PART 4 VALUE CHAIN ANALYSIS TOOLS - QUANTITATIVE TOOLS

PART 3 VALUE CHAIN ANALYSIS TOOLS - QUALITATIVE TOOLS

PART 2 VALUE CHAIN ANALYSIS TOOLS - GENERAL TOOLS

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PART 4 - VALUE CHAIN ANALYSIS TOOLS

QUANTITATIVE TOOLS

Tool 6 – Analysing Costs and Margins

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Tool 6 – Analysing Costs and Margins

1. Introduction

Before deciding to enter a new market or business a person must first determine which business is the most profitable for them. This is particularly important for poor people who have limited resources and so cannot afford to choose the wrong market or sector.

Revenues, costs and margins of value chains should therefore be compared (both different marketing channels and different product chains), but also the potential for scaling up and the required investments should be investigated.

After the value chain has been mapped the next step is to study certain aspects of a value chain in depth. There is a wide choice of aspects that can be further elaborated upon. One of these is costs and margins. The **cost** is the money that an actor in the value chain contributes, while the **margin** is the money that an actor in the value chain receives, minus the costs.

Analysis of costs and margins enables the researcher to determine how "pro-poor" a value chain really is. **Actual costs and margins** should be considered when a researcher aims to find out whether a value chain is a good source of income for the poor and whether a value chain is accessible for the poor. **Historic costs and margins**, on the other hand, enable a researcher to find out what the financial trends have been in the value chain and whether the chain has potential to grow in the future.

Take Note

There are two types of growth. The first is economic growth. This type of growth potentially results in higher absolute incomes for all actors in a value chain. The second type is called pro-poor growth. This type of growth generates **relatively greater improvements in income and wealth for the poor**. Hence in a pro-poor value chain intervention, growth benefits the poor relatively more than it does other actors in the value chain.

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2. Objectives

Knowledge of costs and margins of actors in a value chain enables a researcher to understand:

1. **Costs of entry:** identify how operating and investment costs are currently distributed over the actors in the value chain in order to conclude whether it is possible for the poor to enter the chain: if operating costs or investment costs for starting up a business are high it may be a problem for the poor to join the value chain

2. **Distribution of costs and margins:** identify how revenues and margins are currently distributed over the actors in the value chain in order to conclude whether actors and particularly the poor can increase margins in a value chain. In other words, is it possible to upgrade the position of the poor in the chain by making the chain more efficient (decrease costs) and effective (increase value)?

3. **Change in costs and margins:** see how costs and margins in a chain are changing over time in order to predict future growth or decline of the chain. As some costs increase or decrease (e.g. petrol costs), so will margins decrease or increase. Therefore, a sector that might seem to be profitable now is not necessarily profitable next year

4. **Value chain comparison:** compare profits of one chain with profits in another chain to see if it would be worthwhile to change chains

5. **Performance benchmarking:** compare the practice in the selected value chain to an industry standard or a best practice in order to improve the effectiveness and efficiency of the selected chain. In other words, try to find out why a value chain in area A is less profitable than the same chain in area B and draw lessons from it. If there is time the success factors of value chains in other sectors could also be studied. This process is called benchmarking

Take Note

The main goal of studying costs and margins is to increase the margin per product unit. However, this does not always reduce poverty: if a poor farmer increases their profit margin per unit, but sells fewer products, then the absolute income may decrease. Therefore, researchers should always combine cost and margin analysis with analysis of total revenues or income per actor. More information on income is presented in Tool 7 - Analysing Income Distribution.

3. Key Questions

The key questions that need to be answered by the researcher in order to achieve this section's objectives are:

1. What are each actor's costs (both fixed and variable costs) and what are the required investments for entering a value chain?

2. What are each actor's revenues in the value chain? In other words, what are each actor's sales volumes and selling prices?

3. What are each actor's net profit, margins and break-even point?

4. How are investments, costs, revenues, profits and margins changing over time?

5. How are investments, costs, revenues, profits and margins divided between the actors in the value chain?

6. Are the costs and margins of this value chain lower or higher compared to other product value chains? In other words, what are the opportunity costs of employing production resources for this particular value chain?

7. Are the costs and margins of this value chain lower or higher compared to similar value chains in other places?

8. What are underlying causes of the division of costs and margins in a value chain?

4. Steps

Step 1 Opportunity costs or financial costs?

Cost and margin analysis of a value chain is only useful if producers (farmers or whomever) are treated as micro-entrepreneurs (i.e. small commercial actors seeking the most profitable use of their limited resources in the marketplace) rather than as subsistence actors.

In order to use this type of analysis effectively, it must be recognised that there are important differences between the way economics and accounting treat costs that should guide both analysis and decision-making in pro-poor value chain development.

Economists tend to look at **opportunity costs**, which are the costs of employing production resources (labour, capital, land) in a particular way, rather than pursuing alternative business options. Opportunity costs are useful in evaluating what alternative uses of resources could generate the most income and wealth for producers.

Accountants tend to consider **financial costs**, the monetary expenditures that an actor in the chain incurs in carrying out an activity, and which are usually found in any accounts (formal) or records (informal) being kept by the actor. Financial costs usually do not consider the alternative uses for resources.

Many farmers, if asked why they shifted from one crop to another in a given season, will report that they thought that they could make more money. They are thinking about the relative attractiveness of different options. They may or may not consider all of the costs involved. For example, the additional labour required for a new crop or the possibility of renting out land instead of growing on it. Good value chain analysis should try to reveal the real opportunity costs faced by farmers because these affect choices that producers will make about what to produce for a given season.

In order for value chain practitioners to reveal the real costs of participation in a value chain, cost calculations throughout the chain value chain should take into account opportunity costs for farmer and family labour, the use of land, and capital.

This means assigning a realistic estimated (imputed) value to the value chain participant's (and their family's) time, land, and capital that is dedicated to the activity. If these values are not assigned, analysis will unintentionally treat each of these as free resources, distorting the true picture of cost, profitability, and sustainability for value chain upgrading. This is particularly important when small producers hope to move towards more commercially-oriented participation in value chains. Guidelines for incorporating these values into cost calculations appear in the box below.

Terminology: Opportunity Cost

Opportunity cost for labour. The opportunity cost for labour is a measure of employing scarce labour resources in a chosen activity. For family labour this is generally equal to the cost incurred if a person is employed to do an activity normally carried out by a family member.

Alternatively, it is the income the family member would lose by not hiring himself out to carry out an activity on someone else's farm and instead doing the same activity on his own farm.

It is important to realise that there can be a seasonal variability in the opportunity cost of labour. In a rice production area the opportunity cost for a family member for weeding could be zero (or close to zero) if there is no alternative weeding activity for the farmer to be employed in because of a low labour demand on other farms. Conversely, at times of transplanting and harvesting, when there is a high labour demand and therefore the option of being employed in these activities on other farms, there can be a significant opportunity cost associated with labour.

Opportunity cost of land. The commonly used opportunity cost of land is the return on leasing the land to another producer (or for another use) instead of the farmer producing a crop on it themselves.

Opportunity cost of capital. The opportunity cost of capital is the interest rate that one would receive from a bank or microfinance institution (MFI) when one has an account with such an institution, or the interest that one would receive for lending to an individual.

Box 24: Opportunity cost of choosing different cropping systems

A good example is provided by Laotian farmers in Viengkham district, Luang Prabang province. Farmers in this area were used to monoculture and were cultivating rice only once a year. As the demand for other crops was growing farmers became interested in crop diversification and growing a second product. The farmers could choose between maize, soybeans or sesame. To make the right decision farmers had to consider how much money they would lose (the opportunity costs) by choosing one crop, for example maize, over the other two crops, in this case sesame or soybeans. To help the farmers a simple cost/benefit analysis was carried out. The conclusion was that on average farmers would get the highest returns on soybeans (2.7 million Kip per ha) followed closely by sesame (2.6 million Kip per ha). For maize, the return was only 0.5 million Kip per ha.

One has to be careful though, not to jump to the conclusion that soybeans or sesame would therefore be the best choice for the farmers. For example, it should be noted that in the above analysis labour, mostly family labour, was not included, and it depends on the labour resources available to the farmer whether or not soybeans or sesame are really an option for him or her. Also to be considered is the deployment of other resources such as land use and capital. Is the land suitable for the production of soybeans or sesame (e.g. soil type, availability of water)? Does the farmer have the capital required to invest in the production of these crops? Only if such questions are also answered a recommendation on what would be the best alternative for the farmer can be formulated.

Source: (MPDLC 2005)

Warning

When various alternatives are compared, as in the above example of soybean vs. maize, and one of these shows the highest returns (i.e. soybean), it does not necessarily mean that soybean is the better alternative for a smallholder farmer. Soybean is less drought resistant than maize, so depending on rainfall patterns the farmer could be taking a higher, and possibly even unacceptable, risk by choosing to grow soybean rather than maize. All of the risks associated with each option should be clearly analysed before choosing new activities.

Step 2 Calculating costs and required investments

The second step is to identify what the costs of an actor's activities are. Often only the Operating Costs (Variable and Fixed) and Investment Costs are considered. However, other cost types such as transaction and regulatory costs, as shown in Table 25, should also be considered. Opportunity costs should be included among the appropriate fixed and variable costs; for example, when calculating labour, land, and capital costs.

Not all costs are easily categorised into fixed, variable or other costs, and there is not always a right or wrong category for costs. Assumptions should be made based on the real needs of value chain development, not based on abstract theories. Regardless of which choice is made, try to be consistent throughout the analysis.

Table 25: Examples of costs in a value chain

Operational Costs		**Transaction Costs**	**Regulatory Costs**		**Investment Costs**
Variable Costs	*Fixed Costs*		*Formal*	*Informal*	
• Costs of inventory sold • Wages related to production • Other direct production expenses including losses	• Salaries of non productive staff • Office supplies • Insurance • Legal and accounting fees • Travel • Utilities • Rent • Repairs and maintenance • Depreciation • Marketing expenses • Finance expenses (interest and bank charges)	• legal costs to have contracts checked by a lawyer • information costs for traders: costs incurred to obtain information on which commodities are available, where, and in which volumes, and from whom (trustworthiness) – telephone costs, time spent on driving around in rural areas on the motorcycle, etc • lack of grading standards resulting in increased risk of paying to high a price for the actual quality purchased	• business licensing • levies • grading (external to the value chain, e.g. legally imposed certification)	• grading (internal to value chain)	• Principal • Interest

Warning Accuracy of Data

It may not always be possible to obtain accurate figures on costs, for example production costs from farmers, because they may not keep accurate records.

Data may sometimes have to be calculated in an indirect way, e.g. by asking a trader how much time (hours/day, number of days) and funds (distances covered per day, means of transport) they spend collecting information and establishing contacts ('information costs') without actually performing any transactions.

In both cases it will be necessary to interview a large sample of a group of actors to obtain approximations of such costs. Even then, it may still be necessary to cross-check information collected this way with other sources of information, e.g. industry sources.

Care should be taken to gather further information where required. For example, a farmer may indicate that they spend 30 days on harvesting the crop, while further questioning would reveal that the actual time spent on harvesting on these days is from 06.00 to approximately 10.00 hours, or half days only. The actual number of labour days for harvesting is therefore only 15 days.

It is also important to realise that certain cost types may vary significantly throughout the year. This means that information collected at a certain point in time may not reflect the actual costs. For example, the costs for collecting the crop usually increase once the rains have started because shorter routes become impassable meaning that travel time to both collect and transport crops increase.

Operating costs can be divided in two cost types: variable costs and fixed costs:

A. **Variable costs**, or costs of goods sold, are costs that change in direct relationship to the level of production in a given production or sales cycle. Variable costs are the costs that are relevant to economic decision-making in the short run. Examples of variable costs in agriculture include fuel, fertiliser, seed, chemicals, animal feed, veterinary medicines, and water. More complex examples include the cost of extension staff employed by a company in accordance with the number of outgrowers that are contracted for in a given season, or the hiring of occasional labour for harvesting or planting.

In the case of cattle raising variable costs include, amongst others, food and vaccinations. If a farmer has ten cows and decides to raise two more cows he needs proportionally more food and vaccinations for the two new cows.

Take Note

Instead of simply adding the totals for each of the variable or fixed costs, it can be worthwhile to assign relevant cost types to different activities performed by the same actor. For example, the costs for per diems and fuel for extension officers employed by a company contracting smallholder farmers under an outgrower arrangement could be separated over (i) the recruitment and contracting of farmers; (ii) training activities in accordance with the production cycle (e.g. nursery management, land preparation and transplanting, field management, pest and disease control, harvesting, and post-harvest handling); and (iii) marketing of the produce. Another example is given below.

Delivery and processing of the milk produced by the cows could take place in two stages; for example, through one of a series of milk collection centres, from where the milk is transported to the central dairy plant for further processing. Various costs (variable and/or fixed in this example) should be assigned to each of the milk collection centres or to the dairy plant to better understand how each of these cost centres is performing. When relating the actual expenditures with the amount and quality of milk leaving each of the milk collection centres it is possible to identify which of the milk collection centres are under-performing. It may then be possible to identify remedy the bottlenecks.

Table 26: A virtual example of costs for milk collection centres and dairy plant.

The costs are presented as percentages of the total cost for each expense.

	Vehicle O&M	Telephone & Postage	Utilities	Rental	Payroll	Office	Bank Charges	Equipment
Milk collection centre A	3%	5%	4%		10%	15%		15%
Milk collection centre B	2%	5%	3%		5%	10%		15%
Milk collection centre C	2%	5%	3%		5%	10%		15%
Dairy plant	93%	85%	90%	100%	80%	65%	100%	55%

Most variable costs are easy to calculate as they change with the same proportion as the output. However, there are some exceptions, for example transportation costs. These do not always change in proportion with the volume traded. A 25 ton truck can, for example, transport 25 tons of bamboo, but also 10 tons and, over short distances, even 40 tons. Transportation costs per ton of bamboo therefore vary depending on the total amount of bamboo that is transported. If real costs are not known a researcher needs to make assumptions on the average costs. The following example explains how to calculate transport costs.

Box 25: Example of calculating transport costs

Assume that there are 20 m^3 of space available in a truck and that it costs USD 500 to hire the truck. A container of 0.2 m^3 holds 10 kg of cucumbers and a container of 0.5 m^3 holds 15 kg of chili peppers.

Then the transport cost for cucumbers per container and per kg is ...

USD 500 ÷ (20 m^3 ÷ 0.2 m^3) = USD 5.00 per container

and

USD 5.00 ÷ 10 kg = USD 0.50 per kg

While the transport cost for chili peppers per container and per kg is ...

USD 500 ÷ (20 m^3 ÷ 0.5 m^3) = USD 1.25 per container

and

USD 1.25 ÷ 10 kg = USD 0.125 per kg

Source: (NESDB 2004)

Another cost that is often ignored is the cost of losses. Particularly if products are perishable, such as many fresh products, a certain amount of the traded products will usually be lost. The example in Box 26 below shows how losses should be calculated.

Box 26: Calculating costs on losses

Assume 15 % of the product is damaged and lost. This means that 1 kg of cucumbers purchased by a trader results in 850 g (0.85 kg) available for sale to consumers. The trader buys cucumbers farmer at USD 6 per kg and marketing costs are USD 1.50 per kg. The selling price of cucumbers is USD 9 per kg.

The costs are
1 kg purchased at USD 6 per kg = USD 6.00
1 kg packed and transported at USD 1.50 per kg = USD 1.50

Total Costs = USD 7.50

Sales Revenue USD 9 x 0.85 kg = USD 7.65
Thus the margin to the trader = USD 0.15

Below is an example of the more typical, and wrong, method of calculating margins.

1 kg purchased at USD 6 per kg = USD 6.00
1 kg packed and transported at USD 1.50 per kg = USD 1.50
15 percent losses or USD 6 x 0.15 = USD 0.90

Total Costs = USD 8.40

Sales Revenue or USD 9 x 1 kg = USD 9.00
Thus the margin to the trader = USD 0.60

The second calculation is wrong because the trader is obtaining revenue from produce which has already been lost.

Source: (NESDB 2004)

B. Fixed costs on the other hand are costs that are independent from the size of production.

In case of the cattle example, fixed costs are items such as investments in stables and land. Even though the farmer decides to raise two more cattle, there is usually no immediate need to buy additional land or build a new stable. Other fixed costs examples are depreciation (replacement) costs, capital costs (interest on long-term loans) and in more advanced businesses promotion costs, stationeries and office personnel (not related to the primary production process).

Take Note

As fixed costs do not change with the size of production there is a risk that certain costs are not acknowledged or reported by actors in a value chain. Also, certain costs apply to more than one product. For example, a cattle raiser may also raise pigs that are kept in the same stable. The costs for the stable should therefore be split between the cattle and the pigs. If not, the costs taken into account by the researchers may be too high, or too low.

Investment costs are explored through analysing a value chain actor's required capital for starting up his business. In formal accounting, investment costs are considered a type of fixed cost, but in pro-poor value chain development, they should be analysed as a key potential obstacle to entering and participating in a value chain.

In other words, what assets does an actor need to possess (through buying or renting) to be able to run his business? Finding this out is important in judging whether a value chain is accessible for the poor. For example, a food value chain may require high quality standardised products that cannot be produced manually. This means that expensive machines are required for entering this market, so even though a farmer produces the right raw material the market is not accessible. A complete picture of investment costs is also relevant for calculating depreciation costs.

Take Note

Depreciation means the wearing out of capital goods, such as machines and equipment, which need to be replaced after a while. To be able to pay for replacements companies should save money. The costs of these are called depreciation costs. However, as depreciation costs are not expenses they decrease income but not cash money. Quite understandably poor farmers and micro enterprises usually do not calculate depreciation costs. They need all their income to survive.

Once all the different cost types have been calculated it is possible to present the figures in a table, which may have the format as presented in Table 27.

Table 27: An example of presenting cost compilation across actors in the value chain.

Cost Type	Actor 1	Actor 2	Actor 3	Actor 4
Operating Costs - Variable				
Operating Costs - Fixed				
Investment Costs				
Transaction Costs				
Regulatory Costs - Formal				
Regulatory Costs - Informal				
Total Costs				

Step 3 Calculating revenues per actor

After the costs per actor have been calculated, the revenues need to be identified. Revenues are calculated by multiplying the volume sold (Q) with the selling price (P) and, subsequently, by adding additional sources of income, such as revenues of selling the production waste of a product. Revenues = (Q * P) + other sources of income.

An example of this last source of income is in the bamboo sector, where leftovers are used for producing paper pulp or fuel.

Prices differ per marketing channel or per market segment and sometimes per grade or per quantity sold. Prices can also change over the season. Prices can even vary during one single day, like in many fresh vegetables markets. Therefore, surveys should include questions related to what the prices in different markets, for different products and during the different seasons, are. For calculating average prices, these should be weighted. An example of how to do this is provided in Box 27 below.

Box 27: An example of calculating the weighted average selling price.

Assume an example involving a consignment of 200 kg of cucumbers as follows ...
100 kg sold at USD 2.00 = USD 200
40 kg sold at USD 1.40 = USD 56
40 kg sold at USD 1.00 = USD 40
10 kg sold at USD 0.40 = USD 4
(10 kg which can not be sold)

Total Revenue = USD 300

The average selling price per kg is
USD 2.00 + USD 1.40 + USD 1.00 + USD 0.40 + USD 0.00 = USD 0.96
while the weighted average selling price is
USD 300 ÷ 200 kg = USD 1.50

Source: (NESDB 2004)

Take Note

The price a producer receives for his crop may vary according to the volume he has for sale. For example, a trader looking to buy 1 ton of a commodity would be willing to pay a better price if he can purchase it all from a single farmer. He will pay less if he has to purchase 100 kg of the same quality from ten different farmers as he will incur more costs in collecting, i.e. the trader has a higher transaction cost; see Table 25.

When studying a market over a longer period of time, for example over a ten year period, it is necessary to incorporate inflation and deflation rates. To do this, a base year, against which all prices are adapted, needs to be chosen. If this is too complicated a researcher should at least mention that there had been inflation or deflation in order to make a reader aware of the situation.

Take Note

During interviews many different cost and price units might be used. For example, handicrafts producers sometimes refer to their production volume in pieces, sometimes in tons and sometimes in containers. This can particularly be confusing when the study is conducted by more than one person. It is important to either agree upon which unit of measurement is used, or to determine how many units fit into one container or ton.

Step 4 Calculating financial ratios

Now that the investments, variable, fixed and/or other relevant costs, and revenues are known the financial position of the value chain actors can be analysed. Several ratios can be looked at, such as:

A. Net Income

Net income, or profit, is calculated by deducting total costs (both variable and fixed costs) from revenues.

Net income = revenues - variable costs - fixed costs

For example, in the hypothetical case of a shoe manufacturer who sells 10,000 pairs of shoes (Q) per month for 100,000 VND (P) per pair the revenues would be: 10,000 (P)* 100,000 (Q) = 1,000,000,000 VND. As the total costs for material, labour, rent, depreciation on the machines and tax are 800,000,000 VND per month his net income would be 200,000,000 VND per month.

B. Net Margin - Currency

Net margin: a margin on a product is the net income per product. This is calculated by dividing the net income of the manufacturer by the total number of products sold (Q).

Margin = Net income / Q
In the case of the shoes manufacturer the margin per product would be:
200,000,000 VND net income / 10,000 shoes= 20,000 VND per pair of shoes.

This is a simplified example and in reality there may be other costs. An example of a rice farmer's costs, revenues and margins is presented under Useful Examples - Example 4.

C. Net Profit Margin - Percentage

Net profit margin per unit is usually expressed as a percentage. In this case, net profit margin = unit profit/unit price.

For the shoe manufacturer:
20,000 VND / 100,000 VND = 0.20 or 20% net profit margin.

D. Break Even Point

The break-even point shows how much an actor has to sell before they start making profit. In other words, this is the point at which their revenues are starting to exceed their costs.

Break-even point = Fixed costs / (P-Variable Costs) = the number of units

For example, assume:
- Total fixed costs of the shoe manufacturer = 500,000,000 VND per month
- 1 pair of shoes is sold for 100,000 VND (P)
- Variable costs per pair of shoes = 60,000 VND

To calculate the break-even point:
500,000,000 /(100,000-60,000) = 12,500 units (pairs of shoes)

E: Return on Investment

Calculating the return on investment (ROI) for each actor in the value chain shows how attractive the activity is relative to other potential uses of capital.

ROI= Net Income/ Total Cost
For example, the shoe manufacturer's net income is 200,000,000 VND per month, and his total costs, including material, labour, rent, depreciation on the machines and tax are 800,000,000 VND per month. ROI would, then, be 200,000,000 VND /800,000,000 VND, or 25% for that period.

Basic ROI calculations can be correctly performed only if, as in example A, realistic depreciation of fixed assets is calculated, and if producers' own labour costs are counted among variable costs of production. If an enterprise's total capital costs are attributed to a single year's production, more capital intensive activities will look much less profitable, while if "imputed" labour costs are omitted from the calculation of variable costs, ROI from labour intensive activities will appear to be much higher.

Step 5 Changes over time

All the above aspects should be considered over time. What may look like a valuable value chain today may be invaluable next year. In other words, a researcher should study the trends of a value chain and consider the implications of these trends for the future. For example, to date Vietnamese traders who trade on a small scale have small margins on the products they sell. Over the past few years the cost for petrol has increased significantly and margins of small-scale traders have been decreasing. This means that small-scale traders need to either increase the scale of their business or find another source of income.

Another example can be taken from the commodity product market. Usually, when a country develops and people earn higher incomes, the demand for and hence revenues from commodity products, such as rice and maize, increase rapidly. As a consequence many farmers start growing these products and existing farmers intensify their production. The demand however only grows up to the point that people have sufficient food because people can only eat a certain amount of rice and maize. After that point, when supply exceeds demand, prices and hence revenues go down, and farmers may need to diversify their production.

Step 6 Relative financial position of actors in the value chain

In this step the division of investments, costs, revenues, net income (or profit) and margins among the actors in a value chain are considered. The aim of this step is make conclusions about the financial position of an actor compared with other actors in the chain.

There are several ways to present the financial position of actors in a value chain, for instance in a table or through a diagram.

In Table 28 and Table 29 an example of how to calculate the value added margins and profits along a chain is given. Table 28 gives the formulas used to do the calculation and Table 29 provides a worked example. The calculations appear difficult, but are easily implemented in an Excel Worksheet.

Table 28: Calculation of marketing margins – formulas for calculating ratios

Value Chain Actor	**Costs**			**Revenues**	**Profits**		**Margins**	
	Unit Total Cost	*Added Unit Cost**	*% Added Cost*	*Unit Price*	*Unit Profit*	*% Total Profits*	*Unit Margin*	*Unit Margin*
Farmers	A	-	A/F	G	G-A	(G-A)/(K-F)	G	G
Assemblers	G	B	B/F	H	H-B-G	(H-B-G)/(K-F)	H-G	H-G
Processors	H+C	C	C/F	I	I-C-H	(I-C-H)/(K-F)	I-H	I-H
Traders	I+D	D	D/F	J	J-D-I	(J-D-I)/(K-F)	J-I	J-I
Retailers	J+E	E	E/F	K	K-E-J	(K-E-J)/(K-F)	K-J	K-J
Total		F=A+B+C+D+E	100		K-F	100	K	K

*Added unit costs refer to the added costs at each stage of production net of the procurement cost from the previous stage.

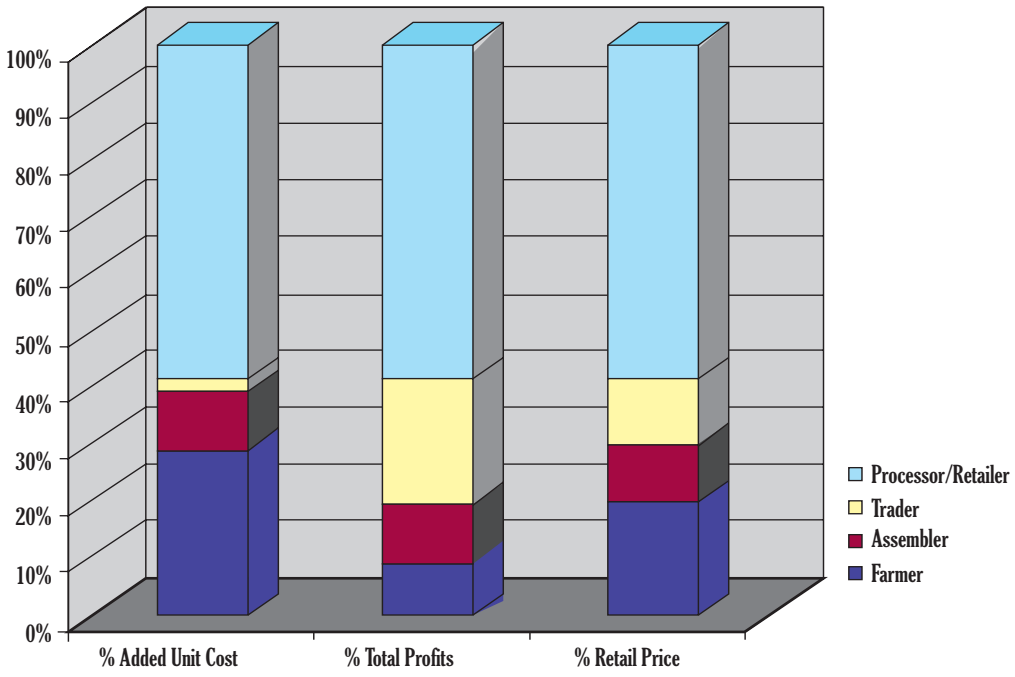
Table 29: Calculation of marketing margins - example of presenting a calculation of value chain margins

Chain Actor	Costs				Profits		Margins	
	Unit Total Cost	*Added Unit Cost*	*% Added Cost*	*Unit Price*	*Unit Profit*	*% Total Profits*	*Unit Margin*	*% Retail Price*
Farmer	20,000	20,000	29%	25,000	5,000	9%	25,000	20%
Assembler	32,100	7,100	10%	37,500	5,400	10%	12,500	10%
Trader	39,185	1,685	2%	50,000	10,815	19%	12,500	10%
Processor/ Retailer	89,873	39,873	58%	125,000	35,127	62%	75,000	60%
Total		**68,658**	**100%**		**56,342**	**100%**	**125,000**	**100%**

Source: (NESDB 2004)

The diagrammatic presentation of the value chain margins is shown in Figure 16 below.

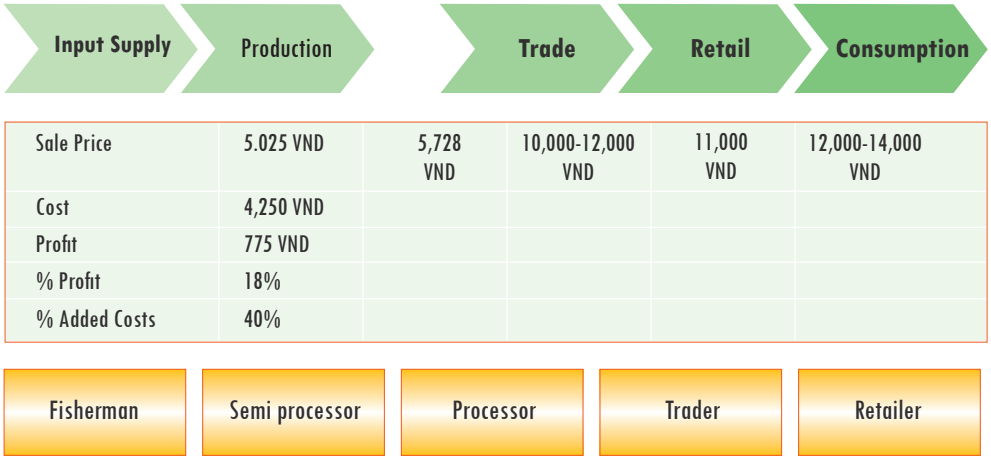
Figure 16: Value chain margins for the actors in each level of the value chain as a percentage of the overall value added



Source: (NESDB 2004)

A visual way to show the division of costs and margins is to include the cost and margin data in the value chain map; see Box 28. A similar map can be also drawn up for presenting the investments per actor.

Box 28: Revenues, costs and profit per unit in the value chain of 1 litre fish sauce (quality 2)



Source: (Boomsma 2006)

After data have been presented a researcher can start the analysis. In Figure 16, for example, it may be evident that the farmer incurs high costs and has little profits, while the trader has little costs and relatively high profits. This suggests that costs and margins are shared unequally in the value chain and could be an intervention point for a project. One such intervention might be scaling up the business of an actor in a chain in order to make the business more attractive for the actor. A good example comes from the bamboo sector in Vietnam. Currently most bamboo growers sell whole bamboo culms to paper, chopsticks and bamboo flooring enterprises. These enterprises cut the bamboo culms and subsequently only use part of the culms for processing. Leftovers are usually used as waste or in some cases as fuel. If farmers were to cut the trees themselves and sell only the relevant parts to each buyer, they could receive higher profit margins.

Take Note: Carefully consider TOTAL costs and revenues

Presenting the total costs, revenues and profits per actor per year (instead of simply presenting cost per unit) shows the scale of an actor's business. This is important because if only the profit per unit is considered an actor might appear to have an unfair share as they make only a small profit per unit. However, looking at the actor's total profit per year may demonstrate that the actor actually earns a reasonable income. This is often the case with commodity products, such as corn. Commodities often have low profit margins per unit, but because they are sold in large quantities the total profit per year can still be financially attractive.

Step 7 Benchmarking

Comparing similar value chains in different regions will provide information on the potential for efficiency gains. For instance, rice farmers in Northern Vietnam spend 1 million VND on inputs per ha, while their counterparts in the central highlands only spend 500,000 VND per ha. This could mean that prices for inputs are different (which would provide an opportunity for market entrants) or that farmers in Northern Vietnam use too many inputs. A situation like this provides an opportunity for the farmers to learn from each other's production techniques, although it is important to ensure that all units are the same before making comparisons.

Step 8 Going beyond the quantitative data

The final step in the costs and margins section is to go beyond the quantitative data and explore why certain actors in the chain have higher margins and lower costs than others. Is this the result of one actor investing more in a value chain than another actor? Is it the result of an unequal power distribution between actors (see Tool 3 - Governance: Coordination, Regulation and Control)? Does one actor have better access to market information because he or she has better linkages to the market than another actor?

5. What Should be Known after Analysis is Complete

Having followed all of the steps related to costs and margins the financial situation of actors involved in the value chain should be clear and strengths and weaknesses related to costs and margins of an actor and / or a value chain can be summarised. After that the constraints and needs of a value chain can be identified and interventions can be designed.

Useful Examples

Example 3: Cotton crop budgets for smallholder farmers in Zambia

The rain-fed smallholder cotton sector in Zambia had several years of stagnant yields of 600 kg/ha or below which was often attributed to a lack of fertilisers. A private sector company aimed to increase cotton yields of their contracted smallholder outgrowers through rolling out an extension programme focussing on the five key basic principles of cotton crop husbandry: early land preparation, early planting, thinning and gap filling to obtain an optimum plant stand, timely weeding, and an integrated pest management (IPM) approach to pest and disease control.

Without the use of fertilisers, and with the same amount of labour input, yields were greatly improved. As shown in the table below, non-collaborating farmers (NCF) achieved yields of 537 kg/ha on average, while collaborating farmers (CF) under the programme achieved yields of 902 kg/ha on average. Lead farmers (LF), who were more actively and directly supported by extension staff employed by the private sector company as intermediaries to reach the large numbers of collaborating farmers, achieved yields of 1,281 kg/ha. On closely monitored farmer-managed demonstration plots average yields of 1,892 kg/ha were achieved, showing the further potential for increased yields.

With 50,000 farmers benefiting from the programme in the first two years, and assuming an average yield increase of 400 kg/ha at USD 0.35/kg, the total benefits accruing to the farmers amounts to USD 7,000,000 per annum, against an investment in the programme of under USD 2,000,000.

Table 30: Cotton crop budgets for smallholder farmers in Zambia

Inputs/Activity	Manual labour				Animal draught power			
	Family labour (man days)		*Family (man days) / Hired (ZMK)*		*Own ox-span Family/Hired labour*		*Hired ox-span Family/Hired labour*	
Seed 15 kg (treated)		36,000		36,000		36,000		36,000
Spear (aphicide) - 100 ml		15,000		15,000		15,000		15,000
Ha pack of chemicals (standard)		115,000		115,000		115,000		115,000
Jacto knapsack sprayer (240,000/6 years)		40,000		40,000		40,000		40,000
Credit Cost		Inclusive		Inclusive		Inclusive		Inclusive
Subtotal	0	206,000	0	206,000	0	206,000	0	206,000
Land preparation	24		1	100,000	1	Ploughing	1	100,000
Planting	12		1	50,000	1	50,000	1	50,000
Gap filling	4		1	15,000	1	15,000	1	15,000
Thinning	4		1	15,000	1	15,000	1	15,000
Weeding 1	24		1	100,000	1	100,000	1	100,000
Weeding 2	16		1	50,000	1	Cultivator	1	80,000
Weeding 3 (4th weeding if necessary only)	16		1	50,000	1	Cultivator	1	80,000
Scouting	2		2		2		2	
Pesticide applications	3		3		3		3	
Harvesting - 1st picking (approx. 450 kg)	15		2	90,000	2	90,000	2	90,000
Harvesting - 2nd picking (approx. 90 kg)	3		1	18,000	1	18,000	1	18,000
Subtotal	123	0	15	488,000	15	288,000	15	548,000
Total man days/cost	123	206,000	15	694,000	15	494,000	15	754,000
NCF Yield 537 kg/ha @ ZMK 1,120		601,440		601,440		601,440		601,440
Profit		395,440		-92,560		107,440		-152,560
Return on Family Labour (ZMK/day)		3,215		-6,170		7,160		-10,170
CF Yield 902 kg/ha @ ZMK 1,120		1,010,240		1,010,240		1,010,240		1,010,240
Additional man days/cost harvesting (+ 365 kg)	12		2	72,000	2	72,000	2	72,000
Total man days/cost	135	206,000	17	766,000	17	566,000	17	826,000
Profit		804,240		244,240		444,240		184,240
Return on family labour (ZMK/day)		5,957		14,367		26,132		10,838
LF Yield 1,281 kg/ha @ ZMK 1,120		1,434,720		1,434,720		1,434,720		1,434,720
Additional man days/cost harvesting (+ 744 kg)	25		4	150,000	4	150,000	4	150,000
Total man days/cost	148	206,000	19	844,000	19	644,000	19	904,000
Profit		1,228,720		590,720		790,720		530,720
Return on family labour (ZMK/day)		8,302		31,091		41,617		27,933
Demo Yield 1,892 kg/ha @ ZMK 1,120		2,119,040		2,119,040		2,119,040		2,119,040
Additional man days/cost harvesting (+1,355 kg)	45		6	270,000	6	270,000	6	270,000
Total man days/cost	168	206,000	21	964,000	21	764,000	21	1,024,000
Profit		1,913,040		1,155,040		1,355,040		1,095,040
Return on family labour (ZMK/day)		11,387		55,002		64,526		52,145

Source: (van Gent 2007)

Example 4: Costs, revenues and margins for rice farming

Similar to the cotton story, rice production and yields can be improved with the application of improved practices. An analysis of rice yields and practices in the Mekong Delta of Vietnam shows that farmers can increase yields and reduce costs significantly. With only a modest increase in yield (100 VND/kg) and a slightly improved quality (resulting in an increased farm gate price), the main improvements come from a reduction in costs by more optimal use of seed, fertilizer and pesticides. Farmer profits go from 0.74% up to 18.89% with just some slight changes in farming practices.

Table 31: Costs, revenues and margins for rice farming

Input		Units	Summer-Autumn Crop - IR64, Can Tho Province, 2001					
			Farmer Practice			*Improved Practice*		
			Quantity	Unit Price	Amount	Quantity	Unit Price	Amount
Seed		Kg	200	2,000	400,000	100	2,000	200,000
Fertiliser	Urea	Kg	150	2,200	330,000	100	2,200	220,000
	DAP	Kg	100	3,000	300,000	100	3,000	300,000
	Phosphorous	Kg	50	2,300	115,000	50	2,300	115,000
Insecticide		VND	1	350,000	350,000	1	200,000	200,000
Fuel	Diesel	Litre	60	5,500	330,000	60	5,500	330,000
	Lubricant	Litre	3	10,000	30,000	3	10,000	30,000
Irrigation		VND	1	50,000	50,000	1	50,000	50,000
Soil Work		VND	1	320,000	320,000	1	320,000	320,000
Threshing		VND	1	320,000	320,000	1	320,000	320,000
Other Facilities		VND	1	160,000	160,000	1	160,000	160,000
Labour	Cleaning Field	Person	10	20,000	200,000	10	20,000	200,000
	Sowing	Person	5	20,000	100,000	5	20,000	100,000
	Weeding	Person	30	20,000	600,000	25	20,000	500,000
	Fertilizing	Person	6	20,000	120,000	5	20,000	100,000
	Spraying Insecticide	Person	6	20,000	120,000	4	20,000	80,000
	Pumping Water	Person	13	20,000	260,000	13	20,000	260,000
Harvesting	Cutting	Person	18	20,000	360,000	18	20,000	360,000
	Transporting	Person	8	20,000	160,000	9	20,000	180,000
	Drying	Person	8	20,000	160,000	8	20,000	160,000
Other Labour		Person	12	20,000	240,000	12	20,000	240,000
Credit	1% @ 4 months	VND	4	50,250	201,000	4	29,250	117,000
Total Cost	Materials	VND			2,705,000			2,245,000
	Labour	VND			2,320,000			2,180,000
	Total	VND			5,226,000			4,542,000
Yield		Kg	3900	1,350	5,265,000	4000	1,400	5,600,000
Cost		VND/kg			1,340			1,136
Gross Margin		VND/ha			39,000			1,058,000
Percent Profit					0.74%			18.89%

Source: Data provided by USDA FAS, HCMC, Authorship unknown. (Purcell and Rich 2002)

Tool 7 - Analysing Income Distribution

4

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Tool 7 - Analysing Income Distribution

1. Introduction

Analysing incomes within the value chain is central to understanding how the participation of the poor can be increased. Understanding how income is distributed along the value chain provides the necessary start to determine opportunities for income generation. Income analysis is different from the analysis in Tool 6 - Analysing Costs and Margins. While costs and margins analysis focuses on the profitability of an activity and the individual actor, analysis of income looks at all of the actors of the value chain.

Analysing distribution of income is not only an analysis within a particular value chain but also recognises that individual actors participate in a number of different value chains at the same time. For example, a farmer may be involved in several agricultural crops and several handicraft activities as a means of income diversification. A trader might be involved in trading multiple agricultural products at the same time or at different times of the year depending on the season. Therefore, livelihood strategies made by various actors are influenced by the sum of their income sources and any analysis must take this into account.

2. Objectives

1. To analyse the impact of value chain participation on the distribution of incomes within and between various levels of the value chain at the level of the individual actor.
2. To analyse the impact of different value chain governance systems on income distribution and on final product price.
3. To analyse the distribution of income at a whole of enterprise level and to analyse how that impacts on value chain participation and decision making.
4. To describe the impact of income distribution on the poor and other disadvantaged groups and the potential for poverty alleviation from different value chains.

3. Key Questions

- Are there differences in incomes within and between different levels of the value chain?
- What is the impact of various governance systems on income distribution between and within various levels of the value chain?
- What are the impacts of the distributional outcomes of the value chain on the poor and other disadvantaged groups, both currently and in the future?
- What are the changes in incomes that result from the development of various types of value chains?
- What is the variability of incomes and risks to livelihoods within and between various levels of the value chain?
- What is the contribution of the particular value chain to the whole of enterprise income and how does this influence decision making?

Terminology

Income is defined as the earnings accruing to an economic unit during a given period of time. Income comprises the money received from the sale of goods plus the value of self-consumed output minus the costs of production.

The costs of production comprise the costs of inputs, depreciation on capital equipment, interest payments and taxes.

Unlike profits (sales minus costs), where costs of production include the opportunity cost of own labour, income does not deduct the cost of own labour (since this accrues to the enterprise as "income" from labour). However, the cost of hired labour is deducted as this is a cost to the enterprise.

Cash income can be distinguished from non-cash income where a barter system occurs. For example, hired labour is sometimes paid for in a combination of cash as well as benefits (food, healthcare, pensions).

4. Steps

Step 1 Define categories

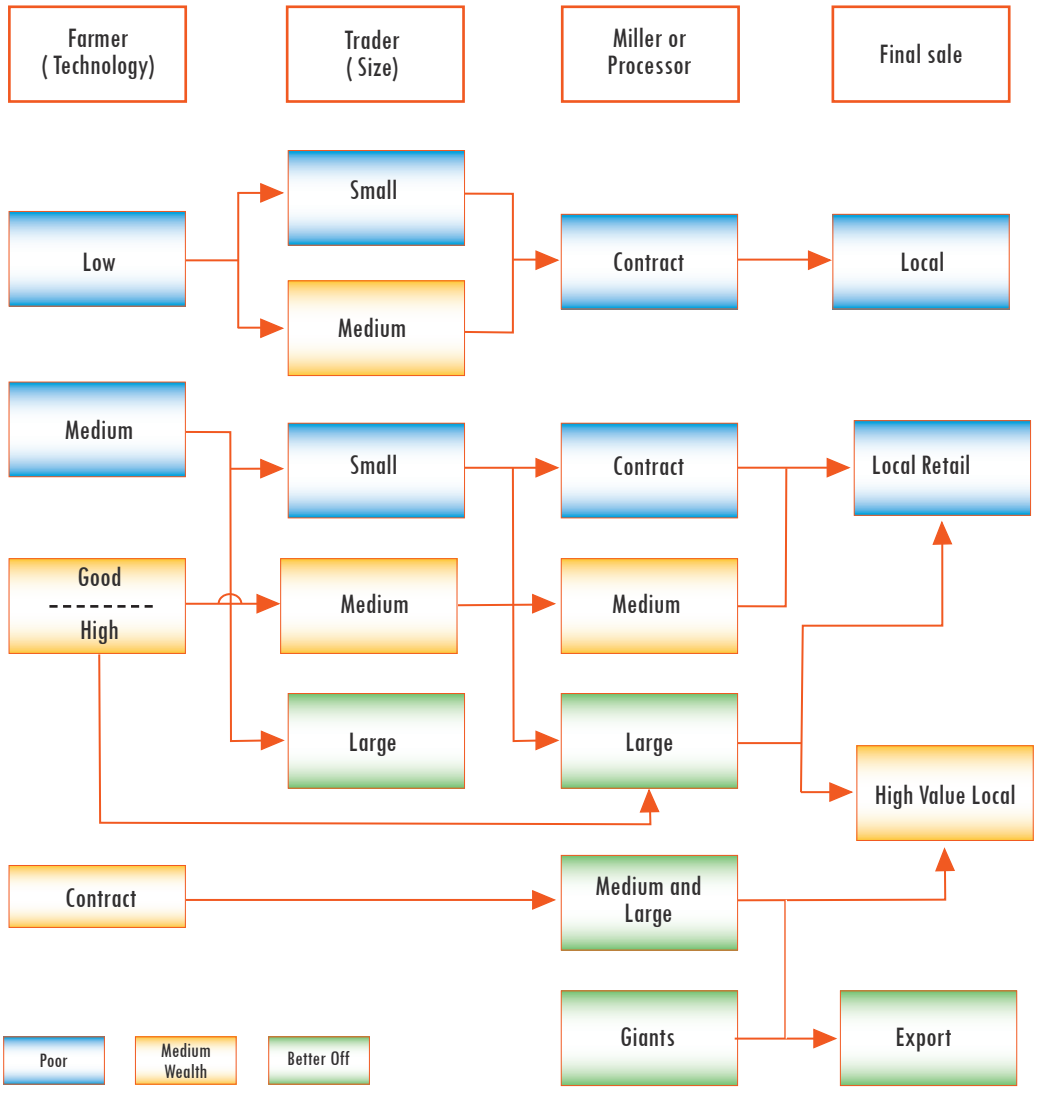
To analyse incomes within value chains it is important to first categorise actors. The mapping of the value chain as discussed in Value Chain Toolbook - Part Two (Tool 2) generally provides a map of actors within categories and this can be used as a basis to add income specific information. Categorisation should include a distinction between poor and non-poor actors as a starting point for analysis of incomes.

An example is given below for the value chain for rice in Cambodia. The value chain is divided into the size of operations at each level of the value chain (low, medium and high technology and volumes), as well as the mode of operations (contract milling, medium and large mills). In this example, each level of the value chain is separated into different categories for poor, medium wealth and better-off actors (distinguished by different colour coding). Thus, low and medium level technology farmers are more likely to comprise poor households, while the high technology and contract farming households are more likely to comprise medium wealth households.

Take Note

Poverty levels are a relative measure and it is difficult (and perhaps unwise) to be comparing poverty (as defined by income) between value chain levels. For example, a poor farming household earning USD 1 per day cannot be compared against a poor factory worker in the city earning USD 4 per day. Both are poor relative to other actors within their particular level of the value chain but there is clearly a difference between USD 1 and USD 4.

Figure 17: Rice value chain - categorisation of actors



Other measures of income (such as purchasing power) may be a better reflection of differences between different levels of the value chain. Use can also be made of official poverty lines, which are often different between urban and rural areas or between mountainous rural areas and flat land agricultural areas.

Step 2 Calculating incomes per unit of output

After the actors at each level of the value chain have been categorised and mapped the calculation of income per unit of output can be carried out at each level of the chain and for each actor. Income per unit at each level is determined using the tools outlined in Value Chain Toolbook - Part Four (Tool 6). Recall from above that income is different from profit in that the cost of own labour is not deducted from the calculation.

Step 3 Calculating the net income at each level of a value chain

Comparing the distribution of net income across each level of a value chain means that the benefits accruing to actors at various levels of the chain can be compared. This is in addition to the analysis of the margins and the profits accruing at each level of the chain. The analysis of income gives a more accurate picture of the true distribution of benefits at each level of the value chain, as it reflects the often vastly different volumes handled by actors at each level of the chain.

To determine income distribution the net income per unit at each level is multiplied by the sales volume at each level. Net income per unit is calculated as total revenue minus total costs (where total costs include hired labour costs but do not include own labour costs). In the example in Table 32 below, the net income and sales volume are used to calculate income earned by each actor at each process level in the value chain[1].

Table 32: Example of income distribution along the value chain for silk in Thailand

	Cocoon - Farmer	Yarn - Farmer	Total Farmer	Trader	Weaver	Small Retailer
Total Cost (Baht)	67	725	704	715	437	744
Total Revenue (Baht)	70	834	834	750	660	812
Net Income per unit (Baht)	3	109	130	35	223	68
Sales Volume	137 kg	18 kg	18 kg	18 kg	100 pieces	100 pieces
Total Income - Baht (USD)	**378 (9.45)**	**1962 (49.05)**	**2340 (58.50)**	**630 (15.78)**	**22266 (556.65)**	**6822 (170.55)**

The average net income level accruing to actors at each level of the chain should be benchmarked (compared with) the official poverty line and a subsistence level of expenditure to determine if the income level generated by the activity at that level of the value chain is sufficient to maintain or improve livelihoods. Using the benchmark level of poverty, and the profit margin and income information, a calculation can be made to determine how much of a particular activity would need to be undertaken in order to generate an income higher than the poverty line. Examples could include: how many hectares of rice cropped or how many tons of fruit traded.

Benchmarking incomes relative to the poverty line is a first way to consider the involvement of the poor in the value chain. A study of supermarket and street vendors (Moustier, Anh et al. 2006) compared street vendors' incomes with the 2005 poverty threshold in Hanoi, (500,000 VND/month) and found that 18% of street vendors are poor, while no poor households were found in the formal markets, nor in the shops or supermarkets.

Comparing income with subsistence level expenses is another way to appraise the role of the participation in the value chain in livelihood strategies. For example, the incomes of

[1] The analysis indicates an immediate opportunity for intervention in the value chain; providing opportunities for farm households to also undertake weaving activities. The weaving step is where the majority of the value added occurs, so any intervention which promotes upgrading will enable poor farming households to increase their income.

peri-urban vegetable commercial farmers in different African cities have been compared with the income necessary for subsistence (Moustier and Danso 2006). In Brazzaville and Bangui, at the time of surveys, market gardening yielded enough income to provide for the basic food requirements of the family, plus housing, clothing and schooling expenses; see Table 33. In this case, even if the total number of farms is small as compared with total urban population, their functioning demonstrates that urban agriculture is one of the sources of stable income that should be protected and considered a portfolio of cash-earning activities that require limited starting capital.

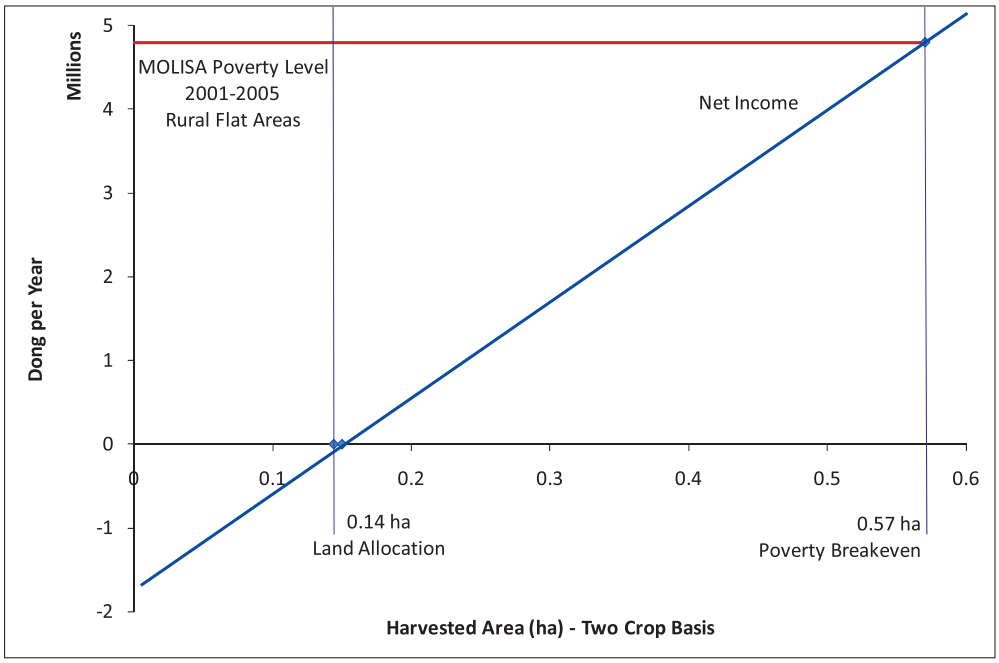
Table 33: Estimates of family commercial farmers' incomes compared with subsistence income

City (year) (source)	Number	Estimation of average monthly income USD	Estimation of minimum subsistence food expenditures USD
Brazzaville (1989)	1000 producers	150	100
(Moustier, 1996)	1700 retailers	120	
Bangui (1991)	300 producers	280	60
(David, 1992)	300 wholesalers	290	

Source: (Moustier and Danso 2006)

In the example in Figure 18 below, net incomes from the production of rice in the Red River Delta of Vietnam was calculated according to land area, and compared against the official poverty line. The example shows that 0.57 ha of paddy would be needed to increase the net income of the household from rice production to take that household up to the poverty line. Given the allocation of land per household usually is around 0.144 ha ($360m^2$ per person and up to four people per household), the analysis implies that unless yields can be dramatically improved poverty alleviation cannot be achieved by rice production alone. Therefore, alternative income generating activities and value chains need to be considered.

Figure 18: Comparison of net incomes from rice production with the official poverty line – minimum area of rice land required to support a four person household in the Red River Delta of Vietnam. The official poverty line is shown by the red horizontal line. The graph demonstrates that 0.57 ha of paddy is required for the harvest to generate enough income to equal the official poverty line.



Source: Adapted from (CIEM 2004)

Step 4 Calculate the wage income distribution

Since the calculation of incomes is profit + own wage income, it is useful to look at the combined components of wage incomes (own wages and hired wages) to see how wages are distributed over the value chain. Looking only at income accruing to the enterprise itself does not capture the contribution of each level of the value chain to the whole sector.

In order to calculate the wage income distribution along the value chain, separate the wage components in the partial budget calculations for margins and incomes. The value of costs (represented by wages multiplied by the value of sales at each level) will give the level of wage income at each level of the value chain. The comparison of wage incomes over different levels of the chain, combined with the categorisation completed in Step 1, gives a picture of the distribution of benefits to individuals within the framework of enterprises at each level of the value chain. Wage costs can be especially high for large-scale farms, as well as processing companies. An example calculation is provided in Table 34 below.

In this example total wage costs, as paid by farmers and processors, are a little more than farmers' and processors' profits. If all profits and wages are used as household incomes (which means that some of the profits are not used for investments) it can be concluded that the chain generates USD 325,000 in terms of incomes (USD 150,000 profit and USD 175,000 wage costs).

Table 34: A virtual example of calculation of total wage costs for a farmer to process 50 tonnes of vegetables

Item	USD /kg	kg/actor	No. of actors	Total (USD)
Farmers' input costs	1			
Farmers' wage costs	0.5	500	100	25,000
Farmers' other costs (depreciation, taxes, interest rates)	0.5			
Farmers' total costs	2			
Farmers' Revenue	3			
Farmers' Profit	1	500	100	50,000
Processors' input costs	2			
Processors' wage costs	3	5000	10	150,000
Processor's other costs	3			
Processors' total costs	8			
Processors' Revenue	10			
Processors' profit	2	5000	10	100,000
Total farmers and processors' profits	3			150,000
Total farmers' and processors' wage costs	3.5			175,000

In the example in Table 35 below looking at profits along the chain would suggest that farmers earn USD 15.9 million and processors earn USD 0.99 million. When wages are taken into consideration it can be shown that the processing industry contributes USD 9.6 million to the Zambian economy in hired labour alone, while the farm level contributes USD 7.3 million.

Table 35: Distribution of incomes and profits in the Zambian cotton value chain

Wage Costs/Profits	USD /tonne	No. Actors	Total (USD)
Farmer			
Wage Costs	40.00	280,000	7,336,000
Profit	86.75	280,000	15,910,000
Processor			
Wage Costs	52.20	6	9,573,000
Profit	5.40	6	990,000
Total Wages			16,909,000
Total Profit			16,900,000

Source: (Purcell, Gent et al. 2008)

In the analysis of income distribution, care should be taken to differentiate between paid labour and unpaid family labour. Although unpaid family labour does not incur a cash cost, it does incur an opportunity cost, frequently calculated using the local paid labour rate. This is explained in more detail in Value Chain Toolbook - Part Four (Tool 6).

Step 5 Calculate income variability over time

Seasonality in income is important to model, as substantial variations can occur. Therefore, value chain investigations based on a single estimate of income (at a particular point in time) may result in biased estimates of income. Variability in income increases risk of production and affects actors' decisions to invest in particular activities. This is particularly important for farmers who grow staple crops (such as rice or maize).

Overall, cash is most constrained in the period just prior to harvest. After a large harvest, households often have sufficient cash for their needs before planting begins and inputs need to be purchased. There may be large differences between households in different locations. This is a function of market access as households in remote areas have to rely on their own resources to make ends meet during the lean months. There may also be significant differences between the cash constraint profiles of poor, average, and better-off households. Box 29 below gives an example of a simple survey instrument designed to determine seasonal levels of cash constraint.

Box 29: Example of survey question to examine seasonal cash constraints

What are the seasonal cash constraints for the farmers?
Get the farmer to place a ☑ or a ☒ in the appropriate row for each month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Surplus Cash	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Enough Cash	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lack of Cash	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Source: (UNDP and NERI 2005)

By cross-referencing the data collected using the survey tool above with the categorisation of poverty levels, a graph can be produced focusing on cash constraints. This type of analysis can highlight the seasonality of cash constraint and surplus in certain value chains. This is not limited to agricultural crop cycles but can also be a result of changes in consumer demand, for example tourist seasons.