, notes in One Note and…your phone!
- **Offline access to email**: No Internet? No problem! Write emails offline and send them when you're connected again.

Tips

- Press Ctrl+R as a shortcut method to reply to email.
- Set your desktop notifications only for very important emails.
- Flag messages quickly by selecting messages and hitting the Insert key.
- Save frequently sent emails as a template to reuse again and again.
- Conveniently save important emails as files.

5.2.3 E-Commerce: What is E-Commerce

E-commerce is the buying or selling of goods and services, or the transmitting of money or data, electronically on the internet. E-Commerce is the short form for "electronic commerce."

Examples of E-Commerce

Some examples of e-commerce are:

- Online shopping
- Online auctions
- Online ticketing
- Electronic payments
- Internet banking

Types of E-Commerce

E-commerce can be classified based on the types of participants in the transaction. The main types of e-commerce are:

- **Business to Business (B2B)**: Both the transacting parties are businesses.
- **Business to Consumer (B2C)**: Businesses sell electronically to end-consumers.
- **Consumer to Consumer (C2C):** Consumers come together to buy, sell or trade items to other consumers.
- **Consumer-to-Business (C2B)**: Consumers make products or services available for purchase to companies looking for exactly those services or products.
- **Business-to-Administration (B2A)**: Online transactions conducted between companies and public administration.
- **Consumer-to-Administration (C2A)**: Online transactions conducted between individuals and public administration.

Benefits of E-Commerce

The e-commerce business provides some benefits for retailers and customers.

Benefits for retailers:

- Establishes an online presence
- Reduces operational costs by removing overhead costs
- Increases brand awareness through the use of good keywords
- Increases sales by removing geographical and time constraints

Benefits for customers:

- Offers a wider range of choice than any physical store
- Enables goods and services to be purchased from remote locations
- Enables consumers to perform price comparisons

Digital India Campaign

Prime Minister Narendra Modi launched the Digital India campaign in 2015, with the objective of offering every citizen of India access to digital services, knowledge and information. The campaign aims to improve the country's online infrastructure and increase internet connectivity, thus boosting the e-commerce industry.

Currently, the majority of online transactions come from tier 2 and tier 3 cities. Once the Digital India campaign is in place, the government will deliver services through mobile connectivity, which will help deliver internet to remote corners of the country. This will help the e-commerce market to enter India's tier 4 towns and rural areas.

E-Commerce Activity

Choose a product or service that you want to sell online. Write a brief note explaining how you will use existing e-commerce platforms, or create a new e-commerce platform, to sell your product or service.

Tips

- Before launching your e-commerce platform, test everything.
- Pay close and personal attention to your social media.

UNIT 5.3: Money Matters

Unit Objectives

At the end of this unit, you will be able to:

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Differentiate between fixed and variable costs
6. Describe the main types of investment options
7. Describe the different types of insurance products
8. Describe the different types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfers

5.3.1 Personal Finance – Why to Save: Importance of Saving

We all know that the future is unpredictable. You never know what will happen tomorrow, next week or next year. That's why saving money steadily through the years is so important. Saving money will help improve your financial situation over time. But more importantly, knowing that you have money stashed away for an emergency will give you peace of mind. Saving money also opens the door to many more options and possibilities.

Benefits of Saving

Inculcating the habit of saving leads to a vast number of benefits. Saving helps you:

- **Become financially independent**: When you have enough money saved up to feel secure you can start making your choices, from taking a vacation whenever you want, to switching careers or starting your own business.
- **Invest in yourself through education**: Through saving, you can earn enough to pay up for courses that will add to your professional experience and ultimately result in higher paying jobs.
- **Get out of debt**: Once you have saved enough as a reserve fund, you can use your savings to pay off debts like loans or bills that have accumulated over time.
- **Be prepared for surprise expenses** : Having money saved enables you to pay for unforeseen expenses like sudden car or house repairs, without feeling financially stressed.
- **Pay for emergencies**: Saving helps you deal with emergencies like sudden health issues or emergency trips without feeling financially burdened.

- **Afford large purchases and achieve major goals:** Saving diligently makes it possible to place down payments towards major purchases and goals, like buying a home or a car.
- **Retire**: The money you have saved over the years will keep you comfortable when you no longer have the income you would get from your job.

Tips 

- Break your spending habit. Try not spending on one expensive item per week, and put the money that you would have spent into your savings.
- Decide that you will not buy anything on certain days or weeks and stick to your word.

5.3.2 Types of Bank Accounts, Opening a Bank Account: Types of Bank Accounts

In India, banks offer four main types of bank accounts. These are:

- Current Accounts
- Savings Accounts
- Recurring Deposit Accounts
- Fixed Deposit Accounts

Current Accounts

Current accounts offer the most liquid deposits and thus, are best suited for businessmen and companies. As these accounts are not meant for investments and savings, there is no imposed limit on the number or amount of transactions that can be made on any given day. Current account holders are not paid any interest on the amounts held in their accounts. They are charged for certain services offered on such accounts.

Savings Accounts

Savings accounts are meant to promote savings, and are therefore the number one choice for salaried individuals, pensioners and students. While there is no restriction on the number and amount of deposits made, there are usually restrictions on the number and amount of withdrawals. Savings account holders are paid interest on their savings.

Recurring Deposit Accounts

Recurring Deposit accounts, also called RD accounts, are the accounts of choice for those who want to save an amount every month, but are unable to invest a large sum at one time. Such account holders deposit a small, fixed amount every month for a pre-determined period (minimum 6 months). Defaulting on a monthly payment results in the account holder being charged a penalty amount. The total amount is repaid with interest at the end of the specified period.

Fixed Deposit Accounts

Fixed Deposit accounts, also called FD accounts, are ideal for those who wish to deposit their savings for a long term in return for a high rate of interest. The rate of interest offered depends on the amount deposited and the time period, and also differs from bank to bank. In the case of an FD, a certain amount of money is deposited by the account holder for a fixed period of time. The money can be withdrawn when the period expires. If necessary, the depositor can break the fixed deposit prematurely. However, this usually attracts a penalty amount which also differs from bank to bank.

Opening a Bank Account

Opening a bank account is quite a simple process. Take a look at the steps to open an account of your own:

Step 1: Fill in the Account Opening Form

This form requires you to provide the following information:

- Personal details (name, address, phone number, date of birth, gender, occupation, address)
- Method of receiving your account statement (hard copy/email)
- Details of your initial deposit (cash/cheque)
- Manner of operating your account (online/mobile banking/traditional via cheque, slip books)

Ensure that you sign wherever required on the form.

Step 2: Affix your Photograph

Stick a recent photograph of yourself in the allotted space on the form.

Step 3: Provide your Know Your Customer (KYC) Details

KYC is a process that helps banks verify the identity and address of their customers. To open an account, every individual needs to submit certain approved documents with respect to photo identity (ID) and address proof. Some Officially Valid Documents (OVDs) are:

- Passport
- Driving License
- Voters' Identity Card
- PAN Card
- UIDAI (Aadhaar) Card

Step 4: Submit All your Documents

Submit the completed Account Opening Form and KYC documents. Then wait until the forms are processed and your account has been opened!

Tips

- Select the right type of account.
- Fill in complete nomination details.
- Ask about fees.
- Understand the rules.
- Check for online banking – it's convenient!
- Keep an eye on your bank balance.

5.3.3 Costs: Fixed vs Variable: What are Fixed and Variable Costs

Fixed costs and variable costs together make up a company's total cost. These are the two types of costs that companies have to bear when producing goods and services.

A fixed cost does not change with the volume of goods or services a company produces. It always remains the same.

A variable cost, on the other hand, increases and decreases depending on the volume of goods and services produced. In other words, it varies with the amount produced.

Differences Between Fixed and Variable Costs

Let's take a look at some of the main differences between fixed and variable costs:

Criteria	Fixed Costs	Variable Costs
Meaning	A cost that stays the same, regardless of the output produced.	A cost that changes when the
Nature	Time related.	Volume related.
Incurred	Incurred irrespective of units being produced.	Incurred only when units are produced.
Unit cost	Inversely proportional to the number of units produced.	Remains the same, per unit.
Examples	Depreciation, rent, salary, insurance, tax etc.	Material consumed, wages, commission on sales, packing expenses, etc.

Tips

- When trying to determine whether a cost is fixed or variable, simply ask the following question: Will the particular cost change if the company stopped its production activities? If the answer is no, then it is a fixed cost. If the answer is yes, then it is probably a variable cost.

5.3.4 Investment, Insurance and Taxes:

Investment

Investment means that money is spent today with the aim of reaping financial gains at a future time. The main types of investment options are as follows:

- **Bonds:** Bonds are instruments used by public and private companies to raise large sums of money – too large to be borrowed from a bank. These bonds are then issued in the public market and are bought by lenders.
- **Stocks:** Stocks or equity are shares that are issued by companies and are bought by the general public.
- **Small Savings Schemes:** Small Savings Schemes are tools meant to save money in small amounts. Some popular schemes are the Employees Provident Fund, Sukanya Samriddhi Scheme and National Pension Scheme.
- **Mutual Funds:** Mutual Funds are professionally managed financial instruments that invest money in different securities on behalf of investors.
- **Fixed Deposits:** A fixed amount of money is kept aside with a financial institution for a fixed amount of time in return for interest on the money.
- **Real Estate:** Loans are taken from banks to purchase real estate, which is then leased or sold with the aim of making a profit on the appreciated property price.
- **Hedge Funds:** Hedge funds invest in both financial derivatives and/or publicly traded securities.
- **Private Equity:** Private Equity is trading in the shares of an operating company that is not publicly listed and whose shares are not available on the stock market.
- **Venture Capital:** Venture Capital involves investing substantial capital in a budding company in return for stocks in that company.

Insurance

There are two types of insurance – Life Insurance and Non-Life or General Insurance.

Life Insurance

Life Insurance deals with all insurance covering human life.

Life Insurance Products

The main life insurance products are:

- **Term Insurance:** This is the simplest and cheapest form of insurance. It offers financial protection for a specified tenure, say 15 to 20 years. In the case of your death, your family is paid the sum assured. In the case of your surviving the term, the insurer pays nothing.
- **Endowment Policy:** This offers the dual benefit of insurance and investment. Part of the premium is allocated towards the sum assured, while the remaining premium gets invested in equity and debt. It pays a lump sum amount after the specified duration or on the death of the policyholder, whichever is earlier.
- **Unit-Linked Insurance Plan (ULIP):** Here part of the premium is spent on the life cover, while the remaining amount is invested in equity and debt. It helps develop a regular saving habit.

- **Money Back Life Insurance:**While the policyholder is alive, periodic payments of the partial survival benefits are made during the policy tenure. On the death of the insured, the insurance company pays the full sum assured along with survival benefits.
- **Whole Life Insurance:** It offers the dual benefit of insurance and investment. It offers insurance cover for the whole life of the person or up to 100 years whichever is earlier.

General Insurance

General Insurance deals with all insurance covering assets like animals, agricultural crops, goods, factories, cars and so on.

General Insurance Products

The main general insurance products are:

- **Motor Insurance:** This can be divided into Four Wheeler Insurance and Two Wheeler Insurance.
- **Health Insurance:** The main types of health insurance are individual health insurance, family floater health insurance, comprehensive health insurance and critical illness insurance.
- **Travel Insurance:** This can be categorised into Individual Travel Policy, Family Travel Policy, Student Travel Insurance and Senior Citizen Health Insurance.
- **Home Insurance:** This protects the house and its contents from risk.
- **Marine Insurance:** This insurance covers goods, freight, cargo etc. against loss or damage during transit by rail, road, sea and/or air.

Taxes

There are two types of taxes – Direct Taxes and Indirect Taxes.

Direct Tax

Direct taxes are levied directly on an entity or a person and are non-transferrable.

Some examples of Direct Taxes are:

- **Income Tax:** This tax is levied on your earning in a financial year. It is applicable to both, individuals and companies.
- **Capital Gains Tax:** This tax is payable whenever you receive a sizable amount of money. It is usually of two types – short term capital gains from investments held for less than 36 months and long term capital gains from investments held for longer than 36 months.
- **Securities Transaction Tax:** This tax is added to the price of a share. It is levied every time you buy or sell shares.
- **Perquisite Tax:** This tax is levied is on perks that have been acquired by a company or used by an employee.
- **Corporate Tax:** Corporate tax is paid by companies from the revenue they earn.

Indirect Tax

Indirect taxes are levied on goods or services.

Some examples of Indirect Taxes are:

- **Sales Tax:** Sales Tax is levied on the sale of a product.

- **Service Tax:** Service Tax is added to services provided in India.
- **Value Added Tax:** Value Added Tax is levied at the discretion of the state government. The tax is levied on goods sold in the state. The tax amount is decided by the state.
- **Customs Duty & Octroi:** Customs Duty is a charge that is applied on purchases that are imported from another country. Octroi is levied on goods that cross state borders within India.
- **Excise Duty:** Excise Duty is levied on all goods manufactured or produced in India.

Tips

- Think about how quickly you need your money back and pick an investment option accordingly.
- Ensure that you are buying the right type of insurance policy for yourself.
- Remember, not paying taxes can result in penalties ranging from fines to imprisonment.

5.3.5 Online Banking, NEFT, RTGS etc.: What is Online Banking

Internet or online banking allows account holders to access their account from a laptop at any location. In this way, instructions can be issued. To access an account, account holders simply need to use their unique customer ID number and password.

Internet banking can be used to:

- Find out an account balance
- Transfer amounts from one account to another
- Arrange for the issuance of cheques
- Instruct payments to be made
- Request for a cheque book
- Request for a statement of accounts
- Make a fixed deposit

Electronic Funds Transfers

Electronic funds transfer is a convenient way of transferring money from the comfort of one's own home, using integrated banking tools like internet and mobile banking.

Transferring funds via an electronic gateway is extremely convenient. With the help of online banking, you can choose to:

- Transfer funds into your own accounts of the same bank.
- Transfer funds into different accounts of the same bank.
- Transfer funds into accounts in different banks, using NEFT.
- Transfer funds into other bank accounts using RTGS.
- Transfer funds into various accounts using IMPS.

NEFT

NEFT stands for National Electronic Funds Transfer. This money transfer system allows you to electronically transfer funds from your respective bank accounts to any other account, either in the same bank or belonging to any other bank. NEFT can be used by individuals, firms and corporate organizations to transfer funds between accounts.

In order to transfer funds via NEFT, two things are required:

- A transferring bank
- A destination bank

Before you can transfer funds through NEFT, you will need to register the beneficiary who will be receiving the funds. In order to complete this registration, you will require the following

- Recipient's name
- Recipient's account number
- Recipient's bank's name
- Recipient's bank's IFSC code

RTGS

RTGS stands for Real Time Gross Settlement. This is a real time funds transfer system which enables you to transfer funds from one bank to another, in real time or on a gross basis. The transferred amount is immediately deducted from the account of one bank, and instantly credited to the other bank's account. The RTGS payment gateway is maintained by the Reserve Bank of India. The transactions between banks are made electronically.

RTGS can be used by individuals, companies and firms to transfer large sums of money. Before remitting funds through RTGS, you will need to add the beneficiary and his bank account details via your online banking account. In order to complete this registration, you will require the following information:

- Name of the beneficiary
- Beneficiary's account number
- Beneficiary's bank address
- Beneficiary's bank's IFSC code

IMPS

IMPS stands for Immediate Payment Service. This is a real-time, inter-bank, electronic funds transfer system used to transfer money instantly within banks across India. IMPS enables users to make instant electronic transfer payments using mobile phones through both, Mobile Banking and SMS. It can also be used through ATMs and online banking. IMPS is available 24 hours a day and 7 days a week. The system features a secure transfer gateway and immediately confirms orders that have been fulfilled.

To transfer money through IMPS, the you need to:

- Register for IMPS with your bank
- Receive a Mobile Money Identifier (MMID) from the bank
- Receive a MPIN from the bank

Once you have both these, you can login or make a request through SMS to transfer a particular amount to a beneficiary.

For the beneficiary to receive the transferred money, he must:

1. Link his mobile number with his respective account
2. Receive the MMID from the bank

In order to initiate a money transfer through IMPS, you will need to enter the following information:

1. The beneficiary's mobile number
2. The beneficiary's MMID
3. The transfer amount
4. Your MPIN

As soon as money has been deducted from your account and credited into the beneficiary's account, you will be sent a confirmation SMS with a transaction reference number, for future reference.

Differences Between NEFT, RTGS & IMPS

Criteria	NEFT	RTGS	IMPS
Settlement	Done in batches	Real-time	Real-time
Full form	National Electronic Fund Transfer	Real Time Gross Settlement	Immediate Payment Service
Timings on Monday – Friday	8:00 am – 6:30 pm	9:00 am – 4:30 pm	24x7
Timings on Saturday	8:00 am – 1:00 pm	9:00 am – 1:30 pm	24x7
Minimum amount of money transfer limit	` 1	` 2 lacs	` 1
Maximum amount of money transfer limit	` 10 lacs	` 10 lacs per day	` 2 lacs
Maximum charges as per RBI	Upto 10,000 – ` 2.5 above 10,000 – 1 lac – ` 5 above 1 – 2 lacs – ` 15 above 2 – 5 lacs – ` 25 above 5 – 10 lacs – ` 25	above 2 – 5 lacs – ` 25 above 5 – 10 lacs – ` 50	Upto 10,000 – ` 5 above 10,000 – 1 lac – ` 5 above 1 – 2 lacs – ` 15

Tips

- Never click on any links in any e-mail message to access your online banking website.
- You will never be asked for your credit or debit card details while using online banking.
- Change your online banking password regularly.

UNIT 5.4. Preparing for Employment & Self Employment

Unit Objectives

At the end of this unit, you will be able to:

1. Discuss the steps to prepare for an interview
2. Discuss the steps to create an effective Resume
3. Discuss the most frequently asked interview questions
4. Discuss how to answer the most frequently asked interview questions
5. Discuss basic workplace terminology

5.4.1 Interview Preparation: How to Prepare for an Interview

The success of your getting the job that you want depends largely on how well your interview for that job goes. Therefore, before you go in for your interview, it is important that you prepare for it with a fair amount of research and planning. Take a look at the steps to follow in order to be well prepared for an interview:

1. **Research the organization that you are having the interview with.**
   - Studying the company beforehand will help you be more prepared at the time of the interview. Your knowledge of the organization will help you answer questions at the time of the interview, and will leave you looking and feeling more confident. This is sure to make you stand out from other, not as well informed, candidates.
   - Look for background information on the company. Ty and find an overview of the company and its industry profile.
   - Visit the company website to get a good idea of what the company does. A company website offers a wealth of important information. Read and understand the company's mission statement. Pay attention to the company's products/services and client list. Read through any press releases to get an idea of the company's projected growth and stability.
   - Note down any questions that you have after your research has been completed.
2. **Think about whether your skills and qualifications match the job requirements.**
   - Carefully read through and analyze the job description.
   - Make a note of the knowledge, skills and abilities required to fulfill the job requirements.
   - Take a look at the organization hierarchy. Figure out where the position you are applying for fits into this hierarchy.
3. **Go through the most typical interview questions asked, and prepare your responses.**
   - Remember, in most interviews a mix of resume-based, behavioral and case study questions are asked.
   - Think about the kind of answers you would like to provide to typical questions asked in these three areas.
   - Practice these answers until you can express them confidently and clearly.

4. **Plan your attire for the interview.**
   - It is always safest to opt for formal business attire, unless expressly informed to dress in business casual (in which case you should use your best judgement).
   - Ensure that your clothes are clean and well-ironed. Pick neutral colours – nothing too bright or flashy.
   - The shoes you wear should match your clothes, and should be clean and suitable for an interview.
   - Remember, your aim is to leave everyone you meet with the impression that you are a professional and highly efficient person.
5. **Ensure that you have packed everything that you may require during the interview.**
   - Carry a few copies of your resume. Use a good quality paper for your resume print outs.
   - Always take along a notepad and a pen.
   - Take along any information you may need to refer to, in order to fill out an application form.
   - Carry a few samples of your work, if relevant.
6. **Remember the importance of non-verbal communication.**
   - Practice projecting confidence. Remind yourself to smile and make eye contact. Practice giving a firm handshake.
   - Keep in mind the importance of posture. Practice sitting up straight. Train yourself to stop nervous gestures like fidgeting and foot-tapping.
   - Practice keeping your reactions in check. Remember, your facial expressions provide a good insight into your true feelings. Practice projecting a positive image.
7. **Make a list of questions to end the interview with.**
   - Most interviews will end with the interviewer(s) asking if you have any questions. This is your chance to show that you have done your research and are interested in learning more about the company.
   - If the interviewer does not ask you this question, you can inform him/her that you have some queries that you would like to discuss. This is the time for you to refer to the notes you made while studying the company.
   - Some good questions to ask at this point are:
     - What do you consider the most important criteria for success in this job?
     - How will my performance be evaluated?
     - What are the opportunities for advancement?
     - What are the next steps in the hiring process?
   - Remember, never ask for information that is easily available on the company website.

Tips

- Ask insightful and probing questions.
- When communicating, use effective forms of body language like smiling, making eye contact, and actively listening and nodding. Don't slouch, play with nearby items, fidget, chew gum, or mumble.

5.4.2 Preparing an Effective Resume: How to Create an Effective Resume

A resume is a formal document that lists a candidate's work experience, education and skills. A good resume gives a potential employer enough information to believe the applicant is worth interviewing. That's why it is so important to create a résumé that is effective. Take a look at the steps to create an effective resume:

Step 1: Write the Address Section

The Address section occupies the top of your resume. It includes information like your name, address, phone number and e-mail address. Insert a bold line under the section to separate it from rest of your resume.

Example:

Jasmine Watts
Breach Candy, Mumbai – India
Contact No: +91 2223678270
Email: jasmine.watts@gmail.com

Step 2: Add the Profile Summary Section

This part of your resume should list your overall experiences, achievements, awards, certifications and strengths. You can make your summary as short as 2-3 bullet points or as long as 8-10 bullet points.

Example:

Profile Summary

- A Content Writer graduated from University of Strathclyde having 6 years of experience in writing website copy.
- Core expertise lies in content creation for e-learning courses, specifically for the K-12 segment.

Step 3: Include Your Educational Qualifications

When listing your academic records, first list your highest degree. Then add the second highest qualification under the highest one and so on. To provide a clear and accurate picture of your educational background, it is critical that include information on your position, rank, percentage or CPI for every degree or certification that you have listed.

If you have done any certifications and trainings, you can add a Trainings & Certifications section under your Educational Qualifications section.

Example:

Educational Qualifications

- Masters in International Management (2007) from Columbia University with 8.8 CPI.
- Bachelor of Management Studies (2004) from Mumbai University with 87% marks.
- 10+2 with Math, Stats (2001) from Maharashtra Board with 91% marks.
- High School (1999) from Maharashtra Board with 93% marks.

Step 4: List Your Technical Skills

When listing your technical skills, start with the skills that you are most confident about. Then add the skills that you do not have as good a command over. It is perfectly acceptable to include just one skill, if you feel that particular skill adds tremendous value to your résumé. If you do not have any technical skills, you can omit this step.

Example:

Technical Skills

- Flash
- Photoshop

Step 5: Insert Your Academic Project Experience

List down all the important projects that you have worked on. Include the following information in this section:

- Project title
- Organization
- Platform used
- Contribution
- Description

Example:

Academic Projects

Project Title: Different Communication Skills

Organization: True Blue Solutions

Platform used: Articulate

Contribution: Content writing and graphic visualization

Description: Development of storyboards for corporate induction & training programs

Step 6: List Your Strengths

This is where you list all your major strengths. This section should be in the form of a bulleted list.

Example:

Strengths

- Excellent oral, written and presentation skills
- Action-oriented and result-focused
- Great time management skills

Step 7: List Your Extracurricular Activities

It is very important to show that you have diverse interests and that your life consists of more than academics. Including your extracurricular activities can give you an added edge over other candidates who have similar academic scores and project experiences. This section should be in the form of a bulleted list.

Example:

Extracurricular Activities

- Member of the Debate Club
- Played tennis at a national level
- Won first prize in the All India Camel Contest, 2010

Step 8: Write Your Personal Details

The last section of your résumé must include the following personal information:

- Date of birth
- Nationality
- Gender & marital status
- Languages known

Example:

Personal Details

- Date of birth: 25th May, 1981
- Gender & marital status: Female, Single
- Nationality: Indian
- Languages known: English, Hindi, Tamil, French

Tips

- Keep your resume file name short, simple and informational.
- Make sure the resume is neat and free from typing errors.
- Always create your resume on plain white paper.

5.4.3 Interview FAQs

Take a look at some of the most frequently asked interview questions, and some helpful tips on how to answer them.

Q1. Can you tell me a little about yourself?

Tips to answer:

- Don't provide your full employment or personal history.
- Offer 2-3 specific experiences that you feel are most valuable and relevant.
- Conclude with how those experiences have made you perfect for this specific role.

Q2. How did you hear about the position?

Tips to answer:

- Tell the interviewer how you heard about the job – whether it was through a friend (name the friend), event or article (name them) or a job portal (say which one).
- Explain what excites you about the position and what in particular caught your eye about this role.

Q3. What do you know about the company?

Tips to answer:

- Don't recite the company's About Us page.
- Show that you understand and care about the company's goals.
- Explain why you believe in the company's mission and values.

Q4. Why do you want this job?

Tips to answer:

- Show that you are passionate about the job.
- Identify why the role is a great fit for you.
- Explain why you love the company.

Q5. Why should we hire you?

Tips to answer:

- Prove through your words that you can not only do the work, but can definitely deliver excellent results.
- Explain why you would be a great fit with the team and work culture.
- Explain why you should be chosen over any other candidate.

Q6. What are your greatest professional strengths?

Tips to answer:

- Be honest – share some of your real strengths, rather than give answers that you think sound good.
- Offer examples of specific strengths that are relevant to the position you are applying for.
- Provide examples of how you've demonstrated these strengths.

Q7. What do you consider to be your weaknesses?

Tips to answer:

- The purpose of this question is to gauge your self-awareness and honesty.
- Give an example of a trait that you struggle with, but that you're working on to improve.

Q8. What are your salary requirements?

Tips to answer:

- Do your research beforehand and find out the typical salary range for the job you are applying for.
- Figure out where you lie on the pay scale based on your experience, education, and skills.
- Be flexible. Tell the interviewer that you know your skills are valuable, but that you want the job and are willing to negotiate.

Q9. What do you like to do outside of work?

Tips to answer:

- The purpose of this question is to see if you will fit in with the company culture.
- Be honest – open up and share activities and hobbies that interest and excite you.

Q10. If you were an animal, which one would you want to be?

Tips to answer:

- The purpose of this question is to see if you are able to think on your feet.
- There's no wrong answer – but to make a great impression try to bring out your strengths or personality traits through your answer.

Q11: What do you think we could do better or differently?

Tips to answer:

- The purpose of this question is to see if you have done your research on the company, and to test whether you can think critically and come up with new ideas.
- Suggest new ideas. Show how your interests and expertise would help you execute these ideas.

Q12: Do you have any questions for us?

Tips to answer:

- Do not ask questions to which the answers can be easily found on the company website or through a quick online search.
- Ask intelligent questions that show your ability to think critically.

Tips

- Be honest and confident while answering.
- Use examples of your past experiences wherever possible to make your answers more impactful.

5.4.4 Work Readiness – Terms & Terminologies: Basic Workplace Terminology

Every employee should be well versed in the following terms:

- **Annual leave:** Paid vacation leave given by employers to employees.
- **Background Check:** A method used by employers to verify the accuracy of the information provided by potential candidates.
- **Benefits:** A part of an employee's compensation package.
- **Breaks:** Short periods of rest taken by employees during working hours.
- **Compensation Package:** The combination of salary and benefits that an employer provides to his/her employees.
- **Compensatory Time (Comp Time):** Time off in lieu of pay.
- **Contract Employee:** An employee who works for one organization that sells said employee's services to another company, either on a project or time basis.
- **Contract of Employment:** When an employee is offered work in exchange for wages or salary, and accepts the offer made by the employer, a contract of employment exists.
- **Corporate Culture:** The beliefs and values shared by all the members of a company, and imparted from one generation of employees to another.
- **Counter Offer/Counter Proposal:** A negotiation technique used by potential candidates to increase the amount of salary offered by a company.
- **Cover Letter:** A letter that accompanies a candidate's resume. It emphasizes the important points in the candidate's resume and provides real examples that prove the candidate's ability to perform the expected job role.
- **Curriculum Vitae (CV)/Resume:** A summary of a candidate's achievements, educational background, work experience, skills and strengths.
- **Declining Letter:** A letter sent by an employee to an employer, turning down the job offer made by the employer to the employee.
- **Deductions:** Amounts subtracted from an employee's pay and listed on the employee's pay slip.
- **Discrimination:** The act of treating one person not as favourably as another person.
- **Employee:** A person who works for another person in exchange for payment.
- **Employee Training:** A workshop or in-house training that an employee is asked to attend by his or her superior, for the benefit of the employer.
- **Employment Gaps:** Periods of unemployed time between jobs.
- **Fixed-Term Contract:** A contract of employment which gets terminated on an agreed-upon date.
- **Follow-Up:** The act of contacting a potential employer after a candidate has submitted his or her resume.
- **Freelancer/Consultant/Independent Contractor:** A person who works for him or herself and pitches for temporary jobs and projects with different employers.
- **Holiday**: Paid time-off from work.
- **Hourly Rate**: The amount of salary or wages paid for 60 minutes of work.

- **Internship**: A job opportunity offered by an employer to a potential employee, called an intern, to work at the employer's company for a fixed, limited time period.
- **Interview**: A conversation between a potential employee and a representative of an employer, in order to determine if the potential employee should be hired.
- **Job Application**: A form which asks for a candidate's information like the candidate's name, address, contact details and work experience. The purpose of a candidate submitting a job application, is to show that candidate's interest in working for a particular company.
- **Job Offer**: An offer of employment made by an employer to a potential employee.
- **Job Search Agent**: A program that enables candidates to search for employment opportunities by selecting criteria listed in the program, for job vacancies.
- **Lay Off**: A lay off occurs when an employee is temporarily let go from his or her job, due to the employer not having any work for that employee.
- **Leave**: Formal permission given to an employee, by his or her employer, to take a leave of absence from work.
- **Letter of Acceptance**: A letter given by an employer to an employee, confirming the offer of employment made by the employer, as well as the conditions of the offer.
- **Letter of Agreement**: A letter that outlines the terms of employment.
- **Letter of Recommendation**: A letter written for the purpose of validating the work skills of a person.
- **Maternity Leave**: Leave taken from work by women who are pregnant, or who have just given birth.
- **Mentor**: A person who is employed at a higher level than you, who offers you advice and guides you in your career.
- **Minimum wage**: The minimum wage amount paid on an hourly basis.
- **Notice**: An announcement made by an employee or an employer, stating that the employment contract will end on a particular date.
- **Offer of Employment**: An offer made by an employer to a prospective employee that contains important information pertaining to the job being offered, like the starting date, salary, working conditions etc.
- **Open-Ended Contract**: A contract of employment that continues till the employer or employee terminates it.
- **Overqualified**: A person who is not suited for a particular job because he or she has too many years of work experience, or a level of education that is much higher than required for the job, or is currently or was previously too highly paid.
- **Part-Time Worker**: An employee who works for fewer hours than the standard number of hours normally worked.
- **Paternity Leave**: Leave granted to a man who has recently become a father.
- **Recruiters/Headhunters/Executive Search Firms**: Professionals who are paid by employers to search for people to fill particular positions.
- **Resigning/Resignations**: When an employee formally informs his or her employer that he or she is quitting his or her job.
- **Self-Employed**: A person who has his or her own business and does not work in the capacity of an employee.
- **Time Sheet**: A form that is submitted to an employer, by an employee, that contains the number of hours worked every day by the employee.

UNIT 5.5. Understanding Entrepreneurship

Unit Objectives

1. At the end of this unit, you will be able to:
2. Discuss the concept of entrepreneurship
3. Discuss the importance of entrepreneurship
4. Describe the characteristics of an entrepreneur
5. Describe the different types of enterprises
6. List the qualities of an effective leader
7. Discuss the benefits of effective leadership
8. List the traits of an effective team
9. Discuss the importance of listening effectively
10. Discuss how to listen effectively
11. Discuss the importance of speaking effectively
12. Discuss how to speak effectively
13. Discuss how to solve problems
14. List important problem solving traits
15. Discuss ways to assess problem solving skills
16. Discuss the importance of negotiation
17. Discuss how to negotiate
18. Discuss how to identify new business opportunities
19. Discuss how to identify business opportunities within your business
20. Understand the meaning of entrepreneur
21. Describe the different types of entrepreneurs
22. List the characteristics of entrepreneurs
23. Recall entrepreneur success stories
24. Discuss the entrepreneurial process
25. Describe the entrepreneurship ecosystem
26. Discuss the government's role in the entrepreneurship ecosystem
27. Discuss the current entrepreneurship ecosystem in India
28. Understand the purpose of the Make in India campaign
29. Discuss the relationship between entrepreneurship and risk appetite
30. Discuss the relationship between entrepreneurship and resilience
31. Describe the characteristics of a resilient entrepreneur
32. Discuss how to deal with failure

5.5.1 Concept Introduction, (Characteristic of an Entrepreneur, types of firms / types of enterprises): Entrepreneurs and Entrepreneurship

Anyone who is determined to start a business, no matter what the risk, is an entrepreneur. Entrepreneurs run their own start-up, take responsibility for the financial risks and use creativity, innovation and vast reserves of self-motivation to achieve success. They dream big and are determined to do whatever it takes to turn their idea into a viable offering. The aim of an entrepreneur is to create an enterprise. The process of creating this enterprise is known as entrepreneurship.

Importance of Entrepreneurship

Entrepreneurship is very important for the following reasons:

1. It results in the creation of new organizations
2. It brings creativity into the marketplace
3. It leads to improved standards of living
4. It helps develop the economy of a country

Characteristics of Entrepreneurs

All successful entrepreneurs have certain characteristics in common.

They are all:

- Extremely passionate about their work
- Confident in themselves
- Disciplined and dedicated
- Motivated and driven
- Highly creative
- Visionaries
- Open-minded
- Decisive

Entrepreneurs also have a tendency to:

- Have a high risk tolerance
- Thoroughly plan everything
- Manage their money wisely
- Make their customers their priority
- Understand their offering and their market in detail
- Ask for advice from experts when required
- Know when to cut their losses

Examples of Famous Entrepreneurs

Some famous entrepreneurs are:

- Bill Gates (Founder of Microsoft)
- Steve Jobs (Co-founder of Apple)
- Mark Zuckerberg (Founder of Facebook)
- Pierre Omidyar (Founder of eBay)

Types of Enterprises

As an entrepreneur in India, you can own and run any of the following types of enterprises:

Sole Proprietorship

In a sole proprietorship, a single individual owns, manages and controls the enterprise. This type of business is the easiest to form with respect to legal formalities. The business and the owner have no separate legal existence. All profit belongs to the proprietor, as do all the losses - the liability of the entrepreneur is unlimited.

Partnership

A partnership firm is formed by two or more people. The owners of the enterprise are called partners. A partnership deed must be signed by all the partners. The firm and its partners have no separate legal existence. The profits are shared by the partners. With respect to losses, the liability of the partners is unlimited. A firm has a limited life span and must be dissolved when any one of the partners dies, retires, claims bankruptcy or goes insane.

Limited Liability Partnership (LLP)

In a Limited Liability Partnership or LLP, the partners of the firm enjoy perpetual existence as well as the advantage of limited liability. Each partner's liability is limited to their agreed contribution to the LLP. The partnership and its partners have a separate legal existence.

Tips

- Learn from others' failures.
- Be certain that this is what you want.
- Search for a problem to solve, rather than look for a problem to attach to your idea.

5.5.2 Leadership & Teamwork: Leadership and Leaders

Leadership means se翿 ng an example for others to follow. Se翿 ng a good example means not asking someone to do something that you wouldn't willingly want to do yourself. Leadership is about figuring out what to do in order to win as a team, and as a company.

Leaders believe in doing the right things. They also believe in helping others to do the right things. An effective leader is someone who:

- Creates an inspiring vision of the future.
- Motivates and inspires his team to pursue that vision.

Leadership Qualities That All Entrepreneurs Need

Building a successful enterprise is only possible if the entrepreneur in charge possesses excellent leadership qualities. Some critical leadership skills that every entrepreneur must have are:

1. **Pragmatism**: This means having the ability to highlight all obstacles and challenges, in order to resolve issues and reduce risks.
2. **Humility**: This means admi翿 ng to mistakes often and early, and being quick to take responsibility for your actions. Mistakes should be viewed as challenges to overcome, not opportunities to point blame.
3. **Flexibility**: It is critical for a good leader to be very flexible and quickly adapt to change. It is equally critical to know when to adapt and when not to.
4. **Authenticity**: This means showing both, your strengths and your weaknesses. It means being human and showing others that you are human.
5. **Reinvention**: This means refreshing or changing your leadership style when necessary. To do this, it's important to learn where your leadership gaps lie and find out what resources are required to close them.
6. **Awareness**: This means taking the time to recognize how others view you. It means understanding how your presence affects those around you.

Benefits of Effective Leadership

Effective leadership results in numerous benefits. Great leadership leads to the leader successfully:

- Gaining the loyalty and commitment of the team members
- Motivating the team to work towards achieving the company's goals and objectives
- Building morale and instilling confidence in the team members
- Fostering mutual understanding and team-spirit among team members
- Convincing team members about the need to change when a situation requires adaptability

Teamwork and Teams

Teamwork occurs when the people in a workplace combine their individual skills to pursue a common goal. Effective teams are made up of individuals who work together to achieve this common goal. A great team is one who holds themselves accountable for the end result.

Importance of Teamwork in Entrepreneurial Success

For an entrepreneurial leader, building an effective team is critical to the success of a venture. An entrepreneur must ensure that the team he builds possesses certain crucial qualities, traits and characteristics. An effective team is one which has:

1. **Unity of purpose:** All the team members should clearly understand and be equally committed to the purpose, vision and goals of the team.
2. **Great communication skills:** Team members should have the ability to express their concerns, ask questions and use diagrams, and charts to convey complex information.
3. **The ability to collaborate:** Every member should feel entitled to provide regular feedback on new ideas.
4. **Initiative:** The team should consist of proactive individuals. The members should have the enthusiasm to come up with new ideas, improve existing ideas, and conduct their own research.
5. **Visionary members:** The team should have the ability to anticipate problems and act on these potential problem before they turn into real problems.
6. **Great adaptability skills:** The team must believe that change is a positive force. Change should be seen as the chance to improve and try new things.
7. **Excellent organizational skills:** The team should have the ability to develop standard work processes, balance responsibilities, properly plan projects, and set in place methods to measure progress and ROI.

Tips

- Don't get too attached to your original idea. Allow it to evolve and change.
- Be aware of your weaknesses and build a team that will complement your shortfalls.
- Hiring the right people is not enough. You need to promote or incentivize your most talented people to keep them motivated.
- Earn your team's respect.

5.5.3 Communication Skills: Listening & Speaking: The Importance of Listening Effectively

Listening is the ability to correctly receive and understand messages during the process of communication. Listening is critical for effective communication. Without effective listening skills, messages can easily be misunderstood. This results in a communication breakdown and can lead to the sender and the receiver of the message becoming frustrated or irritated.

It's very important to note that listening is not the same as hearing. Hearing just refers to sounds that you hear. Listening is a whole lot more than that. To listen, one requires focus. It means not only paying attention to the story, but also focusing on how the story is relayed, the way language and voice is used, and even how the speaker uses their body language. The ability to listen depends on how effectively one can perceive and understand both, verbal and non-verbal cues.

How to Listen Effectively

To listen effectively you should:

- Stop talking
- Stop interrupting
- Focus completely on what is being said
- Nod and use encouraging words and gestures
- Be open-minded
- Think about the speaker's perspective
- Be very, very patient
- Pay attention to the tone that is being used
- Pay attention to the speaker's gestures, facial expressions and eye movements
- Not try and rush the person
- Not let the speaker's mannerisms or habits irritate or distract you

How to Listen Effectively

How successfully a message gets conveyed depends entirely on how effectively you are able to get it through. An effective speaker is one who enunciates properly, pronounces words correctly, chooses the right words and speaks at a pace that is easily understandable. Besides this, the words spoken out loud need to match the gestures, tone and body language used.

What you say, and the tone in which you say it, results in numerous perceptions being formed. A person who speaks hesitantly may be perceived as having low self-esteem or lacking in knowledge of the discussed topic. Those with a quiet voice may very well be labelled as shy. And those who speak in commanding tones with high levels of clarity, are usually considered to be extremely confident. This makes speaking a very critical communication skill.

How to Speak Effectively

To speak effectively you should:

- Incorporate body language in your speech like eye contact, smiling, nodding, gesturing etc.
- Build a draft of your speech before actually making your speech.
- Ensure that all your emotions and feelings are under control.
- Pronounce your words distinctly with the correct pitch and intensity. Your speech should be crystal clear at all times.
- Use a pleasant and natural tone when speaking. Your audience should not feel like you are putting on an accent or being unnatural in any way.
- Use precise and specific words to drive your message home. Ambiguity should be avoided at all costs.
- Ensure that your speech has a logical flow.
- Be brief. Don't add any unnecessary information.
- Make a conscious effort to avoid irritating mannerisms like fidgeting, twitching etc.
- Choose your words carefully and use simple words that the majority of the audience will have no difficulty understanding.
- Use visual aids like slides or a whiteboard.
- Speak slowly so that your audience can easily understand what you're saying. However, be careful not to speak too slowly because this can come across as stiff, unprepared or even condescending.
- Remember to pause at the right moments.

Tips

- If you're finding it difficult to focus on what someone is saying, try repeating their words in your head.
- Always maintain eye contact with the person that you are communicating with, when speaking as well as listening. This conveys and also encourages interest in the conversation.

5.5.4 Problem Solving & Negotiation skills: What is a Problem?

As per The Concise Oxford Dictionary (1995), a problem is, "A doubtful or difficult matter requiring a solution"

All problems contain two elements:

1. Goals 2. Obstacles

The aim of problem solving is to recognize the obstacles and remove them in order to achieve the goals.

How to Solve Problems

Solving a problem requires a level of rational thinking. Here are some logical steps to follow when faced with an issue:

Step 1: Identify the problem

Step 2: Study the problem in detail

Step 3: List all possible solutions

Step 4: Select the best solution

Step 5: Implement the chosen solution

Step 6: Check that the problem has really been solved

Important Traits for Problem Solving

Highly developed problem solving skills are critical for both, business owners and their employees. The following personality traits play a big role in how effectively problems are solved:

- Being open minded
- Being proactive
- Having a positive attitude
- Asking the right questions
- Not panicking
- Focusing on the right problem

How to Assess for Problem Solving Skills

As an entrepreneur, it would be a good idea to assess the level of problem solving skills of potential candidates before hiring them. Some ways to assess this skill are through:

1. **Application forms**: Ask for proof of the candidate's problem solving skills in the application form.
2. **Psychometric tests**: Give potential candidates logical reasoning and critical thinking tests and see how they fare.
3. **Interviews**: Create hypothetical problematic situations or raise ethical questions and see how the candidates respond.
4. **Technical questions**: Give candidates examples of real life problems and evaluate their thought process.

What is Negotiation?

Negotiation is a method used to settle differences. The aim of negotiation is to resolve differences through a compromise or agreement while avoiding disputes. Without negotiation, conflicts are likely to lead to resentment between people. Good negotiation skills help satisfy both parties and go a long way towards developing strong relationships.

Why Negotiate

Starting a business requires many, many negotiations. Some negotiations are small while others are critical enough to make or break a startup. Negotiation also plays a big role inside the workplace. As an entrepreneur, you need to know not only know how to negotiate yourself, but also how to train employees in the art of negotiation.

How to Negotiate

Take a look at some steps to help you negotiate:

Step 1: Pre-Negotiation Preparation	Agree on where to meet to discuss the problem, decide who all will be present and set a time limit for the discussion.
Step 2: Discuss the Problem	This involves asking questions, listening to the other side, putting your views forward and clarifying doubts.
Step 3: Clarify the Objective	Ensure that both parties want to solve the same problem and reach the same goal.
Step 4: Aim for a Win-Win Outcome	Try your best to be open minded when negotiating. Compromise and offer alternate solutions to reach an outcome where both parties win.
Step 5: Clearly Define the Agreement	When an agreement has been reached, the details of the agreement should be crystal clear to both sides, with no scope for misunderstandings.
Step 6: Implement the Agreed Upon Solution	Agree on a course of action to set the solution in motion

Tips

- Know exactly what you want before you work towards getting it
- Give more importance to listening and thinking, than speaking
- Focus on building a relationship rather than winning
- Remember that your people skills will affect the outcome
- Know when to walk away – sometimes reaching an agreement may not be possible

5.5.5 Business Opportunities Identification: Entrepreneurs and Opportunities

"The entrepreneur always searches for change, responds to it and exploits it as an opportunity."

Peter Drucker

The ability to identify business opportunities is an essential characteristic of an entrepreneur.

What is an Opportunity?

The word opportunity suggests a good chance or a favourable situation to do something offered by circumstances.

A business opportunity means a good or favourable change available to run a specific business in a given environment, at a given point of time.

Common Questions Faced by Entrepreneurs

A critical question that all entrepreneurs face is how to go about finding the business opportunity that is right for them.

Some common questions that entrepreneurs constantly think about are:

- Should the new enterprise introduce a new product or service based on an unmet need?
- Should the new enterprise select an existing product or service from one market and offer it in another where it may not be available?
- Should the enterprise be based on a tried and tested formula that has worked elsewhere?

It is therefore extremely important that entrepreneurs must learn how to identify new and existing business opportunities and evaluate their chances of success.

When is an Idea an Opportunity?

An idea is an opportunity when:

- It creates or adds value to a customer
- It solves a significant problem, removes a pain point or meets a demand
- Has a robust market and profit margin
- Is a good fit with the founder and management team at the right time and place

Factors to Consider When Looking for Opportunities

Consider the following when looking for business opportunities:

- Economic trends
- Changes in funding
- Changing relationships between vendors, partners and suppliers
- Market trends
- Changes in political support
- Shift in target audience

Ways to Identify New Business Opportunities

1. Identify Market Inefficiencies

   When looking at a market, consider what inefficiencies are present in the market. Think about ways to correct these inefficiencies.

2. Remove Key Hassles

   Rather than create a new product or service, you can innovatively improve a product, service or process.

3. Create Something New

   Think about how you can create a new experience for customers, based on existing business models.

4. Pick a Growing Sector/Industry

   Research and find out which sectors or industries are growing and think about what opportunities you can tap in the same.

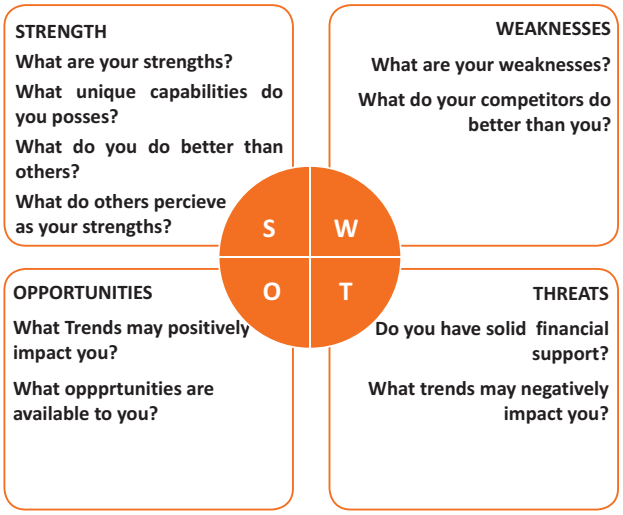
5. Think About Product Differentiation

   If you already have a product in mind, think about ways to set it apart from the existing ones.

Ways to Identify Business Opportunities Within Your Business

1. SWOT Analysis

   An excellent way to identify opportunities inside your business is by creating a SWOT analysis. The acronym SWOT stands for strengths, weaknesses, opportunities, and threats. SWOT analysis framework:



Consider the following when looking for business opportunities:

By looking at yourself and your competitors using the SWOT framework, you can uncover opportunities that you can exploit, as well as manage and eliminate threats that could derail your success.

2. Establishing Your USP

Establish your USP and position yourself as different from your competitors. Identify why customers should buy from you and promote that reason.

Opportunity Analysis

Once you have identified an opportunity, you need to analyze it.
To analyze an opportunity, you must:

- Focus on the idea
- Focus on the market of the idea
- Talk to industry leaders in the same space as the idea
- Talk to players in the same space as the idea

Tips 

- Remember, opportunities are situational.
- Look for a proven track record.
- Avoid the latest craze.
- Love your idea.

5.5.6 Entrepreneurship Support Eco - System: What is an Entrepreneur?

An entrepreneur is a person who:

- Does not work for an employee
- Runs a small enterprise
- Assumes all the risks and rewards of the enterprise, idea, good or service

Types of Entrepreneurs

There are four main types of entrepreneurs:

1. **The Traditional Entrepreneur**: This type of entrepreneur usually has some kind of skill – they can be a carpenter, mechanic, cook etc. They have businesses that have been around for numerous years like restaurants, shops and carpenters. Typically, they gain plenty of experience in a particular industry before they begin their own business in a similar field.
2. **The Growth Potential Entrepreneur**: The desire of this type of entrepreneur is to start an enterprise that will grow, win many customers and make lots of money. Their ultimate aim is to eventually sell their enterprise for a nice profit. Such entrepreneurs usually have a science or technical background.
3. **The Project-Oriented Entrepreneur**: This type of entrepreneur generally has a background in the Arts or psychology. Their enterprises tend to be focus on something that they are very passionate about.
4. **The Lifestyle Entrepreneur**: This type of entrepreneur has usually worked as a teacher or a secretary. They are more interested in selling something that people will enjoy, rather than making lots of money.

Characteristics of an Entrepreneur

Successful entrepreneurs have the following characteristics:

- They are highly motivated
- They are creative and persuasive
- They are mentally prepared to handle each and every task
- They have excellent business skills – they know how to evaluate their cash flow, sales and revenue
- They are willing to take great risks
- They are very proactive – this means they are willing to do the work themselves, rather than wait for someone else to do it
- They have a vision – they are able to see the big picture
- They are flexible and open-minded
- They are good at making decisions

Entrepreneur Success Stories

Dhiru Bhai Ambani

Dhirubhai Ambani began his entrepreneurial career by selling "bhajias" to pilgrims in Mount Girnar on weekends. At 16, he moved to Yemen where he worked as a gas-station attendant, and as a clerk in an oil company. He returned to India with Rs. 50,000 and started a textile trading company. Reliance went on to become the first Indian company to raise money in global markets and the first Indian company to feature in Forbes 500 list.

Dr. Karsanbhai Patel

Karsanbhai Patel made detergent powder in the backyard of his house. He sold his product door-to-door and offered a money back guarantee with every pack that was sold. He charged Rs. 3 per kg when the cheapest detergent at that time was Rs.13 per kg. Dr. Patel eventually started Nirma which became a whole new segment in the Indian domestic detergent market.

The Entrepreneurial Process

Let's take a look at the stages of the entrepreneurial process.

Stage 1: Idea Generation. The entrepreneurial process begins with an idea that has been thought of by the entrepreneur. The idea is a problem that has the potential to be solved.

Stage 2: Germination or Recognition. In this stage a possible solution to the identified problem is thought of.

Stage 3: Preparation or Rationalization. The problem is studied further and research is done to find out how others have tried to solve the same problem.

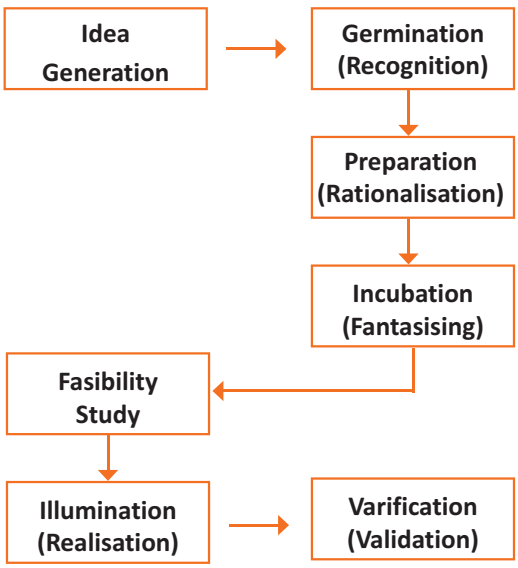
Stage 4: Incubation or Fantasizing. This stage involves creative thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.

Stage 5: Feasibility Study: The next step is the creation of a feasibility study to determine if the idea will make a profit and if it should be seen through.

Stage 6: Illumination or Realization. This is when all uncertain areas suddenly become clear. The entrepreneur feels confident that his idea has merit.

Stage 7: Verification or Validation. In this final stage, the idea is verified to see if it works and if it is useful.

Take a look at the diagram below to get a better idea of this process.



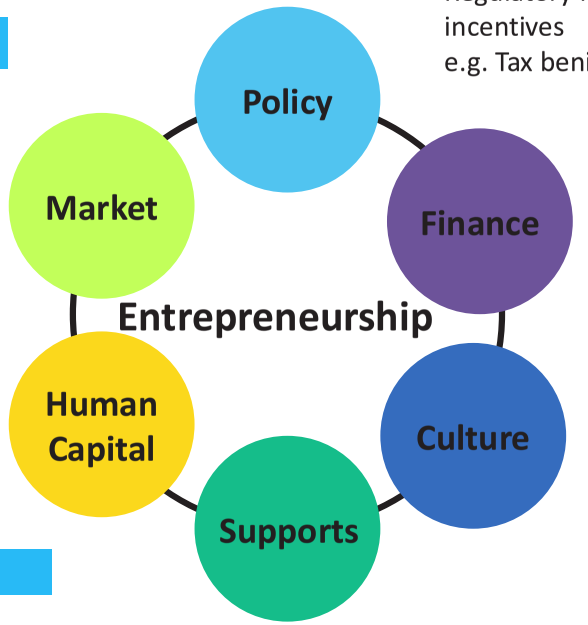
What is an Entrepreneur?

The entrepreneurship support ecosystem signifies the collective and complete nature of entrepreneurship. New companies emerge and flourish not only because of the courageous, visionary entrepreneurs who launch them, but they thrive as they are set in an environment or 'ecosystem' made of private and public participants. These players nurture and sustain the new ventures, facilitating the entrepreneurs' efforts.

An entrepreneurship ecosystem comprises of the following six domains:

1. **Favourable Culture:** This includes elements such as tolerance of risk and errors, valuable networking and positive social standing of the entrepreneur.
2. **Facilitating Policies & Leadership:** This includes regulatory framework incentives and existence of public research institutes.
3. **Financing Options:** Angel financing, venture capitalists and micro loans would be good examples of this.
4. **Human Capital:** This refers to trained and untrained labour, entrepreneurs and entrepreneurship training programmes, etc.
5. **Conducive Markets for Products & Services:** This refers to an existence or scope of existence of a market for the product/service.
6. **Institutional & Infrastructural Support:** This includes legal and financing advisers, telecommunications, digital and transportation infrastructure, and entrepreneurship networking programmes.

These domains indicate whether there is a strong entrepreneurship support ecosystem and what actions should the government put in place to further encourage this ecosystem. The six domains and their various elements have been graphically depicted.



Early Customers

- Early adopters for proof-of-concept
- Expertise in productizing
- Reference customer
- First reviews
- Distribution channels

Leadership

- Unequivocal support
- Social legitimacy
- Open door for advocate
- Entrepreneurship strategy
- urgency, crisis and challenge

Government

- Institutions
  e.g. Investment, support
- Financial support
  e.g. for R&D, jump start funds
  Regulatory framework
  incentives
  e.g. Tax benifits
- Research institutes
- Venture-friendly legislation
- e.g. Bankruptcy, contract enforcement, property rights, and labour

Networks

- Entrepreneure's networks
- Diaspora networks
- Multinational corporations

Financial Capital

- Micro-loans
- Angel investors, friends and family
- Zero-stage venture capital
- Venture capital funds
- Private equity
- Public capital markets
- Debt

Labour

- Skilled and unskilled
- Serial entrepreneures
- Later generation family

Success Stories

- Visible successes
- Wealth generation for founders
- International reputation

Educational Institutions

- General degrees (professional and academic)
- Specific entrepreneurship training

Societal norms

- Tolerance of risk, mistakes, failure
- Innovation, creativity, experimentation
- Social status of entrepreneur
- Wealth creation
- Ambition, drive, hunger

Infrastructure

- Telecommunications
- Transportation & logistics
- Energy
- Zones, incubation centers, clusters

Non-Government Institution

- Entrepreneurship promotion in non-profits
- Conferences
- Business plan contests
- Entrepreneur- friendly association

Support Professions

- Legal
- Accounting
- Investment bankers

Every entrepreneurship support ecosystem is unique and all the elements of the ecosystem are interdependent. Although every region's entrepreneurship ecosystem can be broadly described by the above features, each ecosystem is the result of the hundred elements interacting in highly complex and particular ways.

Entrepreneurship ecosystems eventually become (largely) self-sustaining. When the six domains are resilient enough, they are mutually beneficial. At this point, government involvement can and should be significantly minimized. Public leaders do not need to invest a lot to sustain the ecosystem. It is imperative that the entrepreneurship ecosystem incentives are formulated to be self-liquidating, hence focusing on sustainability of the environment.

Government's Role in the Entrepreneurship Ecosystem

Encouraging new ventures is a major focus for policymakers. Governments across the world are recognizing that new businesses flourish in distinctive types of supportive environments. Policymakers should study the scenario and take into account the following points whilst they formulate policies and regulations that enable successful entrepreneurship support ecosystems.

1. Policymakers should avoid regulations that discourage new entrants and work towards building efficient methods for business startups. Policies and regulations that favour existing, dominant firms over entrepreneurial ventures, restrict competition and obstruct entry for new companies.
2. Instead of developing policies conceptually intended to correct market failures, policymakers should interact with entrepreneurs and understand the challenges faced by them. The feedback should be used to develop policies that incite idea exploration, product development and increased rates of deal flow.
3. Entrepreneurial supporters should create a database that enables identifying who the participants in the ecosystem are and how they are connected. These ecosystem maps are useful tools in developing engagement strategies.
4. Disruptions are unavoidable in economic and social life. However, it's important to note that economic disruption gives rise to entrepreneurial opportunities. Architects of the entrepreneurship ecosystems (entrepreneurs, mentors, policymakers and consumers,) should anticipate these dips, thus capitalizing on the opportunities they create.

The need for effective strategies to enable local entrepreneurship support ecosystems is a practical one. Better understanding of the actual ecosystems provides a framework within which policy makers can ask relevant questions, envisage more efficient approaches, and assess ensuing outcomes.

Snapshot of the Entrepreneurship Ecosystem in India

Entrepreneurship has earned a newfound respect in India. Many Indians, with exposure to the world of business, who traditionally would have opted for a job, are setting up their own ventures. Many elements of the entrepreneurship ecosystem are beginning to come together. For example, increase in venture capitalists, government schemes and incubators, academia industry linkages, and emerging clusters and support to rural economy. All these initiatives are effective but there is a need to scale up and enrich the ecosystem further in the following ways:

1. We need to review our attitude towards failures and accept them as learning experiences.
2. We must encourage the educated to become entrepreneurs and provide students in schools and colleges with entrepreneurship skills.

3. Universities, research labs and the government need to play the role of enablers in the entrepreneurship support ecosystem.
4. Policymakers need to focus on reducing the obstacles such as corruption, red tape and bureaucracy.
5. We need to improve our legal systems and court international venture capital firms and bring them to India.
6. We must devise policies and methods to reach the secondary and tertiary towns in India, where people do not have access to the same resources available in the cities.

Today, there is a huge opportunity in this country to introduce innovative solutions that are capable of scaling up, and collaborating within the ecosystem as well as enriching it.

Make in India Campaign

Every entrepreneur has certain needs. Some of their important needs are:

- To easily get loans
- To easily find investors
- To get tax exemptions
- To easily access resources and good infrastructure
- To enjoy a procedure that is free of hassles and is quick
- To be able to easily partner with other firms

The Make in India campaign, launched by Prime Minister Modi aims to satisfy all these needs of young, aspiring entrepreneurs. Its objective is to:

- Make investment easy
- Support new ideas
- Enhance skill development
- Safeguard the ideas of entrepreneurs
- Create state-of-the-art facilities for manufacturing goods

Tips

- Research the existing market, network with other entrepreneurs, venture capitalists, angel investors, and thoroughly review the policies in place to enable your entrepreneurship.
- Failure is a stepping stone and not the end of the road. Review yours and your peers' errors and correct them in your future venture.
- Be proactive in your ecosystem. Identify the key features of your ecosystem and enrich them to ensure self-sustainability of your entrepreneurship support ecosystem.

5.5.7 Risk Appetite & Resilience: Entrepreneurship and Risk

Entrepreneurs are inherently risk takers. They are path-makers not path-takers. Unlike a normal, cautious person, an entrepreneur would not think twice about quitting his job (his sole income) and taking a risk on himself and his idea.

An entrepreneur is aware that while pursuing his dreams, assumptions can be proven wrong and unforeseen events may arise. He knows that after dealing with numerous problems, success is still not guaranteed. Entrepreneurship is synonymous with the ability to take risks. This ability, called risk-appetite, is an entrepreneurial trait that is partly genetic and partly acquired.

What is Risk Appetite?

Risk appetite is defined as the extent to which a company is equipped to take risk, in order to achieve its objectives. Essentially, it refers to the balance, struck by the company, between possible profits and the hazards caused by changes in the environment (economic ecosystem, policies, etc.). Taking on more risk may lead to higher rewards but have a high probability of losses as well. However, being too conservative may go against the company as it can miss out on good opportunities to grow and reach their objectives.

The levels of risk appetite can be broadly categorized as “low”, “medium” and “high.” The company’s entrepreneur(s) have to evaluate all potential alternatives and select the option most likely to succeed. Companies have varying levels of risk appetites for different objectives. The levels depend on:

- The type of industry
- Market pressures
- Company objectives

For example, a startup with a revolutionary concept will have a very high risk appetite. The startup can afford short term failures before it achieves longer term success. This type of appetite will not remain constant and will be adjusted to account for the present circumstances of the company.

Risk Appetite Statement

Companies have to define and articulate their risk appetite in sync with decisions made about their objectives and opportunities. The point of having a risk appetite statement is to have a framework that clearly states the acceptance and management of risk in business. It sets risk taking limits within the company. The risk appetite statement should convey the following:

- The nature of risks the business faces.
- Which risks the company is comfortable taking on and which risks are unacceptable.
- How much risk to accept in all the risk categories.
- The desired tradeoff between risk and reward.
- Measures of risk and methods of examining and regulating risk exposures.

Entrepreneurship and Resilience

Entrepreneurs are characterized by a set of qualities known as resilience. These qualities play an especially large role in the early stages of developing an enterprise. Risk resilience is an extremely valuable characteristic as it is believed to protect entrepreneurs against the threat of challenges and changes in the business environment.

What is Entrepreneurial Resilience?

Resilience is used to describe individuals who have the ability to overcome setbacks related to their life and career aspirations. A resilient person is someone who is capable of easily and quickly recovering from setbacks. For the entrepreneur, resilience is a critical trait. Entrepreneurial resilience can be enhanced in the following ways:

- By developing a professional network of coaches and mentors
- By accepting that change is a part of life
- By viewing obstacles as something that can be overcome

Characteristics of a Resilient Entrepreneur

The characteristics required to make an entrepreneur resilient enough to go the whole way in their business enterprise are:

- A strong internal sense of control
- Strong social connections
- Skill to learn from setbacks
- Ability to look at the bigger picture
- Ability to diversify and expand
- Survivor attitude
- Cash-flow conscious habits
- Attention to detail

Tips 

- Cultivate a great network of clients, suppliers, peers, friends and family. This will not only help you promote your business, but will also help you learn, identify new opportunities and stay tuned to changes in the market.
- Don’t dwell on setbacks. Focus on what the you need to do next to get moving again.
- While you should try and curtail expenses, ensure that it is not at the cost of your growth.

5.5.8 Success & Failures: Understanding Successes and Failures in Entrepreneurship

Shyam is a famous entrepreneur, known for his success story. But what most people don't know, is that Shyam failed numerous times before his enterprise became a success. Read his interview to get an idea of what entrepreneurship is really about, straight from an entrepreneur who has both, failed and succeeded.

Interviewer: Shyam, I have heard that entrepreneurs are great risk-takers who are never afraid of failing. Is this true?

Shyam: Ha ha, no of course it's not true! Most people believe that entrepreneurs need to be fearlessly enthusiastic. But the truth is, fear is a very normal and valid human reaction, especially when you are planning to start your own business! In fact, my biggest fear was the fear of failing. The reality is, entrepreneurs fail as much as they succeed. The trick is to not allow the fear of failing to stop you from going ahead with your plans. Remember, failures are lessons for future success!

Interviewer: What, according to you, is the reason that entrepreneurs fail?

Shyam: Well, there is no one single reason why entrepreneurs fail. An entrepreneur can fail due to numerous reasons. You could fail because you have allowed your fear of failure to defeat you. You could fail because you are unwilling to delegate (distribute) work. As the saying goes, "You can do anything, but not everything!" You could fail because you gave up too easily – maybe you were not persistent enough. You could fail because you were focusing your energy on small, insignificant tasks and ignoring the tasks that were most important. Other reasons for failing are partnering with the wrong people, not being able to sell your product to the right customers at the right time at the right price… and many more reasons!

Interviewer: As an entrepreneur, how do you feel failure should be looked at?

Shyam: I believe we should all look at failure as an asset, rather than as something negative. The way I see it, if you have an idea, you should try to make it work, even if there is a chance that you will fail. That's because not trying is failure right there, anyway! And failure is not the worst thing that can happen. I think having regrets because of not trying, and wondering 'what if' is far worse than trying and actually failing.

Interviewer: How did you feel when you failed for the first time?

Shyam: I was completely heartbroken! It was a very painful experience. But the good news is, you do recover from the failure. And with every subsequent failure, the recovery process gets a lot easier. That's because you start to see each failure more as a lesson that will eventually help you succeed, rather than as an obstacle that you cannot overcome. You will start to realize that failure has many benefits.

Interviewer: Can you tell us about some of the benefits of failing?

Shyam: One of the benefits that I have experienced personally from failing is that the failure made me see things in a new light. It gave me answers that I didn't have before. Failure can make you a lot stronger. It also helps keep your ego in control.

Interviewer: What advice would you give entrepreneurs who are about to start their own enterprises?

Shyam: I would tell them to do their research and ensure that their product is something that is actually wanted by customers. I'd tell them to pick their partners and employees very wisely and cautiously. I'd tell them that it's very important to be aggressive – push and market your product as aggressively as possible. I would warn them that starting an enterprise is very expensive and that they should be prepared for a situation where they run out of money.

I would tell them to create long term goals and put a plan in action to achieve that goal. I would tell them to build a product that is truly unique. Be very careful and ensure that you are not copying another startup. Lastly, I'd tell them that it's very important that they find the right investors.

Interviewer: That's some really helpful advice, Shyam! I'm sure this will help all entrepreneurs to be more prepared before they begin their journey! Thank you for all your insight!

Tips 

- Remember that nothing is impossible.
- Identify your mission and your purpose before you start.
- Plan your next steps – don't make decisions hastily.

UNIT 5.6: Preparing to be an Entrepreneur

Unit Objectives

At the end of this unit, you will be able to:

1. Discuss how market research is carried out
2. Describe the 4 Ps of marketing
3. Discuss the importance of idea generation
4. Recall basic business terminology
5. Discuss the need for CRM
6. Discuss the benefits of CRM
7. Discuss the need for networking
8. Discuss the benefits of networking
9. Understand the importance of setting goals
10. Differentiate between short-term, medium-term and long-term goals
11. Discuss how to write a business plan
12. Explain the financial planning process
13. Discuss ways to manage your risk
14. Describe the procedure and formalities for applying for bank finance
15. Discuss how to manage your own enterprise
16. List important questions that every entrepreneur should ask before starting an enterprise

5.6.1 Market Study / The 4 Ps of Marketing / Importance of an IDEA: Understanding Market Research

Market research is the process of gathering, analyzing and interpreting market information on a product or service that is being sold in that market. It also includes information on:

- Past, present and prospective customers
- Customer characteristics and spending habits
- The location and needs of the target market
- The overall industry
- Relevant competitors

Market research involves two types of data:

- Primary information. This is research collected by yourself or by someone hired by you.
- Secondary information. This is research that already exists and is out there for you to find and use.

Primary research

Primary research can be of two types:

- Exploratory: This is open-ended and usually involves detailed, unstructured interviews.
- Specific: This is precise and involves structured, formal interviews. Conducting specific research is the more expensive than conducting exploratory research.

Secondary research

Secondary research uses outside information. Some common secondary sources are:

- Public sources: These are usually free and have a lot of good information. Examples are government departments, business departments of public libraries etc.
- Commercial sources: These offer valuable information but usually require a fee to be paid. Examples are research and trade associations, banks and other financial institutions etc.
- Educational institutions: These offer a wealth of information. Examples are colleges, universities, technical institutes etc.

The 4 Ps of Marketing

The 4 Ps of marketing are Product, Price, Promotion and Place. Let's look at each of these 4 Ps in detail.

Product

A product can be:

- A tangible good
- An intangible service

Whatever your product is, it is critical that you have a clear understanding of what you are offering, and what its unique characteristics are, before you begin with the marketing process.

Some questions to ask yourself are:

- What does the customer want from the product/service?
- What needs does it satisfy?
- Are there any more features that can be added?
- Does it have any expensive and unnecessary features?
- How will customers use it?
- What should it be called?
- How is it different from similar products?
- How much will it cost to produce?
- Can it be sold at a profit?

Price

Once all the elements of Product have been established, the Price factor needs to be considered.

The Price of a Product will depend on several factors such as profit margins, supply, demand and the marketing strategy.

Some questions to ask yourself are:

- What is the value of the product/service to customers?
- Do local products/services have established price points?
- Is the customer price sensitive?
- Should discounts be offered?
- How is your price compared to that of your competitors?

Promotion

Once you are certain about your Product and your Price, the next step is to look at ways to promote it. Some key elements of promotion are advertising, public relations, social media marketing, email marketing, search engine marketing, video marketing and more.

Some questions to ask yourself are:

- Where should you promote your product or service?
- What is the best medium to use to reach your target audience?
- When would be the best time to promote your product?
- How are your competitors promoting their products?

Place

According to most marketers, the basis of marketing is about offering the right product, at the right price, at the right place, at the right time. For this reason, selecting the best possible location is critical for converting prospective clients into actual clients.

Some questions to ask yourself are:

- Will your product or service be looked for in a physical store, online or both?
- What should you do to access the most appropriate distribution channels?
- Will you require a sales force?
- Where are your competitors offering their products or services?
- Should you follow in your competitors' footsteps?
- Should you do something different from your competitors?

Importance of an IDEA

Ideas are the foundation of progress. An idea can be small or ground-breaking, easy to accomplish or extremely complicated to implement. Whatever the case, the fact that it is an idea gives it merit. Without ideas, nothing is possible. Most people are afraid to speak out their ideas, out for fear of being ridiculed. However, if are an entrepreneur and want to remain competitive and innovative, you need to bring your ideas out into the light.

Some ways to do this are by:

- Establishing a culture of brainstorming where you invite all interested parties to contribute
- Discussing ideas out loud so that people can add their ideas, views, opinions to them
- Being open minded and not limiting your ideas, even if the idea who have seems ridiculous
- Not discarding ideas that you don't work on immediately, but instead making a note of them and shelving them so they can be revisited at a later date

Tips 

- Keep in mind that good ideas do not always have to be unique.
- Remember that timing plays a huge role in determining the success of your idea.
- Situations and circumstances will always change, so be flexible and adapt your idea accordingly.

5.6.2 Business Entity Concepts: Basic Business Terminology

If your aim is to start and run a business, it is crucial that you have a good understanding of basic business terms. Every entrepreneur should be well versed in the following terms:

- Accounting: A systematic method of recording and reporting financial transactions.
- Accounts payable: Money owed by a company to its creditors.
- Accounts Receivable: The amount a company is owed by its clients.
- Assets: The value of everything a company owns and uses to conduct its business.
- Balance Sheet: A snapshot of a company's assets, liabilities and owner's equity at a given moment.
- Bottom Line: The total amount a business has earned or lost at the end of a month.
- Business: An organization that operates with the aim of making a profit.
- Business to Business (B2B): A business that sells goods or services to another business.
- Business to Consumer (B2C): A business that sells goods or services directly to the end user.
- Capital: The money a business has in its accounts, assets and investments. The two main types of capital are debt and equity.
- Cash Flow: The overall movement of funds through a business each month, including income and expenses.
- Cash Flow Statement: A statement showing the money that entered and exited a business during a specific period of time.
- Contract: A formal agreement to do work for pay.
- Depreciation: The degrading value of an asset over time.
- Expense: The costs that a business incurs through its operations.
- Finance: The management and allocation of money and other assets.
- Financial Report: A comprehensive account of a business' transactions and expenses.
- Fixed Cost: A one-time expense.
- Income Statement (Profit and Loss Statement): Shows the profitability of a business during a period of time.
- Liabilities: The value of what a business owes to someone else.
- Marketing: The process of promoting, selling and distributing a product or service.
- Net Income/Profit: Revenues minus expenses.
- Net Worth: The total value of a business.
- Payback Period: The amount of time it takes to recover the initial investment of a business.
- Profit Margin: The ratio of profit, divided by revenue, displayed as a percentage.
- Return on Investment (ROI): The amount of money a business gets as return from an investment.

- Revenue: The total amount of income before expenses are subtracted.
- Sales Prospect: A potential customer.
- Supplier: A provider of supplies to a business.
- Target Market: A specific group of customers at which a company's products and services are aimed.
- Valuation: An estimate of the overall worth of the business.
- Variable Cost: Expenses that change in proportion to the activity of a business.
- Working Capital: Calculated as current assets minus current liabilities.

5.6.3 CRM & Networking: What is CRM?

CRM stands for Customer Relationship Management. Originally the expression Customer Relationship Management meant managing one's relationship with customers. However, today it refers to IT systems and software designed to help companies manage their relationships.

The Need for CRM

The better a company can manage its relationships with its customers, the higher the chances of the company's success. For any entrepreneur, the ability to successfully retain existing customers and expand the enterprise is paramount. This is why IT systems that focus on addressing the problems of dealing with customers on a daily basis are becoming more and more in demand.

Customer needs change over time, and technology can make it easier to understand what customers really want. This insight helps companies to be more responsive to the needs of their customers. It enables them to modify their business operations when required, so that their customers are always served in the best manner possible. Simply put, CRM helps companies recognize the value of their clients and enables them to capitalize on improved customer relations.

Benefits of CRM

CRM has a number of important benefits:

- It helps improve relations with existing customers which can lead to:
  - Increased sales
  - Identification of customer needs
  - Cross-selling of products
- It results in better marketing of one's products or services
- It enhances customer satisfaction and retention
- It improves profitability by identifying and focusing on the most profitable customers

5.3.4 What is Networking?

In business, networking means leveraging your business and personal connections in order to bring in a regular supply of new business. This marketing method is effective as well as low cost. It is a great way to develop sales opportunities and contacts. Networking can be based on referrals and introductions, or can take place via phone, email, and social and business networking websites.

5.3.5 The Need for Networking

Networking is an essential personal skill for business people, but it is even more important for entrepreneurs. The process of networking has its roots in relationship building. Networking results in greater communication and a stronger presence in the entrepreneurial ecosystem. This helps build strong relationships with other entrepreneurs.

Business networking events held across the globe play a huge role in connecting like-minded entrepreneurs who share the same fundamental beliefs in communication, exchanging ideas and converting ideas into realities. Such networking events also play a crucial role in connecting entrepreneurs with potential investors. Entrepreneurs may have vastly different experiences and backgrounds but they all have a common goal in mind – they all seek connection, inspiration, advice, opportunities and mentors. Networking offers them a platform to do just that.

Benefits of Networking

Networking offers numerous benefits for entrepreneurs. Some of the major benefits are:

- Getting high quality leads
- Increased business opportunities
- Good source of relevant connections
- Advice from like-minded entrepreneurs
- Gaining visibility and raising your profile
- Meeting positive and enthusiastic people
- Increased self-confidence
- Satisfaction from helping others
- Building strong and lasting friendships

Tips

- Use social media interactions to identify needs and gather feedback.
- When networking, ask open-ended questions rather than yes/no type questions.

5.6.4 Business Plan: Why Set Goals

Setting goals is important because it gives you long-term vision and short-term motivation. Goals can be short term, medium term and long term.

Short-Term Goals

- These are specific goals for the immediate future.

Example: Repairing a machine that has failed.

Medium-Term Goals

- These goals are built on your short term goals.
- They do not need to be as specific as your short term goals.

Example: Arranging for a service contract to ensure that your machines don't fail again.

Long-Term Goals

These goals require time and planning.

They usually take a year or more to achieve.

Example: Planning your expenses so you can buy new machinery

Why Create a Business Plan

A business plan is a tool for understanding how your business is put together. It can be used to monitor progress, foster accountable and control the fate of the business. It usually offers a 3-5 year projection and outlines the plan that the company intends to follow to grow its revenues. A business plan is also a very important tool for getting the interest of key employees or future investors.

A business plan typically comprises of eight elements.

Elements of a Business Plan

Executive Summary

The executive summary follows the title page. The summary should clearly state your desires as the business owner in a short and businesslike way. It is an overview of your business and your plans. Ideally this should not be more than 1-2 pages.

Your Executive Summary should include:

- The Mission Statement: Explain what your business is all about.

  Example: Nike's Mission Statement

  Nike's mission statement is "To bring inspiration and innovation to every athlete in the world."
- Company Information: Provide information like when your business was formed, the names and roles of the founders, the number of employees, your business location(s) etc.
- Growth Highlights: Mention examples of company growth. Use graphs and charts where possible.
- Your Products/Services: Describe the products or services provided.
- Financial Information: Provide details on current bank and investors.
- Summarize future plans: Describe where you see your business in the future.

Business Description

The second section of your business plan needs to provide a detailed review of the different elements of your business. This will help potential investors to correctly understand your business goal and the uniqueness of your offering.

Your Business Description should include:

- A description of the nature of your business
- The market needs that you are aiming to satisfy
- The ways in which your products and services meet these needs
- The specific consumers and organizations that you intend to serve
- Your specific competitive advantages

Market Analysis

The market analysis section usually follows the business description. The aim of this section is to showcase your industry and market knowledge. This is also the section where you should lay down your research findings and conclusions.

Your Market Analysis should include:

- Your industry description and outlook
- Information on your target market
- The needs and demographics of your target audience
- The size of your target market
- The amount of market share you want to capture
- Your pricing structure
- Your competitive analysis
- Any regulatory requirements

Organization & Management

This section should come immediately after the Market Analysis.

Your Organization & Management section should include:

- Your company's organizational structure
- Details of your company's ownership
- Details of your management team
- Qualifications of your board of directors
- Detailed descriptions of each division/department and its function
- The salary and benefits package that you offer your people
- The incentives that you offer

Service or Product Line

The next section is the service or product line section. This is where you describe your service or product, and stress on their benefits to potential and current customers. Explain in detail why your product of choice will fulfill the needs of your target audience.

Your Service or Product Line section should include:

- A description of your product/service
- A description of your product or service's life cycle
- A list of any copyright or patent filings
- A description of any R&D activities that you are involved in or planning

Marketing & Sales

Once the Service or Product Line section of your plan has been completed, you should start on the description of the marketing and sales management strategy for your business.

Your Marketing section should include the following strategies:

- **Market penetration strategy**: This strategy focuses on selling your existing products or services in existing markets, in order to increase your market share.
- **Growth strategy**: This strategy focuses on increasing the amount of market share, even if it reduces earnings in the short-term.
- **Channels of distribution strategy**: These can be wholesalers, retailers, distributers and even the internet.
- **Communication strategy**: These can be written strategies (e-mail, text, chat), oral strategies (phone calls, video chats, face-to-face conversations), non-verbal strategies (body language, facial expressions, tone of voice) and visual strategies (signs, webpages, illustrations).

Your Sales section should include the following information:

- **A salesforce strategy**: This strategy focuses on increasing the revenue of the enterprise.
- **A breakdown of your sales activities**: This means detailing out how you intend to sell your products or services – will you sell it offline or online, how many units do you intend to sell, what price do you plan to sell each unit at, etc.

Funding Request

This section is specifically for those who require funding for their venture.

The Funding Request section should include the following information:

- How much funding you currently require.
- How much funding you will require over the next five years. This will depend on your long-term goals.
- The type of funding you want and how you plan to use it. Do you want funding that can be used only for a specific purpose, or funding that can be used for any kind of requirement?
- Strategic plans for the future. This will involve detailing out your long-term plans – what these plans are and how much money you will require to put these plans in motions.
- Historical and prospective financial information. This can be done by creating and maintaining all your financial records, right from the moment your enterprise started, to the present day. Documents required for this are your balance sheet which contains details of your company's assets and liabilities, your income statement which lists your company's revenues, expenses and net income for the year, your tax returns (usually for the last three years) and your cash flow budget which lists the cash that came in, the cash that went out and states whether you had a cash deficit (negative balance) or surplus (positive balance) at the end of each month.

Financial Planning

Before you begin building your enterprise, you need to plan your finances. Take a look at the steps for financial planning:

Step 1: Create a financial plan. This should include your goals, strategies and timelines for accomplishing these goals.

Step 2: Organize all your important financial documents. Maintain a file to hold your investment details, bank statements, tax papers, credit card bills, insurance papers and any other financial records.

Step 3: Calculate your net worth. This means figure out what you own (assets like your house, bank accounts, investments etc.), and then subtract what you owe (liabilities like loans, pending credit card amounts etc.) the amount you are left with is your net worth.

Step 4: Make a spending plan. This means write down in detail where your money will come from, and where it will go.

Step 5: Build an emergency fund. A good emergency fund contains enough money to cover at least 6 months' worth of expenses.

Step 6: Set up your insurance. Insurance provides long term financial security and protects you against risk.

Risk Management

As an entrepreneur, it is critical that you evaluate the risks involved with the type of enterprise that you want to start, before you begin setting up your company. Once you have identified potential risks, you can take steps to reduce them. Some ways to manage risks are:

- Research similar business and find out about their risks and how they were minimized.
- Evaluate current market trends and find out if similar products or services that launched a while ago are still being well received by the public.
- Think about whether you really have the required expertise to launch your product or service.
- Examine your finances and see if you have enough income to start your enterprise.
- Be aware of the current state of the economy, consider how the economy may change over time, and think about how your enterprise will be affected by any of those changes.
- Create a detailed business plan.

Tips

- Ensure all the important elements are covered in your plan.
- Scrutinize the numbers thoroughly.
- Be concise and realistic.
- Be conservative in your approach and your projections.
- Use visuals like charts, graphs and images wherever possible.

5.6.5 Procedure and Formalities for Bank Finance: The Need for Bank Finance

For entrepreneurs, one of the most difficult challenges faced involves securing funds for startups. With numerous funding options available, entrepreneurs need to take a close look at which funding methodology works best for them. In India, banks are one of the largest funders of startups, offering funding to thousands of startups every year.

What Information Should Entrepreneurs Offer Banks for Funding?

When approaching a bank, entrepreneurs must have a clear idea of the different criteria that banks use to screen, rate and process loan applications. Entrepreneurs must also be aware of the importance of providing banks with accurate and correct information. It is now easier than ever for financial institutions to track any default behaviour of loan applicants. Entrepreneurs looking for funding from banks must provide banks with information relating to their general credentials, financial situation and guarantees or collaterals that can be offered.

General Credentials

This is where you, as an entrepreneur, provide the bank with background information on yourself. Such information includes:

- Letter(s) of Introduction: This letter should be written by a respected business person who knows you well enough to introduce you. The aim of this letter is set across your achievements and vouch for your character and integrity.
- Your Profile: This is basically your resume. You need to give the bank a good idea of your educational achievements, professional training, qualifications, employment record and achievements.
- Business Brochure: A business brochure typically provides information on company products, clients, how long the business has been running for etc.
- Bank and Other References: If you have an account with another bank, providing those bank references is a good idea.
- Proof of Company Ownership or Registration: In some cases, you may need to provide the bank with proof of company ownership and registration. A list of assets and liabilities may also be required.

Financial Situation

Banks will expect current financial information on your enterprise. The standard financial reports you should be prepared with are:

- Balance Sheet
- Cash-Flow Statement
- Business Plan
- Profit-and-Loss Account
- Projected Sales and Revenues
- Feasibility Study

Guarantees or Collaterals

Usually banks will refuse to grant you a loan without security. You can offer assets which the bank can seize and sell off if you do not repay the loan. Fixed assets like machinery, equipment, vehicles etc. are also considered to be security for loans.

The Lending Criteria of Banks

Your request for funding will have a higher chance of success if you can satisfy the following lending criteria:

- Good cash flow
- Adequate shareholders' funds
- Adequate security
- Experience in business
- Good reputation

The Procedure

To apply for funding the following procedure will need to be followed.

1. Submit your application form and all other required documents to the bank.
2. The bank will carefully assess your credit worthiness and assign ratings by analyzing your business information with respect to parameters like management, financial, operational and industry information as well as past loan performance.
3. The bank will make a decision as to whether or not you should be given funding.

Tips 

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

5.6.6 Enterprise Management - An Overview: How to Manage Your Enterprise

To manage your enterprise effectively you need to look at many different aspects, right from managing the day-to-day activities to figuring out how to handle a large scale event. Let's take a look at some simple steps to manage your company effectively.

Step 1: Use your leadership skills and ask for advice when required.

Let's take the example of Ramu, an entrepreneur who has recently started his own enterprise. Ramu has good leadership skills – he is honest, communicates well, knows how to delegate work etc. These leadership skills definitely help Ramu in the management of his enterprise. However, sometimes Ramu comes across situations that he is unsure how to handle. What should Ramu do in this case? One solution is for him to find a more experienced manager who is willing to mentor him. Another solution is for Ramu to use his networking skills so that he can connect with managers from other organizations, who can give him advice on how to handle such situations.

Step 2: Divide your work amongst others – realize that you cannot handle everything yourself.

Even the most skilled manager in the world will not be able to manage every single task that an enterprise will demand of him. A smart manager needs to realize that the key to managing his enterprise lies in his dividing all his work between those around him. This is known as delegation. However, delegating is not enough. A manager must delegate effectively if he wants to see results. This is important because delegating, when done incorrectly, can result in you creating even more work for yourself. To delegate effectively, you can start by making two lists. One list should contain the things that you know you need to handle yourself. The second list should contain the things that you are confident can be given to others to manage and handle. Besides incorrect delegation, another issue that may arise is over-delegation. This means giving away too many of your tasks to others. The problem with this is, the more tasks you delegate, the more time you will spend tracking and monitoring the work progress of those you have handed the tasks to. This will leave you with very little time to finish your own work.

Step 3: Hire the right people for the job.

Hiring the right people goes a long way towards effectively managing your enterprise. To hire the best people suited for the job, you need to be very careful with your interview process. You should ask potential candidates the right questions and evaluate their answers carefully. Carrying out background checks is always a good practice. Running a credit check is also a good idea, especially if the people you are planning to hire will be handling your money. Create a detailed job description for each role that you want filled and ensure that all candidates have a clear and correct understanding of the job description. You should also have an employee manual in place, where you

put down every expectation that you have from your employees. All these actions will help ensure that the right people are approached for running your enterprise.

Step 4: Motivate your employees and train them well.

Your enterprise can only be managed effectively if your employees are motivated to work hard for your enterprise. Part of being motivated involves your employees believing in the vision and mission of your enterprise and genuinely wanting to make efforts towards pursuing the same. You can motivate your employees with recognition, bonuses and rewards for achievements. You can also motivate them by telling them about how their efforts have led to the company's success. This will help them feel pride and give them a sense of responsibility that will increase their motivation.

Besides motivating your people, your employees should be constantly trained in new practices and technologies. Remember, training is not a one-time effort. It is a consistent effort that needs to be carried out regularly.

Step 5: Train your people to handle your customers well.

Your employees need to be well-versed in the art of customer management. This means they should be able to understand what their customers want, and also know how to satisfy their needs. For them to truly understand this, they need to see how you deal effectively with customers. This is called leading by example. Show them how you sincerely listen to your clients and the efforts that you put into understand their requirements. Let them listen to the type of questions that you ask your clients so they understand which questions are appropriate.

Step 6: Market your enterprise effectively.

Use all your skills and the skills of your employees to market your enterprise in an effective manner. You can also hire a marketing agency if you feel you need help in this area.

Now that you know what is required to run your enterprise effectively, put these steps into play, and see how much easier managing your enterprise becomes!

Tips

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

5.6.7. 20 Questions to Ask Yourself Before Considering Entrepreneurship

1. Why am I starting a business?
2. What problem am I solving?
3. Have others attempted to solve this problem before? Did they succeed or fail?
4. Do I have a mentor[1] or industry expert that I can call on?
5. Who is my ideal customer[2]?
6. Who are my competitors[3]?
7. What makes my business idea different from other business ideas?
8. What are the key features of my product or service?
9. Have I done a SWOT[4] analysis?
10. What is the size of the market that will buy my product or service?
11. What would it take to build a minimum viable product[5] to test the market?
12. How much money do I need to get started?
13. Will I need to get a loan?
14. How soon will my products or services be available?
15. When will I break even[6] or make a profit?
16. How will those who invest in my idea make a profit?
17. How should I set up the legal structure[7] of my business?
18. What taxes[8] will I need to pay?
19. What kind of insurance[9] will I need?
20. Have I reached out to potential customers for feedback?

Tips

- It is very important to validate your business ideas before you invest significant time, money and resources into it.
- The more questions you ask yourself, the more prepared you will be to handle to highs and lows of starting an enterprise.

Footnotes:

1. A mentor is a trusted and experienced person who is willing to coach and guide you.
2. A customer is someone who buys goods and/or services.
3. A competitor is a person or company that sells products and/or services similar to your products and/or services.
4. SWOT stands for Strengths, Weaknesses, Opportunities and Threats. To conduct a SWOT analysis of your company, you need to list down all the strengths and weaknesses of your company, the opportunities that are present for your company and the threats faced by your company.

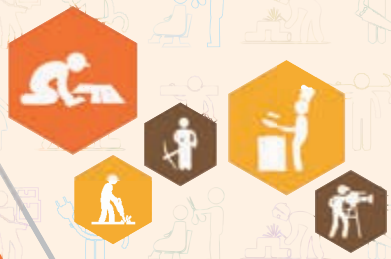
5. A minimum viable product is a product that has the fewest possible features, that can be sold to customers, for the purpose of getting feedback from customers on the product.
6. A company is said to break even when the profits of the company are equal to the costs.
7. The legal structure could be a sole proprietorship, partnership or limited liability partnership.
8. There are two types of taxes – direct taxes payable by a person or a company, or indirect taxes charged on goods and/or services.
9. There are two types of insurance – life insurance and general insurance. Life insurance covers human life while general insurance covers assets like animals, goods, cars etc.

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape



ASCI
Agriculture Skill Council of India

Address: 6th Floor, GNG Tower, Plot No. 10
Sector - 44, Gurgaon - 122004, Haryana, India
Email: info@asci-india.com
Web: www.asci-india.com
Phone: 0124-4288322, 4047488, 4046678
CIN No.: U93000HR2013NPL048073

Price: ₹ 135/-

This book is provided free to students under PMKVY (Pradhan Mantri Kaushal Vikas Yojana)