COST OF PRODUCTION
FOR
FIELD AND HORTICULTURE CROPS IN BHUTAN

DEPARTMENT OF AGRICULTURE
MINISTRY OF AGRICULTURE AND FORESTS

June 2020

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1. FOREWORD

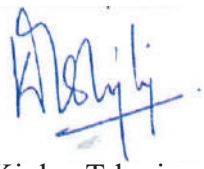
The Department of Agriculture, Ministry of Agriculture & Forests (MoAF) is pleased to bring out the 2nd edition of "Cost of Production for Field and Horticulture Crops in Bhutan 2020". The current publication is a revision of the previous document titled "Cost of Production of Field Crops and Horticulture Crops grown in Bhutan 2017".

This publication includes more number of crops, bigger sample size, larger area coverage, regional representation and good respondent representation done through a purposive two stage stratified sampling methodology. The analysis is done at both the national and regional level. The purpose of having both the regional and the national level cost of production is to ensure evidence-based decision making for farmers/producers, planners, policy makers, financial institutions, investors and youths interested in taking up agriculture farming.

The Department of Agriculture acknowledges the support of FAO Bhutan and FSAPP Project for the support extended in bringing out this publication. Further, this publication would not have been possible without the unwavering support of all the ARDCs and the task force members involved.

The Department of Agriculture is pleased to share copies of the document with all relevant agencies and the electronic copy of the document is also uploaded on our website (www.doa.gov.bt). We are hopeful that this document would be of use to various users.

With best regards,



Kinlay Tshering (Ms.)

DIRECTOR

2. ABBREVIATIONS AND ACRONYMS

APD	: Agriculture Production Division
ARCM	: Agriculture Research Coordination Meeting
ARDC	: Agriculture Research and Development Centre
ARED	: Agriculture Research and Extension Division
CoP	: Cost of Production
DoA	: Department of Agriculture
EOC	: Effective Operating Cost
FAO	: Food and Agriculture Organization
FSAPP	: Food Security and Agriculture Productivity Project
FYM	: Farm Yard Manure
HH	: Household
ICTD	: Information and Communication Technology Division
MAP	: Medicinal and Aromatic Plant
MAPS	: Medicinal Aromatic Plant and Spices
MoAF	: Ministry of Agriculture and Forests
MSP	: Minimum Support Price
NMC	: National Mushroom Centre
NSC	: National Seed Centre
OC	: Opportunity Cost
PPD	: Policy and Planning Division
TFOC	: Total Fixed Operating Cost
TOC	: Total Operating Cost
ToT	: Training of Trainers
TVOC	: Total Variable Operating Cost

3. Table of Contents

1. INTRODUCTION

In any agriculture enterprise, estimating the "Cost of Production" (CoP) has been historically used as one of the key parameters for making effective policies. The information on CoP is essential for making several effective and efficient decisions on a commodity, determining the gross and net returns from cultivating a specific commodity to assess and improve performance of a farm operation and for determining the minimum support prices by the government. CoP indicates how well a commodity is doing and enables farmers or producers to evaluate how efficiently resources are being used in the farm and how the production will respond to specific changes in crop production and management. The CoP data enables researchers and extension to advice farmers and agriculture entrepreneurs on different farm management decisions such as farm efficiency, income and profitability. In Bhutan, several attempts have been made to determine the CoP but a comprehensive CoP for agriculture commodities is not yet in place for both regional and national level.

The 2nd Agriculture Research Coordination Meeting (ARCM) held in Phuntsholing in January, 2019 recommended the immediate need for the revision of the existing cost of production for agriculture commodities. The ARCM proposed that the CoP should be established for both regional and national level. The cost of production data will be useful for crop insurance scheme, buy-back proposals or for Minimum Support Price (MSP), policy and planning, valuing the outputs of agriculture enterprises, support marketing aspects of agriculture commodities, priority sector lending and for availing agriculture loans.

Therefore, the Department of Agriculture (DoA) formed a task-force led by Agriculture Research and Extension Division (ARED) that comprised relevant officials from Policy and Planning Division (PPD), Agriculture Research and Development Centers (ARDCs), National Seed Center (NSC), National Mushroom Centre (NMC) and Agriculture Production Division (APD). The first meeting of the taskforce was held on 11 April 2019 to finalize the list of commodities, calendar of task for CoP, data collection format and sampling method to be adopted. Based on the first task-force meeting, the data collection format was developed for field crops, horticulture crops, oil seed, MAPS and mushroom. A Training of Trainers (ToT) workshop for finalization of cost of production survey format, sampling procedures, familiarization of data collection format and its synchronization in Kobo Toolbox was organized by ARED, DoA. The ToT was held in Paro from 13 -17 May 2019 and was attended by the taskforce members and representatives from all the ARDCs.

1.1. Objectives of the study

The main objective of the study is to revise, update and expand the scope of the existing cost of production for major agriculture and horticulture commodities at national and regional levels.

The specific study objectives are:

- To generate data on cost of production for major agriculture and horticulture commodities for policy and planning decisions including formulation of the MSP, buy back mechanisms, compensation, crop insurance and access to credit facilities.
- To generate the region specific and national data on cost of production for major agriculture and horticulture commodities.
- To provide baseline data on cost of production of key commodities for interested entrepreneurs and agro-based enterprises.

2. STUDY FRAMEWORK AND METHODOLOGY

2.1. Sampling procedures

This CoP is a national level study and dzongkhags were sampled based on the volume of production for each commodity based on the Agriculture Statistics 2017. A total of eight dzongkhags and 16 gewogs were covered by the CoP survey. This study also covered all the major agriculture commodities that includes cereals, oilseed, pulses and grain legumes, fruits, vegetables, medicinal and aromatic plants, spices, roots and tuber crops, mushrooms and plantation crops. The details of dzongkhags, crops and total sample households covered by the CoP survey are presented in Table 1.

Table 1. Crops and number of samples by region

Categories	Number of samples				Total
	ARDC Yusipang	ARDC Bajo	ARDC Samtenling	ARDC Wengkhar	
Cereals	466	351	669	708	2194
Pulses and grain legumes	29	187	249	453	918
Oilseed	7	82	189	350	628
Vegetables	807	863	1311	1891	4872
Roots and tubers	104	152	307	286	849
Fruit crops	186	585	708	1461	2940
Plantation crops	1	50	125	51	227
Mushroom	60	29	47	49	185
Spices	74	168	250	253	745
MAP	41	0	23	116	180
Total	1775	2467	3878	5618	13738

A purposive two stages stratified sampling method was adopted to derive the household samples for enumeration. At the first stage, two dzongkhags with maximum production for each commodity were derived for all the four regions using Agriculture Statistic 2017. From the selected dzongkhags, two gewogs with highest production for a given commodity was selected making a total of four sample gewogs for each commodity in the region. In the second stage, 5% of the major growers from each of the gewogs were taken as the sample households for the survey (Figure 1).

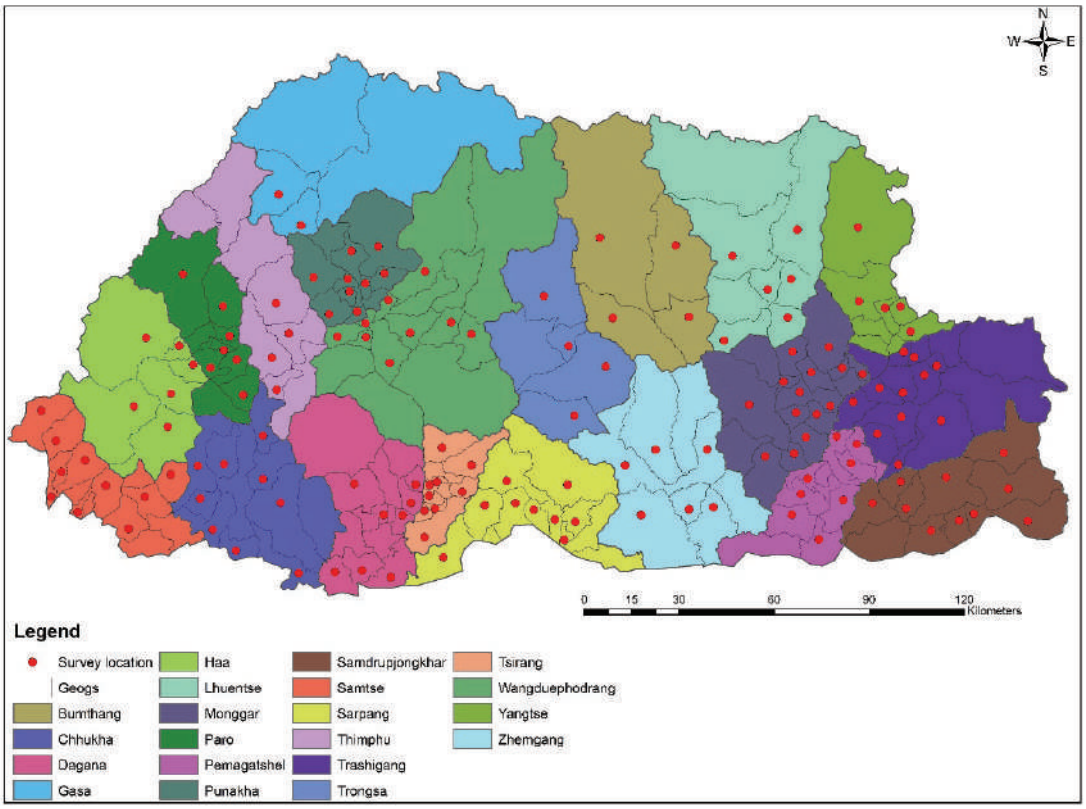


Figure 1: Dzongkhags and gewogs surveyed

CoP data for commodities which are new and not abundantly cultivated by farmers were collected from ARDCs, commercial enterprises or specific farmers growing that commodities. The sample households for MAP and mushroom were selected by ARDC Yusipang and National Mushroom Center (NMC) respectively following the same sampling procedure described above.

As purposive sampling was followed, enumerators were given the liberty to choose the final household (HH) samples within the gewogs selected for particular commodity covering 5% of total HHs of major growers of the particular gewog. The sample households involved those growing the survey commodities with adequate knowledge on that particular crop. The general selection criteria of sample households for different commodities are as indicated in Table 2.

Table 2. Commodities and criteria for sampling of households

Commodity	Sample household selection criteria
Fruit crops	Bearing orchard (minimum of 5 years for perennial crops)
	Minimum of 0.25 acres under cultivation
Cardamom	Bearing orchard (minimum of 5 years)
	Minimum of 0.25 acres under cultivation
Vegetables, ginger and turmeric	Minimum of 0.10 acres under cultivation
Field crops and oilseed	Minimum of 0.25 acres under cultivation
Shiitake mushroom	Fruiting billets (minimum of 3 years old)
Oyster mushroom	Fruiting condition
Plantation crops	Data from on-farm and on-station
MAP	Data from commercial growers

2.2. Data collection, compilation and analysis

The cost of production parameters for each of the commodities were developed by taskforce members in collaboration with relevant national commodity focal officers and commodity coordinators. The cost of production parameters for all the commodities were reviewed and finalized during the Training of Trainers (ToT) workshop. The data collection format was then synchronized and uploaded in Kobo Toolbox with assistance from Information and Communication Technology Division (ICTD) of the Ministry of Agriculture and Forests (MoAF). The survey enumeration was done in four regions led by the Agriculture Research and Development Centers (ARDCs).

Researchers from ARDCs were trained on the enumeration process during the ToT organized in Paro. A CoP focal officer was appointed in each ARDC to lead and coordinate the survey at the regional level. The researchers who attended the ToT further trained other researchers identified to undertake the survey. The data collection survey for the cost of production was carried out by the research officials from the four ARDCs and NMC. Data collection was conducted using Apps through Smart Tablets to ensure efficient use of time and resources. Recall method was used by the enumerators to collect data from the farmers or growers. Compilation of data and analysis was done using MS excel. Expert opinion and views from the national commodity coordinators were sought on the analysis of the primary data collected from the field. This was carried out to remove outliers, validate field data and triangulate the data sets in order to ensure quality of data.

For the perennial crops like fruits, cardamom, asparagus, shiitake mushroom and medicinal plants, the total cost incurred starting from first year till the economic yield bearing of the specific crops were taken into consideration. The opportunity or alternative cost (OC) for various inputs like seeds, farm household labour and FYM were monetized based on the prevailing market prices.

Costs were calculated by means of cross sections in time, in which fixed capital, such as buildings/stores, sheds, fencing, machineries and equipment, etc. participate in the form of flow (straight line depreciation), not in the form of stock (purchase of capital goods). Unit costs were calculated, corresponding to total costs divided by productivity (Kg per acre) for each input type every year.

a) Analysis of annual crops

Since all cereals and vegetables (with exception of asparagus) are produced annually, the cost of production is calculated based on the annual expenditure incurred divided by the total yield.

For perennial crops like asparagus, most of the higher investment costs like fencing, land preparation and development, seeds/seedling costs are incurred in the initial years of establishment. In the second and subsequent years, the costs are reduced and remains similar after a certain year. In the initial year or two, the yield is very low and starting from the 3rd year onwards yield reaches its prime and gives good yield for a period of 7 to 8 years. Therefore, for calculating the cost of production of vegetables like asparagus the total discounted costs incurred for the entire 7 to 8 years is taken into account and is divided by the total production that is expected for this entire duration. The rate of interest used to calculate the discounted total costs is @14% which is the highest interest rate currently prevailing in the financial market.

b) Analysis of fruit crops

The production costs for fruit trees were calculated based on the economic costs of fixed and variable production factors as well as on operating costs. In other words, calculations included: Effective Operating Cost (EOC), which is the sum of input and operations expenses; Total Variable Operating Cost (TVOC), which is the sum of EOC and other expenses incurred during the production period, such as food for hired labour etc., Total Fixed Operating Cost (TFOC), which included expenses such as land tax, interest on loan, insurance, depreciation (of the irrigation system, machineries, fencing, equipment etc.,) and land leasehold.

As fruit trees span over a period of 20 - 25 years since its establishment, the first initial 4 - 5 years was considered as the period of orchard development, followed by an additional period of about 15-20 years with fruiting attaining its full production in about 10-15 years. The expenses incurred in the initial years of orchard establishment is the highest, with certain maintenance and management costs incurred in the subsequent years. On the contrary, there is no harvest in the initial 3-4 years as most fruit trees start fruiting in its 4^{th} or 5^{th} year onwards and reach prime yielding stage from the 10^{th} - 20^{th} year after which the yield starts to decline. It is important to point out that despite its higher cost incurred during the initial period of establishment, orchard when compared with other agricultural commodities involves lesser investment and input costs over the years.

3. DEFINITIONS AND CONCEPTS OF COST OF PRODUCTION

Estimating the cost of production for agriculture commodities involves estimating all economic costs and revenues associated with the production of that commodity[1]. All the inputs used for production should be measured and monetized, whether they are purchased or produced by the farmer. Inputs include seed, fertilizers, farm yard manure, irrigation, hiring of machineries, draught power and pesticides. The labour required for production whether paid out, family labour or labour exchanged should also be valued in terms of money by considering the local labour wage rate of sample area.

For the estimation of fixed costs, the depreciation value of any fixed asset was considered during costing. The depreciation cost was calculated using the straight-line method as:

If a machinery/equipment's lifespan is 10 years, then the depreciation cost that is derived from the above formula has to be used annually for the 10 years period.

In this study two broad categories of cost are used to compute the Cost of Production. These include variable and fixed costs.

1. **Variable Cost** - are the costs of different farm inputs used in production of a given commodity valued at market price at that particular time. The different inputs may include cost of seed, manures, fertilizers, irrigation, and plant protection chemicals, hire charge of draught power, machineries, and value of farm labour and other consumables. Generally, the variable cost depends on the volume of inputs required to produce a certain quantity of produce. These costs vary with production and one can increase or decrease the cost with the use of inputs.
2. **Fixed Cost** - are those that do not vary with size of enterprise and have no bearing upon decisions to increase or decrease production. It includes building cost, machinery cost, irrigation equipment, fencing costs, tools and implements. For ease of calculation, a straight-line depreciation method has been applied for all the fixed costs involved.
3. **Total Cost –** is the sum of Total Variable Cost and Fixed Cost.
4. **Cost of Production** – refers to the total sum of money needed to produce one unit of a particular commodity. It is calculated as:

$$Cost\ of\ Production\ (Nu/Kg) = \frac{Total\ Cost}{Total\ Quantity\ Produced}$$

1 Land and electric fencing cost are excluded in this report.

The cost of production is also referred to as the equilibrium price that corresponds to the quotient between total operating cost and total physical production, i.e., the minimum price the product must fetch for the income to cover all operating expenses and profitability index, which is equal to the proportion of gross income that constitutes available resources (operating profit).

4. COST OF PRODUCTION: National level

4.1. Cereal

4.1.1. Paddy

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Low altitude paddy	52721	1401	38
2	Mid altitude paddy	68404	1672	41
3	High altitude paddy	93931	2416	39

The low altitude paddy incurs the lowest expenditure with an estimated Nu. 52721/ acre and yield of 1401 Kg/acre. The mid altitude paddy has the highest cost of production at Nu. 41/Kg with an estimated total cost of Nu. 68404/acre and yield of 1672 Kg/acre. Although the high-altitude paddy incurs the highest total expenditure of Nu. 93931/acre, it has the highest yield of 2416 Kg/acre, the cost of production is therefore low.

4.1.2. Other cereal

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Quinoa	22622	300	75
2	Millet	28123	518	54
3	Wheat	32318	695	47
4	Barley	26872	608	44
5	Buckwheat	25086	717	35
6	Maize	26285	1386	19

Amongst the other cereals, the highest cost of production is incurred for quinoa at Nu.75/Kg as it has the lowest total yield of 300 Kg/acre. Millet has the second highest cost of production at Nu. 54/Kg followed by wheat, barley and buckwheat. Maize has the lowest cost of production at Nu.19/Kg as it has the highest yield amongst all other cereals at 1386 Kg/acre.

4.2. Pulses and grain legumes

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Rajma bean	24673	432	57
2	Lentil	16605	300	55
3	Soybean	21738	400*	54
4	Urd/Mung bean	20063	400	50

** Yield of soybean reflected as 400kg/acre is when it is cultivated as a sole crop and not intercropped*

The highest cost of production among pulses and grain legumes is for rajma beans at Nu. 57/Kg since it incurs the highest expenditure. Other pulses and grain legumes like lentil, soybean and Urd/Mung beans have cost of production ranging from Nu. 50 to 55/Kg.

4.3. Oilseed

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Mustard	15865	313	51
2	Sunflower	19386	300	65
3	Groundnut	42727	495	86
4	Perilla	10059	401	25
5	Niger	12308	131	94

Amongst the oilseeds, the lowest cost of production is for perilla at Nu. 25/Kg followed by mustard at Nu. 51/Kg and sunflower at Nu. 65/Kg. The highest cost of production is for niger at Nu. 94/Kg because it has the lowest yield of 131 Kg/acre. Groundnut has the second highest cost of production at Nu. 86/Kg since the total expenditure incurred is the highest amongst all oilseeds.

4.4 Vegetable

4.4.1. Solanaceous vegetable

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Chili	80790	2155	37
2	Tomato	50953	1424	36
3	Eggplant	37498	1050	36

4.4.2. Pod vegetable

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1.	Beans	46622	1370	34
2.	Pea	35566	1160	31
3.	Okra	19579	658	30

4.4.3. Leafy vegetable

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Spinach	33476	1189	28
2	Mustard green	33720	1249	27

4.4.4. Bulb vegetable

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Onion	31309	935	33
2	Garlic	66956	680	98

4.4.5. Cole crop

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Cauliflower	66784	1887	35
2	Broccoli	47226	1820	26
3	Cabbage	59393	3320	18

4.4.6 Cucurbit

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Bitter gourd	40208	2500	16
2	Cucumber	32536	3000	11
3	Pumpkin	27550	3000	9

4.4.7. Stem vegetable

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Asparagus		620	80

4.4.8. Root and tuber

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Potato	92313	4553	20
2	Radish	32340	2416	13
3	Carrot	29718	1380	22
4	Turnip	32619	5999	5
5	Cassava	19407	985	20
6	Sweet potato	20098	1211	17
7	Yam	28822	2500	12
8	Ground apple	110000	8000	14

The highest cost of production is for garlic at Nu. 98/Kg followed by asparagus at Nu. 80/Kg. Amongst other vegetables, the cost of production ranges between Nu. 30-40/Kg for chilli, tomato, eggplants, cauliflower, beans, onion, pea and okra. Vegetables with CoP ranging from Nu. 20 - 29/Kg are spinach, mustard green, broccoli, carrot and potato. The lowest cost of production for vegetables are pumpkin with Nu. 9/Kg and turnip at Nu.5/Kg.

4.5. Mushroom

4.5.1. Shiitake

Sl. No	Scale	Expenditure (Nu)	Yield (Kg)	Cost of Production (Nu/Kg)
1	Large (5000 billets[2])	589489	6000	98
2	Medium (3000 billets)	376276	3600	105
3	Small (1000 billets)	166951	1200	139

4.5.2. Oyster

Sl. No	Scale	Expenditure (Nu)	Yield (Kg)	Cost of Production (Nu/Kg)
1	Large (1000 bags[3])	74138	1320	56
2	Medium (500 bags)	42233	660	64
3	Small (100 bags)	12876	132	98

The cost of production for shiitake and oyster mushrooms were calculated based on the quantity of cultivation as large, medium and small scales. As shown in the above tables, the expenditure increases as the scale of cultivation increases whereas the cost of production decreases. For large scale shiitake mushroom cultivation of 5000 billets, the cost of production is Nu.98/Kg and expenditure is Nu.589489 whereas cost of production of small-scale of 1000 billets is Nu.139/Kg and expenditure are Nu.166951. Similarly, for large scale oyster mushroom cultivation of 1000 plastic bags, the cost of production is Nu. 56/Kg and expenditure is Nu.74138 whereas small scale of 100 plastic bags, the cost of production is Nu. 98/Kg and expenditure is Nu. 12876.

4.6. Spices

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Cardamom	46965	130	361
2	Ginger	93279	2095	45
3	Turmeric	105,064	3400	31

2 Yield: 1.2 Kg per billet

3 Yield 1.3 Kg per bag

Amongst the three spices crops, the highest cost of production is for cardamom (dried yield) at Nu.361/Kg which is mainly due to the low yield of 130 Kg/acre against the high expenditure of Nu.46965/acre. Ginger's cost of production is calculated at Nu.45/Kg although it has one of the highest expenditures of Nu.93279/acre. This is due to its high yield of 2095 Kg/acre. Turmeric with cost of production of Nu. 31/Kg is the lowest among all spices which is mainly due to its very high productivity of 3400kg/acre.

4.7 Fruit crop

4.7.1 Temperate fruit

Sl. No.	Name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Apple	77031	2818	27
2	Persimmon	61957	2975	21
3	Apricot	53385	1870	29
4	Pear	72374	4381	17
5	Plum	64546	4256	15
6	Peach	61831	3528	18
7	Walnut	42735	2159	20
8	Kiwi	72239	2419	30
9	Hazelnut	32585	1215	27

Amongst the temperate fruit crops, kiwi has the highest cost of production at Nu. 30/Kg due to its high expenditure and low yield. The cost of production of other temperate fruit crops ranges from Nu.15-29/Kg with plum as the lowest at Nu.15/Kg.

4.7.2 Sub-tropical fruit

Sl. No.	Name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Mandarin	69738	2174	32
2	Mango	50234	1900	26
3	Banana	81092	6272	13
5	Litchi	44120	1826	24
6	Watermelon	80406	3,038	26
7	Papaya	141945	10478	14
8	Jackfruit	33770	2754	12
9	Passion fruit	68030	5454	12
10	Guava	41988	2410	17
11	Pomegranate	65768	2298	29
12	Avocado	50355	1974	26
13	Pineapple	124862	5066	25

Amongst the sub-tropical fruit crops, mandarin, mango, avocado, pomegranate, watermelon, pineapple and litchi have the high cost of production ranging from Nu.24-32/Kg. Papaya and pineapple have highest expenditure of Nu.141945 and Nu. 124862 per acre, respectively compared to other fruit crops as the seedlings requirement are very high. However, CoP of papaya is low as yield per acre is very high at 10478 Kg/acre. The rest of the sub-tropical fruits such a guava, passion fruit, jackfruit, banana, papaya and ground apple have lower cost of production ranging from Nu.12-17/Kg.

4.8. Plantation crop

Sl. No	Crop Name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Green tea	141457	459	308
2	Coffee	47532	1440	33
3	Areca nut	49837	3417	15

Amongst the plantation crops, green tea (fresh leaves) has the highest cost of production as well as expenditure at Nu. 308/Kg and Nu.141457/acre, respectively. The second highest cost of production is coffee (fresh berry) at Nu.33/Kg followed by areca nut (fresh nut) at Nu. 15/Kg.

4.9 Medicinal and Aromatic Plants

Sl. No.	Crop name	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
1	Goned	61100	200	306
2	Zanthoxyllum	34523	218	158
3	Tiyangku	65206	350	186
4	Ruta	159886	2000	80
5	Manu	166000	2000	83

Medicinal and Aromatic Plants are well known for their high value and medicinal benefits. Some of the MAP are annual crops while others are perennial. For annual MAP crops, the annual cost and yield are taken into account whereas for perennial the total costs incurred and the total years of fruiting/yield are averaged and used to calculate the cost of production.

For MAP crops, the CoP is calculated based on the dried yields. Amongst MAP, ruta and manu has the lowest cost of production at Nu. 80/Kg and Nu.83/Kg respectively whereas the others have cost of production ranging from Nu.158/ Kg to Nu.306/Kg.

5. COST OF PRODUCTION- Regional level

Apart from the national level cost of production, current publication includes the regional level cost of production of selected agricultural commodities which has potential for commercial cultivation and are widely grown in the country. Some of the minor crops as well as crops which are region specific (example apple) are not included in the regional level cost of production.

The regions are broadly categorized into four based on the client dzongkhags of respective Agriculture Research and Development Centres (ARDCs) located across the country as below:

SN	Regions	Dzongkhags
1	Bajo	Wangdue, Punakha, Tsirang, Dagana and Gasa
2	Samtenling	Sarpang, Samtse, Samdrup Jongkhar, Trongsa and Zhemgang
3	Wengkhar	Mongar, Trashigang, Trashiyangtshe, Lhuntse, Bumthang and Pemagatshel
4	Yusipang	Thimphu, Paro, Haa and Chukha

5.8 Cereals

5.8.1 Maize

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	29279	1288	23
Wengkhar	25844	1438	18
Samtenling	25755	925	28
Bajo	24261	1893	13

5.8.2 Quinoa

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	27737	300	92
Samtenling	15062	300	50
Yusipang	25066	300	84

5.8.3 Buckwheat

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	19933	465	43
Wengkhar	29468	726	41
Samtenling	26354	974	27
Bajo	24590	701	35

5.9 **Vegetables**

5.9.1 Asparagus

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	59187	721	82
Wengkhar	56938	721	79
Samtenling	30915	475	65
Bajo	51602	563	92

5.9.2 Chilli

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	99803	2954	34
Wengkhar	86303	2260	38
Samtenling	42251	994	43
Bajo	94805	2411	39

5.9.3 Beans

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	57433	1845	31
Wengkhar	37855	1024	37
Samtenling	36569	1102	33
Bajo	54629	1510	36

5.9.4 Cauliflower

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	87621	2375	37
Wengkhar	53983	1486	36
Samtenling	54624	1509	36
Bajo	70909	2177	33

5.9.5. Broccoli

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	53754	3694	15
Wengkhar	47702	1015	47
Samtenling	35684	1096	33
Bajo	51762	1474	35

5.9.6 Cabbage

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	81102	5381	15
Wengkhar	51296	2551	20
Samtenling	46199	963	48
Bajo	58973	4386	13

5.9.7 Carrot

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	36426	1943	19
Wengkhar	22887	1397	16
Samtenling	13113	855	15
Bajo	46446	1326	35

5.9.8 Onion

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	28559	1026	28
Samtenling	28174	961	29
Bajo	37194	819	45

5.9.9 Tomato

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	60670	1849	33
Wengkhar	45782	1557	29
Samtenling	31257	1131	28
Bajo	66103	1159	57

5.10 Mushroom

5.10.1 Shiitake Mushroom

Scale	Region	Expenditure (Nu)	Yield (Kg)	Cost of Production (Nu/Kg)
Small (1000 billets)	Yusipang	248516	1200	191
	Wengkhar	149013	1200	115
	Samtenling	127669	1200	98
	Bajo	142606	1200	110
Medium (3000 billets)	Yusipang	508984	3600	131
	Wengkhar	326882	3600	84
	Samtenling	283987	3600	73
	Bajo	385251	3600	99
Large (5000 billets)	Yusipang	824775	6000	127
	Wengkhar	506250	6000	78
	Samtenling	478126	6000	74
	Bajo	548806	6000	84

5.10.2 Oyster Mushroom

Scale	Region	Expenditure (Nu)	Yield (Kg)	Cost of Production (Nu/Kg)
Small (100 bags)	Yusipang	14605	132	111
	Wengkhar	10501	132	85
	Samtenling	12513	132	95
	Bajo	13886	132	105
Medium (500 bags)	Yusipang	47455	660	72
	Wengkhar	39822	660	60
	Samtenling	36911	660	56
	Bajo	44743	660	68
Large (1000 bags)	Yusipang	84676	1320	64
	Wengkhar	67121	1320	51
	Samtenling	77831	1320	59
	Bajo	66925	1320	51

5.11. Spices

5.11.1. Cardamom

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	46734	130	359
Wengkhar	45820	130	352
Samtenling	47606	130	366
Bajo	47702	130	366

5.11.2. Ginger

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	109004	2000	55
Wengkhar	72175	1800	40
Samtenling	88160	2579	34
Bajo	103777	2000	51

5.12. Fruits

5.12.1 Mandarin

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	73739	2143	34
Wengkhar	68258	2204	31
Samtenling	62153	2204	28
Bajo	74802	2143	35

5.12.2. Banana

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Yusipang	91787	6272	15
Wengkhar	86162	6272	14
Samtenling	65328	6272	10

5.12.3. Mango

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	48014	1942	25
Samtenling	53403	1981	27
Bajo	49285	1778	28

5.12.4. Avocado

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	50234	1963	26
Samtenling	42976	1984	22
Bajo	57856	1976	29

5.12.5. Persimmon

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	79640	2975	27
Samtenling	46303	2975	16
Bajo	59929	2975	20

5.12.6. Watermelon

Region	Expenditure (Nu/acre)	Yield (Kg/acre)	Cost of Production (Nu/Kg)
Wengkhar	89,480	3038	29
Samtenling	69,711	3038	23
Bajo	82,028	3038	27

6. ANNEXURE

6.1. Cost of production formulation process and timeline

SN	Time line	Activity
1	11 April 2019	1st taskforce meeting to discuss way-forward on CoP.
2	13 – 17 May 2019	Workshop cum ToT by taskforce members to the focal officers from the ARDCs and NMC at Paro. The topics covered were CoP parameters, sampling methodologies, and survey questionnaires. The mock exercise on data enumeration using app (Kobo toolbox) on Samsung tablet was conducted.
3	20 -30 May 2019	ToT by focal officers to enumerators of respective ARDCs and NMC.
4	June-September 2019	Data collection by the enumerators.
5	21-25 October 2019	Data cleaning, processing and validation at Paro.
6	6-10 January 2020	Data analysis at IMS Serbithang.
7	23 January 2020	Presentation at ARCM for comments and feedbacks.
8	9-10 June 2020	Consultation meeting with commodity specialists, coordinators and focal officials at IMS Serbithang.
9	11-12 June 2020	Drafting of final CoP Document by taskforce.
10	22 June 2020	Finalization meeting for endorsement and publication.

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6.3. List of specialists, commodity coordinators and focal officials consulted

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6.4. Questionnaire sample

Data Collection Format (Paddy)

Dzongkhag: Gewog: Village: Crop Name: Area under cultivation:				
Parameters	Unit	Farm-gate price/assumed cost		Total costs/ benefits (Nu)
		Total Quantity (kgs/ Numbers/ hours.)	Unit Cost (Nu/unit)	
Material costs				
Seeds	Kg			
Farm yard manure	Kg			
Fertilizer	Kg			
Butachlor	Kg			
Ploughing (Ox/Power tiller)	Nu			
Puddling by power tiller	Nu			
Puddling by ox	Nu			
Machine hiring for harvesting	Nu			
Threshing mechanically	Nu			
Total material Costs				
Labour cost				
Nursery preparation	Person day			
Nursery weeding	Person day			
Nursery uprooting	Person day			
Main field ploughing (first & second ploughing)	Person day			
FYM transportation	Person day			
Irrigation for puddling	Person day			
Puddling by labour if used	Person day			

Transplanting	Person day			
Butachlor application	Person day			
Weeding	Person day			
Irrigation	Person day			
Harvesting	Person day			
Stacking and threshing	Person day			
Transportation to store	Person day			
Total labour costs (Nu)				
Fixed costs				
Land taxes (if its own land)	Nu. (lump-sum)			
Crop insurance if any	Nu. (lump-sum)			
Management cost	Nu. (lump-sum)			
Interest on loan	Nu. (lump-sum)			
Others (Please specify)				
Total fixed cost				
Total Cost				
COST OF PRODUCTION (Nu/Kg) = Total Cost /Total Quantity Produced				

Data Collection Format (Cereals)

Dzongkhag:
Gewog:
Village:
Crop Name:
Area under cultivation:

Parameters	Unit	Farm-gate price/assumed cost		Total costs/ benefits (Nu)
		Total Quantity (kgs/ Numbers/ hours.)	Unit Cost (Nu/unit)	
Material Costs				
Seeds	Kg			
Farm Yard Manure	Kg			
Fertilizer	Kg			
Insecticide	Kg			
Ploughing by Power tiller	Nu			
Ploughing by ox	Nu			
Tool and equipment	Nu			
Fencing materials	Nu			
Transportation cost (Inputs)	Nu			
Total material costs				
Labour cost				
Field ploughing	Person day			
FYM transportation	Person day			
Second ploughing	Person day			
Irrigation	Person day			
Weeding	Person day			
Harvesting	Person day			
Drying and threshing	Person day			
Transportation to store	Person day			
Total labour costs (Nu)				

Fixed costs				
Land taxes (if its own land)	Nu. (lumpsum)			
Crop insurance if any	Nu. (lumpsum)			
Management cost	Nu. (lumpsum)			
Interest on loan	Nu. (lumpsum)			
Others (Please specify)	Nu.			
Total fixed cost	Nu.			
Total Cost	Nu.			
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced				

Data Collection Format (Vegetable Crops)

Dzongkhag:
Gewog:
Village:
Crop Name:
Area under cultivation:

Parameters	Unit	Farm-gate price/assumed cost		Total costs/ benefits (Nu)
		Total Quantity (kgs/Nos.)	Price per item or (Nu/unit)	
Return: Production (yield)* Farm gate price				
Material costs		Quantity	Rate	Amount
Seed	Kg			
FYM	Kg			
Fertilizer	Kg			
Machinery ploughing	hrs			
Herbicides	Kg			
Fencing materials	Nu. (lumpsum)			
Leaf mould/compost collection	Nu. (lumpsum)			
P.P. chemicals	Nu. (lumpsum)			
Planting	Nu. (lumpsum)			
Irrigation equipment	Nu. (lumpsum)			
Mulching materials	Nu. (lumpsum)			
Staking materials	Nu. (lumpsum)			
Transportation of inputs	Nu. (lumpsum)			
Total material cost				
Labour cost				
Fencing	Person days			
Bed preparation	Person days			
FYM application	Person days			
Transplantation/Sowing	Person days			
Fertilizer application	Person days			
Irrigation	Person days			

P. P. chemicals application	Person days			
Weeding	Person days			
Pesticides application	Person days			
Fruit thinning	Person days			
Crop guarding	Person days			
Harvesting	Person days			
Transportation within farm	Nu. (lumpsum)			
Others (Please specify)				
Total labour cost				
Fixed costs				
Land taxes (if its own land)	Nu. (lumpsum)			
Crop insurance if any	Nu. (lumpsum)			
Management cost	Nu. (lumpsum)			
Interest on loan	Nu. (lumpsum)			
Others (Please specify)				
Total fixed cost				
Total Cost				
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced				

Data Collection Format (Fruit Crops)

Dzongkhag:
Gewog:
Village:
Crop Name:
Area under cultivation:

Parameters	Unit	Farm-gate price/assumed cost		Total costs/ benefits (Nu)
		Total Quantity (kgs/Nos.)	Price per item or (Nu/unit)	
Return: Production (yield)* Farm gate price				
Variable cost		Quantity	Rate	Amount
Orchard establishment				
Land rental (if leased)	Nu.			
Land preparation & lay out	Person days			
Pit digging	Person days			
Machinery hire charge	Nu.			
Seedlings	Number			
FYM	Kg			
Leaf mould/compost collection	Person days			
Chemical fertilizers	Nu. (lumpsum)			
Planting	Person days			
Irrigation	Person days			
Trellis installation	Nu. (lumpsum)			
Mulching	Person days			
Basin preparation	Person days			
Staking	Person days			
Fencing	Nu. (lumpsum)			
Orchard maintenance				
FYM	Kg			
Compost Collection	Person days			
Chemical fertilizers	Nu. (lumpsum)			
P. P. chemicals	Nu. (lumpsum)			
Irrigation	Person days			

Spraying	Person days			
Weeding &basin	Person days			
Pruning & training	Person days			
Fruit thinning	Person days			
Picking fruits (Harvesting)	Person days			
Materials used for harvesting	Nu. (lumpsum)			
Transportation within farm	Nu. (lumpsum)			
Others (Please specify)				
Total variable cost				
Fixed costs				
Land taxes (if its own land)	Nu. (lumpsum)			
Machinery, Tools & Implements	Number			
Irrigation pipes & equipment	Meter			
Sprayer	Number			
Harvesting ladder	Number			
Harvesting baskets	Number			
Crop insurance if any	Nu. (lumpsum)			
Management cost	Nu. (lumpsum)			
Interest on loan	Nu. (lumpsum)			
Others (Please specify)				
Total fixed cost				
Total Cost				
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced				

Data Collection Format (MAPS)

Dzongkhag:
Gewog:
Village:
Crop Name:
Area under cultivation:

Parameters	Unit	Farm-gate price/assumed cost		Total costs/ benefits (Nu)
		Total Quantity (kgs/Nos.)	Price per item or (Nu/unit)	
Return: Production (yield)* Farm gate price				
Variable cost		Quantity	Rate	Amount
Orchard establishment				
Land rental (if leased)	Nu.			
Land preparation & lay out	Person days			
Pit digging	Person days			
Machinery hire charge	Nu.			
Seedlings	Number			
FYM	Kg			
Leaf mould/compost collection	Person days			
Chemical fertilizers	Nu. (lumpsum)			
Planting	Person days			
Irrigation	Person days			
Dryer/Drying shed	Nu. (lumpsum)			
Mulching	Person days			
Basin preparation	Person days			
Staking	Person days			
Fencing	Nu. (lumpsum)			
Firewood	Nu. (lumpsum)			
Orchard maintenance				
FYM application	Kg			
Compost collection	Person days			
Chemical fertilizers	Nu. (lumpsum)			
P. P. chemicals	Nu. (lumpsum)			

Irrigation	Person days			
Spraying	Person days			
Weeding & basin	Person days			
Gap filling	Person days			
Firewood collection	Person days			
Harvesting	Person days			
Materials used for harvesting	Nu. (lumpsum)			
Curing and drying	Person days			
Others (Please specify)				
Total variable cost				
Fixed costs				
Land taxes (if its own land)	Nu. (lumpsum)			
Machinery, Tools & Implements	Number			
Irrigation pipes & equipment	Meter			
Sprayer	Number			
Harvesting tools	Number			
Harvesting baskets	Number			
Crop insurance if any	Nu. (lumpsum)			
Management cost	Nu. (lumpsum)			
Interest on loan	Nu. (lumpsum)			
Others (Please specify)	Nu.			
Total fixed cost	Nu.			
Total Cost	Nu.			
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced				

Data Collection Format (Shiitake)

Dzongkhag: Gewog: Village: Crop Name: No. of billets under cultivation:				
Revenue	Units	1 year	2 year	3-7 year
Yield	Kg. per log			
No. of log	Nos.			
Production	Kg. per 5000 logs			
Farm gate price	Nu/Kg			
Total revenue				
Material costs				
Spawn (Qty.)	Bottle			
Price	Nu/bottle			
Value	Nu.			
Shed (Depreciated)	Nu.			
Maintenance cost	Nu.			
Soaking tank (Depreciated)	Nu.			
Log (3000@Nu. 20)	Nu.			
Royalty for logs	Nu.			
Wax (Kg)	Nu.			
Rosin (Kg)	Nu.			
Napkin (roll/piece)	Nu.			
Plastic sheets (meters/ bundles)	Nu.			
Water pipes (bundles)	Nu.			
Sprinkler	Nu.			
Thermohygro meter (no)	Nu.			
Heating system (back load/ no)	Nu.			
Cost electricity (Year)	Nu.			
Total material cost	Nu.			
Labour Cost				
Inoculation	Person day			
Turning of logs	Person day			
Re-staking	Person day			

Watering of logs	Person day			
Soaking of logs	Person day			
Staking	Person day			
Harvesting	Person day			
Total Labour	Person day			
Wage rate	Per person day			
Total labour cost				
Total Cost				
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced				

Data Collection Format (Oyster)

Dzongkhag: Gewog: Village: Crop Name: No. of bags under cultivation:			
Revenue	1 year	2 year	3 year
Quantity (Kg/bag)			
No. of bag			
Kg/100			
Price/Unit (Farm gate Price)			
Total Revenue			
Material costs			
Spawn			
Qty (Nos)			
Price/Unit			
Value			
Total cost of shed (Lum-sum)			
Cost of straw including transportation			
Cost of firewood			
cost of plastic bags			
Cost of rubber band used			
Cost of jute bags used			
Cost of plastic sheet used (meters/ bundles)			
Cost of Rope			
Cost of water pipe			
Cost of ethanol			
Cost of spray bottles			
Cost of Thermohygro meter used (no)			
Cost of straw chopping machine			
Cost of watering can			
Cost of barrel			
Cost of sprinkler used			
Cost of heating system used (back load/ no)			

other cost			
Cost electricity (month/Year)			
Total material cost			
Labour Cost (Person/day)			
Cost labour used for Chopping of straw			
Cost labour used for soaking and sterilizing			
Cost of labour used for inoculation			
Cost of labour used for watering			
Cost of labour used for harvesting			
Total Labour			
Wage rate/Day (Nu/day)			
Total Labour Cost			
Total Cost			
COST OF PRODUCTION (Nu/Kg) = Total Cost / Total Quantity Produced			

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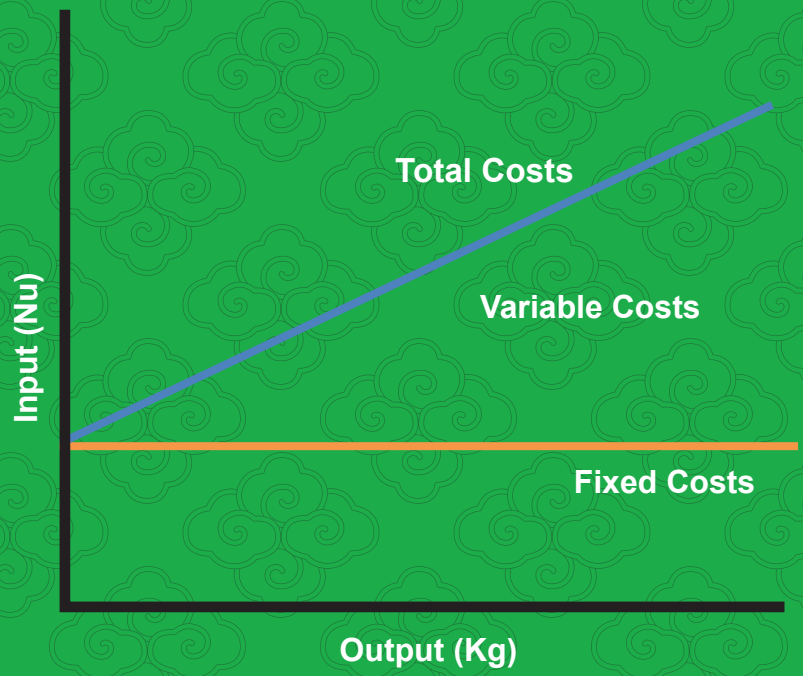

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