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Final Project 2008

THE JENSSON COMPUTER MODEL: AN OPTION FOR GROWTH IN THE FISHING INDUSTRY

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ABSTRACT

The Kingdom of Tonga, an archipelagic group in the southwest Pacific, is the home of more than 100,000 people who have been subsisting mainly on fish and crops which can be grown on the land. Many types of fisheries have emerged in the past few years and commercial fishing, particularly tuna long line fishing, is slowly becoming an important part of Tonga's economic development. A closer look at the operations of local fisheries companies in Tonga is presented in this paper using the Jensson Computer Model, designed by Professor Pall Jensson of the University of Iceland, for measuring profitability and assessment of risks. Concepts such as cash flows, NPV and the IRR will be discussed and how they are applied in measuring the profitability of a tuna long line fishing business in Tonga. Risk will be explored in an attempt to measure the sensitiveness of uncertain variables to the NPV and IRR using an impact and a scenario analysis. Finally the Monte Carlo simulation method is conducted using the @RISK software to address the uncertainties as random variables chosen from a probability distribution.

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1 INTRODUCTION

1.1 Background information

Tuna is probably the most important natural renewable resource for almost all of the Island Nations of the South Pacific. In business, economics and even within academic circles, it is almost impossible to stage any discourse or dialogue regarding the *welfare* of the Pacific Region without reference to the tuna fishery. It is a multi-million dollar business (for example in Fiji and Papua New Guinea) and has been predominantly regarded as the most important fishery in the region in the sense that it is potentially an economic life-line for most of the smaller Pacific Island Nations. For Tonga, in particular, this fishery is gradually claiming a permanent position in the economy, not only as a major source of foreign earnings but also because of the employment opportunities it provides and above all in providing welfare for the whole nation. Small scale fisheries and aquaculture and mari-culture, which are manageable and practically appropriate for most people, promise huge potential for economic growth but still have not been fully exploited.

The tuna fishery has been the backbone of the fishing industry in Tonga for the last two decades but it was rather unfortunate that some local fishing companies, which went out of business a few years ago, were not well prepared for such business undertakings. Many reasons were identified for the failure of the companies ranging from internal inefficiencies within the fishing companies themselves to natural and global economic problems beyond human control. Several foreign fishing companies with locally based fishing vessels left the fishery signalling that a decline in effort, and hence in volume of catch, were to be expected in due course. Licensed vessels for tuna long lining dramatically dropped from 33 in 2003 to only 11 in 2007 (Hamilton and Batty 2007) and the industry managed to survive in part from government subsidies such as duty free fuel, full refunding of consumption tax for exporters etc. Therefore, the desire for some modification and improvement in the tuna fishery and its related business environment was desirable. On the other hand, aquaculture, mari-culture and other small scale fisheries were simply not within the planning horizon of local entrepreneurs in the fishing sector. The government has placed very little emphasis on this kind of development and hence no serious planning has been done to initiate and implement such ideas. Furthermore, the environment that is conducive to such development was simply not present. One can witness that there has been no major improvement in aquaculture and marine culture for the last four or five decades, apart from the biological experiments and spawning of molluscs to replenish the wild.

It is generally believed that the decline in catch rates, the escalating price of fuel, fluctuations in market prices, the introduction of new government taxes and many other factors are culpable not only for the stagnant development in the tuna fishery but also for the collapse of some local fishing companies. The problems inherent in management of fishing companies, however, were neither formally addressed in important conferences and meetings nor considered as a serious problem. It was simply left aside to be solved at some later time if not deliberately forgotten. The central hypothesis of this report assumes that the absence of a proper management tool for analysing risks and profitability is equally blameworthy as those enumerated above.

1.2 Goal

This paper endeavours to apply the Jensson Computer Model whose output would provide the necessary tool for measuring profitability and the assessment of risks. It would also generate the appropriate accounting information required by decision makers in the management of any fishing company. In this study, the model will be developed with an anticipation of investment in small and medium sized fishing companies. A series of cash flow data will be considered in conjunction with the development of a balance sheet which will be simulated over the life-time of the investment. The model will be based on assumptions which are deterministic and every result is uniquely determined by parameters which may be regarded as initial conditions or previously calculated results within the model itself. The mode of representation will enable users to tailor-make the desired results by changing or giving an estimate of the few parameters or initial conditions allowed to be input into the model. Uncertain factors represented by a random variable that may be chosen from a probability distribution can also be added. Apart from analysing investments, it can also be used for the study of how a company is affected by government taxation and payment of dividends to stakeholders. The What-if Analysis tool offered by Excel can also be used in analysing company policies and related government regulations.

It is also an objective of this project to foster the discipline required for the successful running of a small or medium sized fishing company. This is done by a brief outline of the development of major management theories, a general outline of the role of managers and proper accounting practices. These must be strictly observed as computer models are only tools to assist managers in making decisions and will never yield the expected results without observing the proper business discipline.

1.3 Main tasks

1. The Jensson Computer Model, which will be used in this project, has been widely applied in many fishing projects. In this study, its general form will be developed to justify the connection between all quantities involved.

2. Another aim is to present an outline of the major management theories, role of a manager and the proper accounting practices required for running any business.

3. Furthermore, a revenue and cost budget will be prepared for a tuna long line fishing vessel that can operate in the Pacific Region. This will be based on the author's experience in operating tuna long liners specifically the vessel *Neiufi 1* owned by Global Fishing Co. Ltd. (an incorporated company in the Kingdom of Tonga). Such preparation begins with assumptions on the number of hooks deployed and fishing days. The Catch per Unit Effort will be estimated per specie, which will be used in forecasting revenue.

4. An investment plan will be outlined to show the main capital goods required and how the operation will be funded. This will be followed by a statement of operation taking care of all costs and eventually the appropriation of profit.

5 A stream of cash flow will be generated considering mainly the values of profit after and before tax, using a discount rate (or the minimum attractive rate of return) chosen by the user. At the same time, a balance sheet will be developed and followed by a source and allocation sheet to outline the main sources of funds and how they were utilised.

6 The main tools for measuring profitability which are the Net Present Value (NVP) and the Internal Rate of Return (IRR) will be obtained from the cash flows. The related financial ratios will be extracted from the information gathered in the model for comparison purposes.

7 Sensitivity Analysis will be performed using Impact, Scenario and Monte Carlo methods of Analysis as a means of addressing uncertainties in a more advanced way than the usual contingency method. This will be carried out using the *Data Analysis Tool* and *Scenario Manager* of Excel with a simulation performed by the Microsoft Excel Add-in, the @RISK software.

2 THE KINGDOM OF TONGA IN FOCUS

2.1 Geography and history

2.1.1 Geography

Dwarfed by the expanse of the Pacific Ocean, the string of islands known as the Kingdom of Tonga is comparatively tiny on the world map and it may be located with the aid of a magnifying apparatus, but its geographical position is globally marked by a geological phenomenon that has attracted scientists worldwide in the past few decades (Figure 1). This is the Tonga trench (second deepest point on earth, approximately 10.8 km from mean sea level) which is a subduction zone formed from two tectonic plates converging at a velocity of almost 24 centimetres per year, the fastest crustal motion on earth yet observed (Bevis *et al*. 1995). The second point of geographical significance is that the whole group lies just to the west of the International Dateline, well positioned to be the first nation on the planet to greet every new day giving rise to the meaning of the phrase “Tonga, where time begins”.

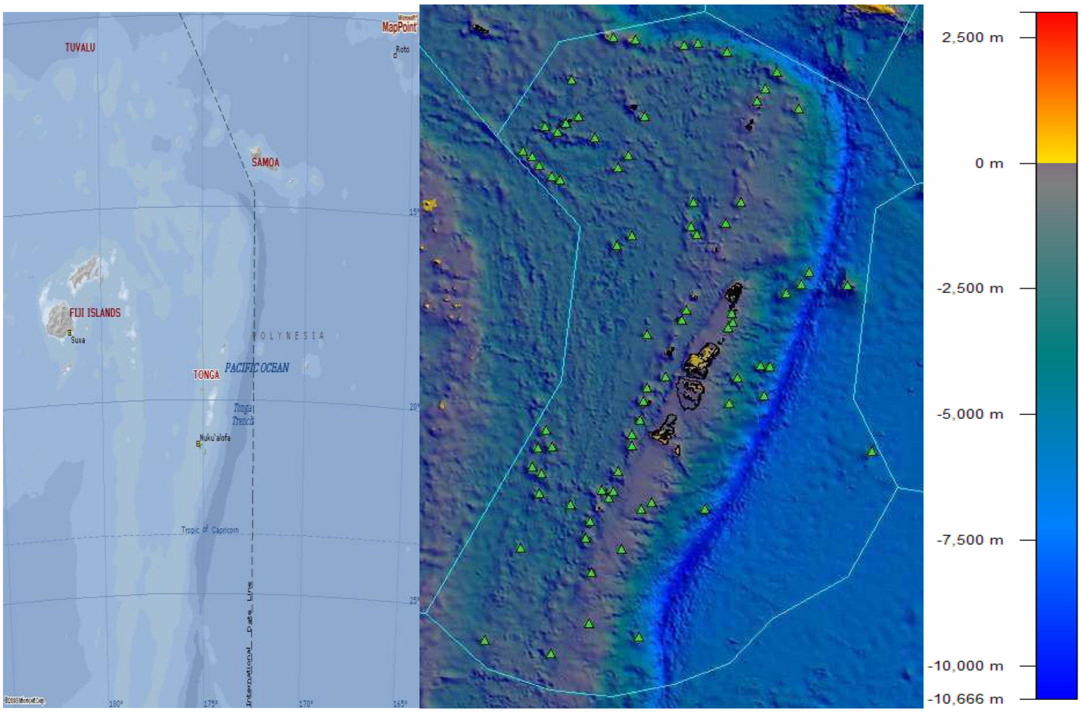

Figure 1: Bathymetry and location of seamounts in the Tongan EEZ (Allain *et al*. 2007).

Geologically, the whole group can be categorised into two main types of islands. The first consists of all islands with a limestone base (Coral Atolls), formed from uplifted coral formations, and the other category may be described as volcanic based islands most of which are strings of volcanic islands lying from south to north and to the western side of the group. The group consists of about 171 islands of which 28% are inhabited and approximately bounded by the meridians 173° and 177° west and the parallels 15° and 23° south. It is further subdivided into three main sub-groups of islands, the Tongatapu group (including ‘Eua Island), Ha’apai and Vava’u groups with two other islands, Niuatoputapu and Niuafo’ou, as northern outliers but not as a separate group. Tongatapu (within the Tongatapu group) is the largest island where the capital city *Nuku’alofa* is located.

The geographical outlay of many islands is extended by miles of coral reefs whose richness in marine life have supported its inhabitants for many years. Until recently, the rapid growth in population and the need for further development in agriculture coupled with unplanned industrial activities have resulted in voluminous wastes being transferred to the ocean by erosion. This has resulted in pollution and eutrophication of the nearby reefs causing a signicant loss of coastal habitat. The scale of human impact on the nearby coral reefs is negatively making a mark on the environment with high intensity on nearby urban areas and least on remote islands. The climate may be described as subtropical and because it lies in the southeast tradewinds area, the temperature is cooler during winter (from May to November) with an average temperature of about 20°C and warmer during summer (December to April) when the temperature can rise as high as 32°C. The whole island is at a position which is vulnerable to tropical cyclones and earthquakes. This has led the government to set up a Natural Disaster Relief Department in collaboration with neighbouring Island Nations in streamlining immediate warning systems and aid when natural disasters occur. Tonga‘s economy may be described as still being at the subsistence level since a large proportion of the population has not engaged in export oriented business activities. Agricultural and marine products in excess of daily consumption are usually not exportable. This may be due to small volumes as well as various other factors and so products are usually sold on the local market. Only a few have successfully set up companies that are export-oriented in both agricultural and fishery sectors.

The money received from foreign aid and remittances from Tongan nationals living abroad particularly in New Zealand, Australia and the United States have kept the economy afloat by offsetting the unfavourable balance of trade experienced every year in the past few decades. There have been many economic initiatives designed by the government through the relevant ministries, particularly the Ministry of Labour, Commerce and Industry (MLCI), to stimulate economic growth which is gradually materilising but still in the development phase. In the past two to three years, attempts have been made through the MLCI to sign MOU‘s with companies in New Zealand and Australia to hire their labourers from Tonga which in turn generates foreign reserve in addition to remittances. Such programmes include The NZ Seasonal Employer Programme (New Zealand) and The Pacific Seasonal Worker Pilot Scheme (Australia). Both are well under way. Government economic policies have revolved around the urgent need to revitalise the private sector by providing a conducive legal environment for its development, a new taxation system and setting up national goals with guidelines for achieving them. A case in point would be the introduction of a tax system which is low rate but broad-based as against the heavy tax imposed on importers and businesses carried out internationally which is usually an impediment to importation of raw materials and capital goods that necessitate production. Aid money from foreign countries has been directed to setting up the infrastucture that is necessary for development in the private sector such as roads, harbours and airports. The following list summarises some important facts related to the geography and demography of Tonga:

- Capital and largest city — Nuku’alofa (with approximately 25,000 people)
- Total area — 748 square km [96% is land and 4% is water or swamp]
- Tonga EEZ — 700,000 square km
- Coastline — 419 km
- Population — 101,991 people (2006 estimate)
- Population growth rate — 1.08%
- Life expectancy — 70 years
- Religion (faith) — 99% Christians
- Literacy rate — 98.4%
- Inflation rate — 5.9%
- Unemployment — 13%
- Main exports — Squash, root crops, vanilla, fish, sea weeds, live corals
- Main industries — Fishing and tourism.
- Balance of trade (2007) — -264,315,877 [Export:16,715,644, Import: 281,031,541]

Source: Annual Foreign Trade Report, 2007: Statistics Department of the Government of Tonga

2.1.2 History

The history of Tonga can be traced back to antiquity where myths and historical facts are blended together. Kings were divine rulers, and their social status was maintained and reinforced by some forms of traditional beliefs in ancient religion. Totemism and Taboos (as in the sense of Nietzsche) were the guiding principles that maintained and perpetuated the status-quo of this social class (the ruling class) for centuries. Experts and researchers in Pacific ancient history have made significant contributions toi reconstructing the history of the Pacific Islands including Tonga and a considerable effort in extracting the facts of history (what actually happened) from that offered by mythology (what society desired to have happened), especially when there were no written records. The period of significance to any discussion of the history of Tonga is from the first European contacts (17th-Century) up to the present. It was precisely during this period that the foundation of modern Tonga as we know it today was laid (Spenneman 2004)

On record, the Dutch explorers Willem Shouten and Jacob Le Maire (1616) were the first Europeans to have visited the Tongan waters coming very close to Niuatoputapu Island at the north of Tonga. A few years later, the famous Dutch explorer, Captain Abel Tasman (1643), is said to have been the first European navigator to discover Tonga in the sense that he officially chartered this particular part of the South West Pacific and placed Tonga on the world map for the first time. This was followed by three significant visits by Captain James Cook in 1773, 1774 and 1777. In return for the peaceful environment he found and the hospitality he received from the natives, he named Tonga the “Friendly Islands”. (Claessen 1968). Cook is held responsible for publicising this first image of Tonga worldwide and as a consequence laid down the blueprint for the later inflows of European settlers, missionaries and businessmen that hence forth changed the lives of the people of Tonga.

It is the only nation in the Pacific that has never been colonised by a foreign power, but in the late 18th to mid 19th Century colonialism was at its peak in the Pacific Region. Tonga has been ruled by a monarch since 950 A.D. up to the present. It was not until the 19th Century when the internal politics of the nation were decided between warlords and chiefs, whom were descendents of kingly lines, through civil wars and internal strife amongst the chiefs themselves. The acutest of all was *Taufa’ahau* (later King George Tupou I) who ascended to the kingly line of *Kanokupolu* as the supreme ruler and decisively laid down the foundation of Tonga as a nation in the modern sense of the term. Taufa’ahau, assisted by the missionaries, united the whole of Tonga under one government and converted all people to Christianity.

Among his legacies were the complete obliteration of serfdom and slavery, promulgation of a constitution in 1875, the establishment of a parliament which represented commoners, the implementation of a land tenure system and collaboration with the missionaries in setting up educational institutions. Towards the end of the 19th Century, the civil wars and revolutions that plagued Tonga for many years finally came to an end. Treaties with major European powers were negotiated and Tonga was recognised worldwide as a sovereign nation (Claessen 1968).

At the beginning of the 20th Century, the need to modernise the country gradually became a necessity. Like any other nation moving in this direction, Tonga's ability to accumulate wealth is one of the basic, if not the most important, ingredient for modernisation. Traders and businessmen mainly from Europe helped the government in streamlining trade. The main exportable resources at the time were mainly agricultural products, particularly dried copra. The land tenure system that was introduced and legalised by the founder helped to a certain extent in facilitating farming activities and production was encouraged by the government and the business community of the time. Later, during the 1950s, the export of fresh bananas to New Zealand in exchange for refrigerated products and canned food were added to the list. Very much later, the squash pumpkin industry emerged with huge potential during the early 1990s with the Japanese market as its destiny. Since then, there have not been any major breakthroughs to any other markets except individual farmers exporting stable food to neighbouring metropolitan countries on their own but not on a collective basis like before. Such were the brief developments in the semi-commercial agricultural sector of Tonga.

In 1887, a Royal Proclamation by King George Tupou I declared that ownership of all territorial waters had been vested in the Crown. Another Royal Proclamation of 1972 included Minerva Reef (Telekitonga and Telekitokelau) in the Kingdom of Tonga. As a consequence, nobody owns any part of the ocean and all fishing is under open access with some exceptions regarding community based exclusive fishing rights which eventually became impractical (Fairburn 1992).

Fisheries products from the turn of the 20th Century were somewhat different to agricultural products. Apart from being highly perishable, they were produced in small quantity and there was no knowledge whatsoever of any market opportunities, not only for fish but for all marine products. The fishing industry at the time existed only to serve the local market and the local market only operated if there was catch in excess to sell. It was not until the 1970s that the government, assisted by Japanese expatriates, experimented with the idea of exporting tuna to the fish cannery at Pagopago. Later with frequent international air services, provided by the National Airline of Tonga and Air New Zealand, fresh tuna was exported to Japan and America. Deep water fishing targeting red snapper, sea weeds, live corals and sea cucumber were among the export-oriented industries that followed. New fishing companies were established which specialised in different types of fisheries. The industry continued to expand and now, after three decades, the tuna fishery remains the backbone of the fishing industry in Tonga.

2.2 A brief history of tuna long line fishing in Tonga

Tuna long line fishing activities in Tongan waters have been recorded as early as the 1950s and were dominated by overseas flagged vessels mostly from Japan, Korea and Taiwan (Molony 2007a). This was during a time when neither the government of Tonga nor anyone in the private sector owned a vessel with the appropriate fishing gears for this type of fishery. It was not until the early 1970s that some second-hand vessels for skipjack and long line fishing were first introduced in Tonga. This can be taken as the beginning for most Tongan fishermen to learn about tuna long line fishing and the fishing gears to be used in this type of fishery, with assistance offered by Japanese expatriates.

In 1982, the Tongan government experimented with the vessel FV Lofa, donated by the government of Japan, to find out more about the commercial viability of tuna long lining. FV Lofa was the only long liner that operated from 1982 to 1990. The results looked promising and the administration and operation of FV Lofa was later handed over to the semi-government company, Sea-Star Fishing Co. Ltd. Shortly thereafter, Sea-Star Fishing Co. Ltd could not operate the vessel successfully, experienced a lot of difficulties and later went out of business.

The size and fish-hold capacity of vessels like FV Lofa may be regarded as big in the sense that it can stay afloat in the ocean and fish for up to three months with catch volumes that can exceed 100 metric tons as compared to vessels of smaller size which would not be able to do this. All of her catch would be frozen, of which most was albacore destined to the cannery in Pagopago and the rest was offloaded at Nuku'alofa to be sold locally.

At the beginning of the 1990s, the USAid/Tonga Fisheries Project introduced the idea of a medium sized vessel, much smaller in size and capacity than the FV Lofa, with the aim of targeting fresh tuna to be exported to Japan. This idea seemed favourable and within the financial capability of some local entrepreneurs. It led to a considerable increase in fleet size and catch, which reached its peak in the early 2000s. At the same time, tuna long lining was also opened for foreign fishing vessels to operate locally. These vessels were licensed as "Locally Based Foreign Fishing Vessels or LBFFV" and local vessels were licensed as "Local Fishing Vessels or LFV". These additional vessels increased in number reaching a peak in 2002 and 2003 before declining due to poor catch rates and the escalating price of fuel. After 2004, most of the locally based foreign fishing fleet left Tonga and moved to other neighbouring countries. The following table summarises the structure of the fleet, effort and catch volume from 1982 to 2006.

Table 1: The fleet structure in Tonga from 1982 - 2006, effort and catch volume – tuna long line (Molony 2007b).

Year	Fleet Size			Effort	Catch Volume	CPUE
	LFV	LBFFV	Total	10^6 Hooks	Metric Tons	
1982 - 1990	1	0	1	4.447	**2,704**	0.608
1991	2	0	2	0.367	**231**	0.629
1992	3	0	3	0.452	**259**	0.573
1993 - 1995	7	0	7	1.478	**843**	0.570
1996 - 1997	8	0	8	2.446	**1,528**	0.625
1998	10	0	10	2.702	**1,033**	0.382
1999	15	4	19	3.61	**1,400**	0.388
2000	17	2	19	3.569	**1,495**	0.419
2001	14	5	19	4.442	**2,007**	0.452
2002	14	12	26	6.251	**1,965**	0.314
2003	13	9	22	5.657	**1,366**	0.241
2004	11	9	20	2.44	**654**	0.268
2005	12	0	12	4.018	**977**	0.243
2006	13	0	13	4.063	**1,059**	0.261

Note: The period 1982 – 1990, only one fishing vessel dominated the Tuna Fishery. The cumulative number of hooks for the 8 years is 4.447 X 10^6 . The Ave. CPUE was calculated by the author based on the volume and hooks given on report as: $Ave.CPUE = {}^{Volume}/_{Hooks}$

2.3 Some statistics on tuna fisheries in Tonga

The Secretariat of the Pacific Community (SPC) has been providing its member states with information followed by advice to assist them in management of regional tuna fisheries. Over the past few decades, all member countries have been provided with reports called the National Tuna Fisheries Status Report (NTSFR) which contain summaries of catch trends, data regarding effort from the main fisheries, summaries of research that has been carried out and stock assessment information. The NTSFR of 2004 (Langley 2004) gave a summary of stock status, oceanographic information and catch trends from previous years up to 2003. The NTSFR of 2007 (Molony 2007) provides an update of the 2004 report with similar information up to 2006. Most of the estimates presented in these reports are derived from historical data, ususally collected by observers on board or logsheets from fishing vessels. The other method of estimating is Regional Stock Assessment done using the MULTIFAN-CL computer programme.

Since the 1950s, almost all commercial fishing activities have been carried out within the Tonga EEZ with tuna long lining as the main fishing method. Since 1982, the domestic fleet has been building up its capacity with one vessel operating for about a decade and increasing slowly to a maximum of 26 vessels in 2002 but declining again to about 13 active vessels in 2006. Although the government opened the registry for licensed tuna vessels at a maximum limit of 50 vessels, this level was never reached. Most of the Tongan fleet conducted fishing activities almost exclusively within the Tongan EEZ except for bigger vessels that could go beyond the EEZ boundary and fish in the high seas. The effort and catch volumes within and outside the EEZ is tabulated in below.

Table 2: Effort and catch within and outside the Tongan EEZ (Molony 2007a).

Year	Total Effort (10^6 Hooks)			Total Catch (metric tons)		
	Within EEZ	Outside EEZ	**Total**	Within EEZ	Outside EEZ	**Total**
1982 - 1990	3.656	0.791	**4.447**	2,125	580	**2,705**
1991	0.292	0.075	**0.367**	165	67	**232**
1992	0.343	0.109	**0.452**	184	75	**259**
1993 - 1995	1.381	0.097	**1.478**	794	49	**843**
1996 - 1997	2.428	0.018	**2.446**	1,521	7	**1,528**
1998	2.567	0.135	**2.702**	987	45	**1,032**
1999	3.321	0.289	**3.610**	1,294	106	**1,400**
2000	3.490	0.079	**3.569**	1,471	24	**1,495**
2001	3.981	0.461	**4.442**	1,763	244	**2,007**
2002	4.433	1.818	**6.251**	1,430	535	**1,965**
2003	4.163	1.494	**5.657**	935	431	**1,366**
2004	2.401	0.039	**2.440**	636	18	**654**
2005	3.838	0.180	**4.018**	924	53	**977**
2006	4.023	0.040	**4.063**	1,038	21	**1,059**
Total	**40.317**	**5.625**	**45.942**	**15,267**	**2,255**	**17,522**

Note: In the period 1982 – 1990, only one fishing vessel dominated the tuna fishery. The cumulative number of hooks for eight years is 4.447 X 10^6.

The National Tuna Fisheries Status Report for Tonga of 2007 made a significant contribution to the status of the fishery as highlighted above. Mor importantly are the assessments of the current stock of the main tuna species in Tonga which are albacore, yellowfin and big eye. Some of the findings are summarised as follows:

Albacore assessment: The assessment of albacore catch rates in the Tongan EEZ were recorded as less than 2% of all albacore caught on the South Pacific. The findings indicated that the effort was still below the fishing mortality needed to achieve the maximum sustainable yield. In terms of biomass, the stock was still above the biomass at maximum sustainable yield. The stock size, therefore, can still support an increase in the current level of exploitation.

Yellowfin assessment: The assessment of yellowfin was conducted in relation to the rest of the Western Central Pacific Ocean (WCPO) area. It indicates that the yellowfin stock in this region is approaching the fishing mortality rate at maximum sustainable yield. The catch in the Tongan EEZ is insignificant compared to that in the WCPO. For management reasons, the catch of yellowfin should be closely monitored.

Big eye assessment: The assessment of bigeye reveals that the current level of exploitation is likely to exceed the fishing mortality required for a maximum sustainable yield. The catch rate in the Tongan EEZ is still insignificant in comparison to the WCPO but needs to be monitored since it is a species targetted by the local long liners.

2.4 Government policies related to fisheries

All government policies in relation to fisheries are based on a framework provided by the law. Some of the most important acts and regulations regarding fisheries include the following:

- Royal Proclamation of 1887 defining the boundaries of Tonga both land and sea.
- Royal Proclamation of 1972 extending the boundaries of Tonga to include Minerva Reef (the islands of Telekitonga and Telekitokelau).
- Territorial Sea and Exclusive Economic Zone Act of 1978
- Fisheries Act of 1989 (amended in 1993)
- Fisheries Regulation of 1994 (Conservation and Management)
- Fisheries Regulation of 1995 (Local Fishing)
- Aquaculture Management Act of 2003

The Royal Proclamations of 1887 and 1972 are statements defining the boundary of Tonga (both land and sea) and a declaration of the limits of the national jurisdiction vested in the crown. However, the Fisheries Act of 1989 is the basis of all regulations and policies for administering all type of fisheries. It defines the territorial waters and declares that the government owns both the territory and all living marine animals in it. The Department of Fisheries, a subsidiary of the Ministry of Agriculture Fisheries Forestry and Food (MAFFF), is empowered by the Fisheries Act 1989 to prepare and review all plans regarding conservation, management and development of any fishery in the Kingdom. The same Act authorises the Director/Minister of Fisheries to take full responsibility for carrying out the above preparation and review. Such legal arrangements delegate the authority in setting up fisheries policies to the Minister of MAFFF.

In terms of licensing requirements, the Act also provides criteria for licensing of local fishing vessels such as length, fees to be charged and business prerequisites required. For foreign fishing vessel, there has to be a bilateral or multilateral agreement between the governments of the flag state of the vessel with the government of Tonga before a license is issued to the foreign applicant wishing to fish in the Tongan EEZ. There is also another category called the “locally based foreign fishing vessels” which is treated differently. Under this category, the relevant company has to operate and land all catch in Tonga before exportation so that all fees and tax obligations are settled and the relevant data can be accurately recorded.

There are laws specifically designed for conservation of marine life and habitats. A case in point would be the law that prohibits the use of any poison or explosives as a means of catching fish. The Minister of MAFFF is also authorised to prohibit the export of species that he thinks would affect other fisheries or harm the fishing industry as a whole. There are also policies related to management measures such as gear standards, mesh size of nets, maximum and minimum size of species, maximum number of operators for a type of fishery and also when to close and open a season for specific species.

Apart from the regulations and policies to be observed locally, Tonga is also a party to some regional and international agreements related to fisheries. The most important ones include the United Nations Convention on the Law of the Sea relating to the conservation and management of straddling fish stocks and highly migratory fish stocks. Tonga is also a member of the South Pacific Commission, FAO and the Forum of Fisheries Agencies. These organisations have specific interests which are incorporated into agreements between member countries and must be strictly observed.

2.5 The business environment in Tonga

The commercial centre of Tonga is the capital city *Nuku’alofa* and has been the home of the early entrepreneurs, mostly of European origin. They have been serving the public for over a century in setting up grocery stores and bakery services. Indian immigrants later set up their businesses specialising in importing and selling textiles and Tongans tended to follow suit. During the late 1970s the government set up the Small Industry Business Centre with the intention of exporting of goods, mostly textiles manufactured locally from imported raw materials. The Centre has continued to expand to include other types of businesses. In the early 1970s, apart from the exporters of agricultural products, some Tongan businessmen started to establish themselves in the business sector by specialising in importating goods from overseas and selling them locally. The type of products ranged from textiles, frozen and canned food to second hand automobiles and construction materials. The same trend was followed by an influx of Chinese citizens who automatically became naturalised citizens of Tonga from the late 1980s as a result of a government policy related to sales of Tongan passports. Most of them have become very successful businessmen, considering the short time that they have spent in Tonga. The Chinese community, since then, has been rapidly growing in size and has dominated the small and medium sized grocery outlets throughout the Kingdom. Their inquisitiveness regarding the needs of the public and their willingness to work long hours have paid off giving them a wider margin in terms of business opportunities than their Tongan counterparts.

Tongans, being rivalled with the Chinese, found the business atmosphere very competitive. Some of the Tongans, who were new comers into the business sector, registered their companies in the Government Registry and some decided to do without it with the deliberate intention of avoiding tax obligations. Some take the view that the existing government business application procedures take too much time to process with unnecessary fees being charged.

The service industry manages to survive from revenues collected from the constant inflow of tourists. Tourists are the users of restaurants, taxis and occupants of hotels and accommodation facilities. They buy souvenirs from local shops and stalls at the main street and spent a few dollars at the beaches and tourist resorts. The airline industry plays a central role in facilitating the operation of all tourist operators as most tourists travel to Tonga by air. The national airline of Tonga was instrumental in the development of the tourist industry but it declared bankruptcy in 2004 leaving Air New Zealand as the only carrier that connected Tonga and the outside world. As a result the number of tourists significantly reduced and the industry barely survives. Now that a new airline, Pacific Blue, has become an additional carrier, tourism is gradually on the ascent again. The inbound trips by cruise liners, although carrying a lot of passengers, are only frequent during the summer time and passengers spend no more than a day in Tonga and then depart for their next destination.

The Commerce Division of the Ministry of Labour, Commerce and Industry is the section whose primary responsibility is to serve the business community. One of its main functions is the issuing of business licenses and this service is provided in compliance with the Business License Act of 2002. Later the Business License Regulation of 2007 came into effect in April of that year. It enforces the requirement that everyone who is conducting any business activity in Tonga must hold a valid license. The same Regulation states clearly how to apply for a business license, the costs involved, its terms with renewable options and a list of the commercial categories which the applicant can choose from. Commercial categories include service providers, manufacturers, processors, food providers and many others.

The Industry Division of the Ministry includes in its main functions facilitating industrial development with the aim of attracting foreign investors to invest in Tonga. This service is provided in compliance with the Industrial Development Act of 1978 and the Foreign Investment Act of 2002. Tonga's Industrial Incentives Development Scheme has been offering incentives and concessions to projects which are aimed at attracting foreign reserves. This was issued in the form of a development license granted to new projects with the above aim. The scheme was repealed in 2007 to be in line with new customs and the excise tax regulation in which all industrial sector imports will be exempted from duty. Although it has been passed as law, it is yet to be enforced.

The need to attract foreigners to invest in Tonga has been an attractive option for the government. It, therefore, has to tailor make the rules and regulations in such a way that would serve this purpose. The MLCI is administering a policy on foreign investment. All foreign companies that want to conduct business in Tonga must hold a Foreign Investment Registration Certificate obtainable from the secretary upon application. If it is a company incorporated outside Tonga, it must apply for incorporation in Tonga and be issued with a Company Registration Certificate.

It is the government's desire to adopt good rules and regulations that are efficient, transparent and accessible to everyone. It was anticipated that this would allow small and medium sized enterprises to do better in business and ensure long term survival in the fast-changing world. There was a need to liberate businesses that had been trapped in the unregulated informal economy, a type of economy characterised by having less access to finance and inability to hire good and skilled labourers and their employees would usually lack the security and protection offered by the labour law.

Regulatory reform is desirable in procedures related to applying for business licences and obtaining various permits and is to be expedited to ensure that regulatory reforms are carried out immediately. The hope for a better business environment is the main focus.

The Commercial Law's main function is primarily to determine how businesses are created and also how they are terminated and look closely at how business agreements between any two parties are structured. Local businessmen have become very critical of this law saying that part of it is very helpful to some and simultaneously make life difficult for others. Some of the laws and regulations are out of date and should be replaced while others do not exist at all, though the demand is there. Despite the effort of the government, the commercial law of Tonga has been heavily criticised by the local business community and reform is an ongoing process like in any other country.

3 DECISIONS, MANAGEMENT AND ACCOUNTING

3.1 The basis of decision making, accounting principles and management

3.1.1 Decision making

In any business environment, a decision for a task to be executed may be informally defined as the end result of a series of theoretical considerations of all related aspects of a particular situation as the basis for the execution of that task. Usually, decisions may be classified as good or bad, correct or incorrect depending on whether the objective is met or at least attained its optimum result. Such objectives may involve maximising of profits or minimising costs and many more that cannot be enumerated here. Objectives are sometimes prioritised due to scarcity of resources, or may be due to some other factors having a material impact on the business. We can enumerate an endless list of the hindrances and factors affecting decision making but in real life, we often ask the question: "How do managers make good decisions?"

Part of the answer is having a good and reliable source of information together with experience in interpreting the information. In some cases, managers would consult experts in the trade for their views and experience which can be of valuable assistance to decision making. Sharing the views of experts and the various techniques they have would help to make information clearer and better analysed, and to add numerical and objective precision to decision making. Managers also need an environment which is supportive in contrast to an environment of fear of being criticised which stifles risk taking and ceativity. In a non-supportive environment, managers would respond by safeguarding himself/herself from the risk of being criticised rather than taking a proactive stand point in relation to problems which in turn diminishes the business's effectiveness in responding to the changes in the environment.

At all levels of a business organisation, there is always an authority being delegated to that person in that level to make decisions which is in line with the scope of his/her job. For example, the executive is given the authority to choose among other options a strategic decision about an investment plan and its direction of future growth. A manager, on the hand, can decide on a more tactical approach about how his/her department may effectively contribute to the overall business objective. Down to the basement of the heirarchy we have the ordinary employees who are also expected to make decisions about the conduct of their own tasks, how to form up decisions when responding to customers and improvements to business practice as a whole. Therefore, at all levels and at some point, there are decisions to be made and the recruitment and selection of the workforce is critical in terms of decision making. Usually, the most important level of decision making is the executive level which is expected to be in full command of the whole system.

3.1.2 Managers and their role

A manager is someone who works with other people and may be through other people in coordinating their work activities in order to accomplish an organisational goal or objective. Management can be defined as the process of coordinating work activities so that they are completed effectively and efficiently. Effective in the sense that after completing the work or activity, the goal is attained or better described as "doing the right thing" and efficient in the sense that, the most output is being derived from the least input which is described as "doing things right". In summary the manager's job is to ensure that the end result is attained (effectiveness or doing the right thing) and that the end result is attained with the least wastage of resources (efficiency or doing things right). Despite changes in organisations and the working environment, which have blurred the distinction between a managerial job and a non-managerial job, a manager is one which is capable of the following, or better described as the most useful conceptualisation of a manager's job.

1. *Planning*
   The manager must incorporate in his/her functions the ability to define goals or objectives establish strategies in achieving those goals. The manager must possess the ability to develop plans to integrate and coordinate work.

2. *Organising*
   Organising work involves the ordering of tasks to be done and streamlining of workers in accordance with what they are supposed to be doing within a specified time interval. The chain of command in the workplace must be organised so that everyone knows his superiors and who reports to whom and where decisions are made.

3. *Leading*
   The manager must be able to direct and motivate all parties involved, and must be capable of dealing with the different behaviour of all people in the working area.

4. *Controlling*
   Controlling refers to monitoring of activities in the work place to ensure that they are executed according to plan.

There are also certain management skills that are expected from different levels in the management hierarchy of an organisation. At the top level, managers are expected to possess some conceptual skills. This type of skill involves thinking in abstract terms or the ability to diagnose and analyse present situations as the basis for predicting the future. On the other hand, considering human resources as the most important resources possessed by an organisation, the middle management level is expected to possess human skills in the sense that middle management must understand the different types of behaviour of everyone involved. Equipped with this kind of skill, middle managers are able to devise tactical approaches in providing motivation so that everyone contributes to the overall business objective. The low management level is expected to have technical skills. This type of skill is the knowledge and proficiency required for the successful accomplishment of a task.

3.1.3 The contingency perspective

Business organisations can be thought of as evolving from one stage to another. This evolution perspective is the result of the changes that management has gone through. Different styles of management are required for different organisations at different times. The contingency perspective is the view that management adheres to no simplistic or universal rule and that management style changes according to the type of organisation and what the circumstances at the time dictates. The contingency perspective in management is popularised with what is known as the contingency variables of which some of them are as follows:

1 The size of the organisation

As the size of an organization increases, the problem of coordination proportionally increases. An organisational structure for a company with 30 employees may not be appropriate for one with 500 employees. The style of management must be adjusted so that it is still effective and efficient in relation to size.

2 Uncertainties in environment

Management is greatly influenced by the changing nature of politics, society and the dynamic economic systems. The degree of uncertainty within a dynamic environment increases and future events are less likely to be predictable in contrast to an environment which is stable.

3 Individual differences

Individuals within the organisation differ in terms of their aspirations, beliefs and their social background. Their expectations and desires are different and managers must recognise these differences when designing motivation techniques, leadership styles and allocation of jobs.

Considering the variables above and adapting the management style to suit the environment, today’s organisations have adopted flexible work arrangements, open communications and greater responsiveness to change. It is in this type of setting that organisations of today are able to live at ease with uncertainties. There are many examples and only a few can be mentioned here. Traditionally work was defined by job-position and was individual-oriented whereas in today's organisation, work is defined by "tasks to be done" and is team-oriented. In some organisations, there were rigid rules to follow or rule-oriented whereas today's organisation is customer-oriented. The vertical hierarchical relationship in the traditional organisation is being slowly replaced by a lateral and network relationship. Managers usually and always make the decisions but today, employees also participate in decision-making.

3.1.4 Accounting

Accounting can be referred to as the language of business. This type of language is the information system that is used to measure business activities. The usual procedure is that information is processed and later converted into reports and finally the end result is communicated to the decision makers. Such information is the basis for decision making. People who use this information can be individuals, managers of companies, investors from foreign countries, government regulatory agencies, community leaders and many more. Since there are many users who are almost from all walks of life, it is possible that accounting information, if it conveys the wrong message, can have an adverse effect on all individuals and organisations enumerated above and ultimately affect the life of many people.

In accounting, particularly financial accounting, information must meet certain standards of relevance and reliability. In addition to standards, there have to be certain regulations for disseminating information so that that which is confidential stays within the right place and that which is public can be shared. Management accounting deals with confidential information which is meant to be used by top executives of the organisation and stays within the organisation.

Relevance and reliability can only be accomplished, apart from the usual "checks and balances" routine in offices, by some ethical considerations of accounting and the accountant. Ethical standards in accounting are designed to produce accurate information for decision making. The ethical behaviour of accountants, although external and indirectly related to his/her job, is something that society can rely on or trust and this public trust is further extended to the result that the accountant is producing. Although the target of any organisation is to increase the wealth of the shareholders which primarily originates from society, the public trust is required and in the long run, this trust in turn depends on ethical business practices. So we have this inter-dependence relationship between the organisation's ethical standards and the public trust. Most organisations have a code of ethics designed to encourage ethical and responsible behaviour in accounting and their accountants alike.

3.2 Major management theories

It is human instinct to live in groups and groups seem to be formed naturally according to similar human interests. Those who are interested in farming tend to form a group called the "farmers", those interested in businesses form another group of their own and many more in society which we could enumerate endlessly. In a civic society, one may argue that organising groups in an orderly manner using rules and regulations presumably derived from a standard code of ethics, is the only way that would guarantee an ongoing production of wealth for the organisation and above all guarantee the organisation's long term survival.

In business management, the same idea seems to be applicable in setting up businesses as their target is wealth and long term survival. After the Industrial Revolution, organisations grew to be very large in size and the use of machineries in factories sped up production which in turn increased quantity. As a result, wealth proportionally increased and there seemed to be a universal need for management of organisations, particularly businesses. So management automatically became a necessity for any organisation of any size (small or large), and in all types (profit or non-profit), at any level (from top to bottom) and in any area of operation, be it manufacturing, marketing, human resources, information systems etc. Theories about management and suggestions of solutions to related problems emerged from company's top executives, educational institutions and universities, some of which are as follows:

The Scientific Management Theory: Proponents of this theory most notably Frederick Taylor (late 19^{th} Century) advocates the four Taylor principles of management.

1 Study and measure the way in which a task is performed now and then determine new ways of doing it.

2 Convert the new ways of doing things (No. 1) into rules to be followed by everyone in the work place.

3 Rearrange the workers by matching up their ability to the rules obtained in No. 2 above.

4 Establish a fair return (pay level) for the workers according to performance and output.

The Administrative Management: This theory maintains that the primary task of management is to create an organisation that is both effective and efficient. The concept of bureaucracy developed by Max Weber better explained in the "Weber five principles" is taken to be the basic tenet of this theory. They are as follows:

1 Authority must be established as the ultimate control mechanism that holds people responsible for their actions.

2 The relative position in the hierarchy must be well defined and these positions in turn define what is expected of them.

3 Positions in the organisation must be held based on performance and not on any social consideration.

4 The chain of command or lines of authority must be clearly defined so that everyone knows who to report to.

5 The operation within the organisation is governed by rules and standard operating procedures.

The Behavioural Management: The central idea of this theory is that productivity can be improved through a better understanding of the behaviour of individuals at work within the organisation. Employees are human beings with feelings, ideas and aspirations and if these behavioural traits are developed and improved, then they will significantly contribute to productivity. The emphasis, therefore, is for managers to motivate the employee as the employee knows the best way to analyse and make improvements for his/her job. The employee must be given a certain degree of autonomy and enough room for improvement. A classic example used to popularise this theory is the study of the Hawthorne Works of the Western Electric company in Chicago conducted in the 1920s. The concepts advocated by proponents of this theory have been replaced by later concepts but the ideas provided a platform for improvements in areas such as human resource management, selection of employees and motivation.

The Quantitative Approach Management (Management Science): Management Science emerged during the 1940s as a new style of management that used rigorous quantitative techniques in mathematics to assist managers and improve decision making. Application of branches of mathematics such as operations research, theory of optimisation, probability and statistics were extensively used in this approach. A method of linear programming was used in solving resource allocation problems. The "critical path analysis" is a mathematical algorithm that was used to improve scheduling procedures for work to be done efficiently or any problem related to scheduling. Later when computers were introduced into offices, Management Science added to its business arsenal much more powerful tools in simulating almost all types of management activities. Computer models were wizards in modelling reality through simulations that involved millions of computations that human beings cannot do with a pencil and paper. With all these new innovations in technology and science, management dramatically changes its direction of development.

The brief outline of the major management theories above and their place in history has cemented a platform for future development giving us an idea of the direction in which management is heading.

4 THE TIME VALUE OF MONEY

4.1 Money as a commodity

Most of the theories about making decisions in businesses and planning of investment revolve around the concept "time value of money". Money, in the world of investment, can be regarded as a commodity that can be bought and can be sold. This line of reasoning would imply the existence of a market where money can be traded. The immediate question that comes to mind is the value of money in the market, i.e. how much would I pay if I bought $1,000 in the money market today? Similarly, how much would I get if I sold $1,000 today in the same market. Obviously, the price of the $1,000 in the market is not going to be less than $1,000 as the seller will lose out. The price is certainly not going to be $1,000 either as the seller is not making any profit out of the transaction which is equivalent to doing no business at all. The best bet is that the price would certainly be more than $1,000. Like any other commodity, money has different values at different points in time and its value is subject to change as dictated by market conditions such as inflation etc. Another option apart from buying the $1,000 is to borrow the sum for a period of time but then you have to return it and pay the cost of borrowing. The cost of borrowing money is measured by an interest rate. Interest then is the cost of having money available for use for a certain period of time. If the interest rate is 10% per annum, $1,000 today (called the present value or PV) would become $1,100 (called the future value or FV) after one year from now. This is exactly what we mean when we say that money has earning power over time. The $1,000 of today is capable of earning more after one year compared to the $1,000 of next year which does not have that capability now.

4.2 Future value and present value of an investment

Let *A* be the amount to be invested at a rate *r%* per annum. If *A* is invested for *n* years then:

$FV_n = A(1+r\%)^n \text{ where } FV_n \text{ is the Future Value after } n \text{ years.}$

The present value is $PV \text{ or } PV_n \text{, and if } PV = A, \quad \text{then } FV_n = PV(1+r)^n$

Suppose we invest $1,000 for two years at a rate of 10% per year. The future value can be calculated using the above formula as follows:

$FV_2 = 1{,}000(1+10\%)^2 = 1{,}000(1+0.1)^2 = 1{,}000(1.1)^2 = 1{,}210.$

The Jensson Computer Model which is the scope of the next chapter will use Microsoft Excel to calculate future and present value using the built-in function.

$= FV(RATE, NPER, PMT, PV, TYPE)$

There are five parameters required by the FV function. *RATE* is the interest rate per period, *NPER* is the total number of periods and *PV* is the present value. The other two parameters *PMT* and *TYPE* are included in the formula to be used only when calculating Annuities (series of equal payments on equal time intervals) and will be set as zero in the Jensson Model unless specified. It is also important to note that when we enter the *PV* parameter, it must be negative and the *RATE* must be a number between zero and one. Applying the Excel *FV* function to our example above we hope to get

$= FV(0.1, 2, 0, -1000, 0) = 1{,}210$

The PV function can be obtained by taking the FV functions and solve for PV, i.e.

$FV_n = PV(1+r)^n \text{ and dividing both sides by } (1+r)^n \text{ we get } PV = \dfrac{FV_n}{(1+r)^n}$

With our example above, $PV = \dfrac{FV_2}{(1+r)^2} = \dfrac{1{,}210}{(1+0.1)^2} = \dfrac{1{,}210}{1.21} = 1{,}000.$

Our Excel built-in formula for the PV function is exactly the same as that of the FV function except that the parameter PV is replaced by FV, i.e.

$= PV(RATE, NPER, PMT, FV, TYPE)$

4.3 Cash flows

Most financial analysts regard cash flow as the best indicator of the financial health of a company. Increased cash flow means that more funds are available for payment of company obligations such as tax, dividends etc. The simplest cash flow to consider is annuity which is a series of nominal cash flow of equal amounts spaced out in equal intervals of time. An example can be shown in the following diagram where an amount of $1,000 is the cash flow on the first year, $1,000 on the second year and so on.

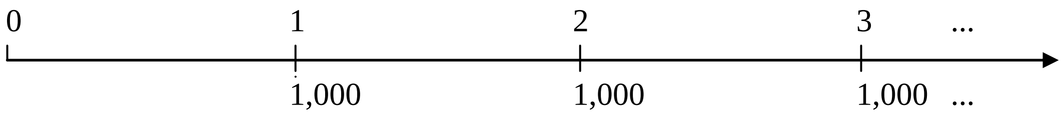

Figure 2: An example of an even cash flow (annuity)

The principle of additivity states that the value of a stream of cash flow is obtained by adding the cash flow of each and every one of the cash flows. Finding the FV and PV of a stream of cash flow such as above (annuity) is applying the formulas for *FV* and *PV* for each one and then adding them together to get the *FV* or *PV* of the total cash flow. Mathematically this is expressed as:

$$PV_A = \sum_{t=1}^{n} \frac{PMT_t}{(1+r)^t} \quad and \quad FV_A = \sum_{t=1}^{n} PMT_t\,(1+r)^{n-t}$$

PV_A: $Present\ Value$, FV_A: $Future\ value\ and\ PMT_t$: $Periodic\ Payments\ and$
$r, t\ and\ n\ are\ the\ rate, time\ period\ and\ the\ number\ of\ payments\ respectively.$

The above formulas are rather tedious to work with when the payments to be made are more than 3. There is, however, a closed formula for both $PV_A\ and\ FV_A$ which will speed up the calculations (Chan 1993.) but we will restrict ourselves only to those offered by the corresponding built-in function by Excel.

In Excel, the formulas for *FV* and *PV* shown earlier are also used for annuity except that we have to put in the values for the quantities *PMT* and *TYPE* that were set to zero earlier. *PMT* is the amount of cash flow recorded for every period which is assumed to be the same for every period. *TYPE* is a binary code (0 or 1) which informs Excel whether the payment occurs at the beginning (*TYPE* = 0) or at the end (*TYPE* = 1) of the period.

4.4 Uneven cash flow

Annuities as shown above is a neat cash flow in the sense that the amount is always the same throughout. In real life most investments don't have cash flows that are always the same at different periods of time. Such cash flows are called uneven cash flows and are conceptually the same as annuity in terms of the additivity principle in the sense that you can find each one separately and add them together. Excel *PV* and *FV* functions cannot be applied to uneven cash flow as they assume equal payments or lump sum only.

The NPV Excel formula is the one used to find the present value (PV) of a stream of uneven cash flows. The FV is obtained by nesting the NPV function within the FV function. In Excel, the PV and FV of an uneven cash flow are calculated as follows:

$$=NPV(RATE, Value\ 1, Value\ 2, ...)$$

$$=FV(RATE, NPER, PMT, -NPV, TYPE)$$

4.5 Profitability and sensitivity analysis

4.5.1 3.5.1 NPV and the IRR

There are many techniques that Financial Analysts used in measuring profitability but the Jensson Model will consider the two most important tools, the NPV and the internal rate of return (IRR) in deciding whether a business is going to be profitable or not.

The NPV is a simple concept but a very power tool in financial analysis. In simple terms it can be explained in the following way. When purchasing an asset, the buyer's preference is to spend an amount that is always less than the value of the asset to be bought. When translated into investment, the value of an asset is the present value of its future cash flow. The initial outlay (*I.O.*) is the cost of buying this asset and the difference is what we normally called the NPV and it represents the excess value of an asset that is collected as a result of purchasing. To be more specific, we can represent it as follows:

$$\begin{aligned} NPV &= Present\ Value\ of\ Future\ Cash\ Flow - Initial\ Outlay. \\ &= PVCF - I.O. \end{aligned}$$

where *PVCF* represents present value of future cash flow and *I.O.* is the initial outlay. In mathematical terms this idea is explicitly expressed as:

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - I.O.$$

If $NPV \geq 0 \; i.e. \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} \geq I.O.$, the project should be accepted. Likewise, if $NPV < 0 \; i.e. \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} < I.O.,$ then the project should be rejected.

The NPV measures the change in the shareholder's wealth. A positive NPV always results in a cash flow which is in excess of costs which means that the project or business is generating enough cash flow to cover the cost implying an increase in the shareholder's wealth. The NPV function is applied to an "after tax" cash flow to ensure that shareholders are not obligated to pay tax when dividend is paid.

In the Jensson Model, the NPV for "cash flow after tax" and the "net (free) cash flow" are both presented. The NPV of cash flow after tax is worked out against the I.O. (loan plus equity) whereas the NPV of net (free) cash flow is worked out against the equity.

To apply the method of NPV to an investment, we follow the steps outlined below:

1 First determine an interest rate (discount rate) that the company would like to earn from the investment. This rate is called the Minimum Attractive rate of Return (MARR).

2 Determine the planning horizon which would be the economic life time of the business.

3 Determine the net cash flow for each period of the planning horizon (cash inflow – cash outflow)

4 Find the NPV using the formula $NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+MARR)^t}$ using MARR as the discount rate.

5 If $NPV \geq 0, accept\ the\ project, \quad and\ if\ NPV < 0, reject\ the\ project$

The NPV as defined above was the difference between the "present value of future cash flows" ($\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}$) of an investment and the "cost of the investment" (I.O.). The usual definition of the IRR is the rate (value of *r*) that equates the *NPV* to zero. Equivalently, it is the rate that equates the PV of future cash flows to the I.O., i.e.

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - I.O. = 0 \quad or$$

$$\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} = I.O. where\ r\ is\ called\ the\ IRR.$$

4.5.2 Sensitivity analysis

Most cash flows, budget preparations and forecasting done in the working environment are assumed to be certain and analyses based on these assumptions are used in selecting the best investment option. In most cases, this is very useful in the sense that it provides a basis for making reasonable decisions, but it would be more realistic if we also considered that the usual situations dealt with in real life are indeed subject to some degree of uncertainty. Because of uncertainty, the best that management can do is to estimate some range of possible values for an uncertain item (called a random variable) and estimate the relative chances of it occurring. Sensitivity analysis, therefore, is an attempt to understand the effects of uncertainties on NPV or the IRR.

In the Jensson Model, there will be three main methods of sensitivity analysis applied to risks as explained below.

Impact Analysis: This type of analysis determines the impact of one uncertain variable at a time such as sales volume, variable costs, prices, etc on the NPV and the IRR. The uncertain variables are called the input variables and impact analysis is trying to measure the impact of these uncertain items on the NPV or the IRR when the input variables are changing. For example, a small change in price might cause a significant change in the NPV whereas the same magnitude of change in variable costs would cause very little change in the NPV. In such cases, we say that the NPV is more sensitive to price in comparison with variable costs.

Scenario Analysis: This is a technique which is similar to impact analysis but deals with simultaneous changes in more than one uncertain variable and also with occasions that could possibly be happening. Such occasions are called scenarios and traditionally decision makers consider a worst case and a best case in contrast to the expected case scenario. A worst case scenario to consider would be a drop in sales volume and an unexpected rise in costs. What would the NPV or IRR be under these circumstances? A best case scenario to consider would be a rise in price and decline in inflation rate etc. These are possible scenarios that could happen and an understanding of these situations can assist decision makers understand what to expect in the future.

Monte Carlo Simulation: This method is the most advanced of all the sensitivity analysis methods and is basically an iterative method that uses random numbers as input for simulation. Simulation is a way of modelling reality and using its results in making predictions and later as a decision making tool. Monte Carlo Simulation is best performed by an Add-in to Excel called @RISK which allows the user to use a specific probability distribution for the uncertain items.

5 THE JENSSON COMPUTER MODEL

The Jensson Computer Model uses Microsoft Excel in its development. Each sheet of the model is titled J1, J2, ..., J7 for ease of reference. They are as follows:

J1 Assumptions and results
J2 Investment and financing
J3 Operations statement
J4 Cash flow
J5 Balance sheet
J6 Sources and allocation of funds
J7 Profitability and financial ratios

5.1 Assumptions and results (J1)

5.1.1 Investment

The Jensson Computer Model assumes that there will be capital goods consisting of all the items that are initially put forward to start a project or a business. This includes expenses for purchasing equipment such as a new fishing vessel with extra fishing equipment on board, machineries for a processing plant such as refrigeration facilities, a laboratory unit with equipments for quality management, facilities for an aquaculture project, new buildings and warehouses that may be used in the production line etc. Since capital goods are made up of several items, it would be best if some consistent notation was created to take into account the different types of capital goods. With this approach, generalisations can be easily made and all necessary information for reporting purposes and analysis would be obtainable from this model. For example, capital goods can be classified into Type 1, Type 2, etc with their corresponding values shown as they depreciate during the lifetime (planning horizon) of the business. The planning horizon in general would be divided into equal periods or intervals of time whether weekly, monthly quarterly etc. but in our case it would be years. There will be *m* types of capital goods and the planning horizon is *n* years. We start with the following:

$$\text{Let } C_t^j \text{ be the value of the capital goods of type } j \text{ at year } t\,, j = 1,2, \dots, m \text{ and } t = 0, 1,2, \dots, n$$

Considering an example with this notation, we can then report on the values of each item say, the value of a building as capital goods of type 1 in year 2, the value of a fishing vessel as capital goods of type 2 in year 3 etc., then with our notation the values of these two items can be represented as $C_2^1 \text{ and } C_3^2$ respectively.

The planning horizon is assumed to be in years with operation assumed to be starting on the first year labelled as Y_1 , then Y_2 as the second year of operation etc. and will be represented as:

$$Y_0, Y_1, Y_2, \dots, Y_t, \dots, Y_n \text{ where } Y_0 \text{ is the year prior to commencement of operation}$$

The second part of the investment is the working capital W which will be an amount of money that is put forward for the starting of the business. The total investment I

will therefore be the sum of the capital goods at the beginning of Y_0 and the working capital W which is given by:

$$I = W + \sum_{j=1}^{m} C_0^j$$

Note that the summation sums up the values of all types of capital goods at the beginning of the business, i.e. at Y_0 prior to commencement of operation at Y_1.

Another component of the investment which will be considered separately is the inventory build-up.

5.1.2 Sources of funds

The source of funds anticipated in the Jensson Model comes from two sources. The first is equity E and the second is a loan L (for principal amount) from a bank or a financial institution. A fixed term of $t_* \, years$ will be assumed for the repayment of loans together with interest $i\,\%$ of the principal amount and a loan management fee (LMF) calculated as $f\,\%$ of the principal amount L.

Equity will be $a\% \; of \; I$, and the rest $(1 - a\%)I$ will be from the loan which is usually written as $E + L = aI + (1-a)I = I$ or simply as $I = E + L.$

5.1.3 Sales quantity, prices, fixed and variable costs

Another important part of the assumptions in the model is the amount of sales quantity Q with their corresponding prices p which is supposed to be derived from a carefully worked-out budget and business plan. The budget and the business plan may be based on past experience, the current situation and may be other factors that contribute to its formation and hence to its final result, but they are not directly relevant to this part of the model. However, it will be used to work out the revenue R that would be generated during the planning horizon. The revenue R is the product of the price p and the sales quantity Q written as $R = pQ$.

A similar notation to that used for capital goods is required here as the sales quantity would be classified into types like fresh fish as of type 1, frozen fish to cannery to be of type 2, by-catch saleable in the local market to be of type 3 and probably many more. Their corresponding prices would of course be different depending on the product and also in different years during the planning horizon. To accommodate these differences we use similar notations as applied to capital goods. There will be *k* types of sales quantities with the corresponding *k* different prices yielding k types of revenues generated from these different products in year *t*.

$$So\ let\ R_t^s = p_t^s Q_t^s\ \ be\ the\ Revenue, price\ and\ Sales\ quantity\ of\ type\ s\ at\ year\ t$$
$$where\ s = 1, 2, \dots, k\ \ and\ \ t = 0, 1, 2, \dots, n$$

From the same budget and business plan, the cost of operations will also be considered and properly categorised into the two main traditional categories, i.e.

variable costs V_t^C and fixed costs F_t^C at any year *t*. Other types of costs (if there are any) which do not belong to either one of the categories above can also be represented as a different category in the same form.

5.1.4 Others

The next part of the assumption is to assume certain percentages for the items below and for our purpose, the percentage sign (%) will be omitted for simplicity with the understanding that these items are percentages unless otherwise specified.

1. Debtors (accounts receivable) which will be $x\ \%$ of turnover (revenue)
2. Creditors (accounts payable) which will be $y\ \%$ of V_t^C at any year *t*.
3. Dividend which will be $z\ \%$ of profit at any year *t*.
4. Depreciation will depend on the type of capital goods with the following rates: $w_1\%\ for\ type\ 1,\quad w_2\ \%\ for\ type\ 2, \ldots, w_m\ \ for\ type\ m$.
5. The loan management fee will be $f\ \%\ of\ L$
6. Percentage contribution of equity to total investment will be $a\ \%\ of\ I$.
7. Income tax which will be $q\ \%\ of\ Taxable\ Profit\ (TaxP)_t$

5.1.5 Results

The main results that will be presented here are the net present value (NPV) and the internal rate of return (IRR) of both the total cash flow and the net cash flow. Mathematically, NPV and IRR are related by the formula:

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}\ \ and\ the\ IRR\ is\ exactly\ the\ value\ of\ r\ where\ NPV = 0$$

$$i.e\ NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} = 0\ when\ r = IRR\ (Internal\ Rate\ of\ Return)$$

$where\ t\ is\ years, r\ is\ the\ discount\ rate\ and\ CF_t\ is\ the\ cash\ flow\ at\ year\ t$.

In Microsoft Excel, the above formula is expressed and calculated with the following syntax:

For the Net Present Value we use =NPV(rate,value1,value2,...)

For the Internal Rate of Return we use =IRR(values,guess)

5.2 Investment and financing (J2)

There are basically three main components that will be highlighted in this model sheet J2. They are capital goods, depreciation and financing.

5.2.1 Capital goods

The *capital goods* (buildings, equipment etc.) component will be shown with their values as they depreciate over the years during the planning horizon. Now, with our notation developed above, we can record the depreciated values of every type of capital goods under the respective years of the planning horizon with the following array.

$$
\begin{array}{lllll}
Y_0 & Y_1 & Y_2 & \dots & Y_n \\
C_0^1 & C_1^1 = C_0^1(1 - w_1) & C_2^1 = C_0^1(1 - 2w_1) & \dots & C_n^1 = C_0^1(1 - nw_1) \\
C_0^2 & C_1^2 = C_0^2(1 - w_2) & C_2^2 = C_0^2(1 - 2w_2) & \dots & C_n^2 = C_0^2(1 - nw_2) \\
\dots & \dots & \dots & \dots & \dots \\
C_0^m & C_1^m = C_0^m(1 - w_m) & C_2^m = C_0^m(1 - 2w_m) & \dots & C_n^m = C_0^m(1 - nw_m)
\end{array}
$$

An entry on the above array would represent the booked value of any type of capital goods in any year. In general, the booked value for capital goods of type *j* in year *t* is $C_t^j = C_0^j(1 - tw_j)$. This is the general term on any entry on the above array of numbers where $j = 1, 2, \dots, m$ and $t = 0, 1, \dots, n$.

Another point to consider related to the booked values is that we don't allow it to be zero or negative in this model. It is anticipated that if there is a point in time where the booked value is less than or equal to the amount of depreciation then we take the last positive booked value to be the booked value of that capital goods for the rest of the planning horizon. This will be explained in detail later when depreciation is worked out.

The total booked values for all capital goods at any one year is the sum of any column of the above array, say on the t^{th} *year* the total booked values is:

$$
\begin{aligned}
\sum_{j=1}^{m} C_t^j &= C_t^1 + C_t^2 + \dots + C_t^m \\
&= C_0^1(1 - tw_1) + C_0^2(1 - tw_2) + \dots + C_0^m(1 - tw_m) \\
&= \sum_{j=1}^{m} C_0^j (1 - tw_j)
\end{aligned}
$$

5.2.2 Depreciation

The depreciation component simply shows the calculated value of depreciation of each item under the capital goods component for every year at the rate assumed in model sheet no. J1. These values are then subtracted from each of the capital goods items to obtain the booked values which are already built into the above formula. What we need in this part is to work out the depreciation component for each type of capital goods with their corresponding totals for any year *t*. It is also common practice in business (and will be shown in this model) that the depreciation of any asset is only realised at the end of the first period of its life-time or the beginning of the second period and similarly to the years that will follow. So at Y_0 the value of depreciation for any of C_0^j is zero until at the end of Y_0 or the beginning of Y_1 that its depreciation value is realised as $w_j C_0^j$ and recorded on Y_1. This amount is a constant throughout the planning horizon (i.e. it does not depend on *t*) which linearly reduces the booked value.

The successive subtraction of the depreciation amount would eventually come to an end when the value of the capital goods reduces to zero and therefore cannot depreciate anymore. The question is when will this happen?

To determine when the value of the capital goods is equal to zero under the influence of depreciation, we reason as follows: after *t* years, we have successively subtracted an amount of $tw_j C_0^j$ from the original value C_0^j. The result of these successive subtractions is that the difference between them becomes less and less. To avoid having a negative booked value, the difference must effectively be non-negative, i.e. it must be either equal to or greater than zero after *t* years. That is:

$$C_0^j - tw_j C_0^j \geq 0 \quad or \quad C_0^j(1 - tw_j) \geq 0. Solving\ for\ t\ we\ get\ t \leq \frac{1}{w_j}$$

which means that the booked value is non-negative when $t \leq \frac{1}{w_j}$. This value of *t* is usually a rational number and since we measure *t* in years, an integer value is much more preferable. The need to round up or round down to the nearest integer significantly brings out the connection between the two quantities that we are calculating. Both booked value approaching zero and ending the subtraction of depreciation value happens almost simultaneously. In the Jensson Model this is best described using the ceiling and floor functions as a means of rounding up or down to the nearest integer value as described below. Therefore, the booked value will be recorded as $C_t^j\ when\ t \geq \left\lfloor \frac{1}{w_j} \right\rfloor$ to avoid negative values and depreciation $w_j C_0^j$ to be recorded as zero at Y_0 and also when $t \geq \left\lceil \frac{1}{w_j} \right\rceil$. The pattern runs as follows:

$Y_0,$	$Y_1,$	Y_2 ,	...	Y_t ,	.....	etc
$C_0^j,$	$C_1^j,$	$C_2^j,$	...	$C_t^j = C_t^j\ when\ t \geq \left\lfloor \frac{1}{w_j} \right\rfloor$		
0	$w_j C_0^j,$	$w_j C_0^j,$	...	$w_j C_0^j = 0\ when\ t \geq \left\lceil \frac{1}{w_j} \right\rceil$		

The concept of depreciation, as explained above, is what will be used in the Jensson Model. In real life, assets usually do not depreciate to zero but to some value called the "scrap value" which is a value less than its original value but greater than zero. The Jensson Model also allows this extra extension if required.

The total depreciation of all types of capital goods at any one year is the sum of the depreciation amount of every type of capital goods for that year. On the hand the total depreciation for just one type of capital good during the whole planning horizon is slightly different and both of them are given below.

$$Tot.Dep. = \sum_{j=1}^{m} w_j C_0^j\,, \qquad for\ all\ types\ in\ one\ year$$

$$Tot.Dep. = \left(\left\lceil \frac{1}{w_j} \right\rceil - 1\right) w_j C_0^j\,, \qquad for\ one\ type\ in\ all\ years$$

5.2.3 Financing

The financing component highlights the main sources of funds which are equity and bank loan and their respective percentage contributions to the total investment. It is calculated accordingly as shown in J1 as:

$$E = aI\ and\ L = (1-a)I\ where\ I\ is\ the\ total\ investment\ i.e.$$

$$I = E + L\ and\ \ a\ is\ the\ percentage\ contributed\ by\ Equity.$$

Bank loan, on the other hand, as the other source of funds needs detailed explanation as it consists of three main important items, i.e. the principal amount which must be paid back on a regular basis, the interests on loan which must also be paid on a regular basis and the loan management fee. The other part of financing presented here is how the repayment of the loan on a fixed period of $t_*\ years$ is calculated, the method and schedule for repayments of principal, interests and the loan management fee.

The principal amount is recorded under Y_0 and the first year Y_1 of operation is usually assumed to be a grace period offered by the lender where interest is the only amount to be paid and the payback of the loan actually starts on Y_2 until the end of the payback period. The annual amount of payback is $\frac{L}{t_*}\ dollars$ and is evenly spread out over the payback period. A summary of repayment of the principal amount together with interests and loan management fees is as follows:

The principal amount L will decrease during the planning horizon by successively subtracting the annual payback amount which is $\frac{L}{t_*}\ dollars$ until the loan is fully paid. Let us look at how the principal amount decreases.

Y_0	Y_1	Y_2	...	Y_t	...	Y_n
L	$L\left(\frac{t_* - 0}{t_*}\right)$	$L\left(\frac{t_* - 1}{t_*}\right)$	...	$L\left(\frac{t_* - (t-1)}{t_*}\right)$	...	

The principal amount $L \text{ on } Y_0$ is still the same on Y_1 as the payback of loans will not start until Y_2. This is because Y_1 was a grace period and the payback did not start until the second year of operation but the formula for the year Y_1 (same with Y_0) is placed in position to assist the reader in following the pattern. The principal amount will be equal to zero (i.e. principal is fully paid) when:

$$L\left(\frac{t_* - (t-1)}{t_*}\right) = 0 \text{ and it can only happen if } t - 1 = t_* \text{ or } t = t_* + 1.$$

Suppose

$$t = t_1* \quad \text{then } L((t_\downarrow * -(t-1))/t_1* \quad) = L((t_1 * -(t_1 * -1))/t_1* \quad) = L((t_1 * - t_1 * +1))/t_1 * \quad) = L(1/t$$

Implying that the last repayment amount is due, and in the following year $t = t_* + 1$ the principal amount as said above should be zero. Going beyond this point in time the Jensson Model will yield a negative value which is in this context usually neglected as it is meaningless in our interpretation of repayment of loans. From the above analysis the principal amount will be fully paid by the end of year $t = t_* + 1$ except of course the loan interest which is taken as a separate item. The most important observation regarding the loan interest at this point is that its value will be zero after year $t = t_* + 1$ since the principal would have been fully paid by then and therefore no interest will be incurred.

The interests for any year Y_t is now easily obtained by multiplying the principal amount of the previous year by the interest rate *i*. The amount of interest due at the end of year Y_t *is* the quantity.

$$iL\left(\frac{t_* - (t-2)}{t_*}\right) \quad 2 \leq t \leq t_* + 1. \text{Note that } t = 0 \text{ and } t = 1 \text{ is self explanatory.}$$

The loan management fee $LMF = fL$ which is the other part of the financial costs is to be fully paid at the beginning, i.e. at Y_0 when the loan was processed, then $LMF = 0$ for the rest of the planning horizon.

5.3 Operations statement (J3)

The purpose of the operations statement is to record the revenues that can be generated from the sales quantity and their respective prices with the aim of achieving a net profit or net loss after costs, taxes etc. are deducted. The sales quantity and their respective prices together with cost of operations and income tax rate originate from model sheet J1 which was part of the assumptions.

5.3.1 Revenue

The revenue, price and sales quantity for the respective years are recorded accordingly as $R_t^s = p_t^s Q_t^s \quad for\ t = 1, 2, \dots, n\ and\ for\ s = 1, 2, \dots, k$ under the respective years of the planning horizon.

Y_0	Y_1	Y_2	...	Y_n
$R_0^1 = p_0^1 Q_0^1$	$R_1^1 = p_1^1 Q_1^1$	$R_2^1 = p_2^1 Q_2^1$	...	$R_n^1 = p_n^1 Q_n^1$
$R_0^2 = p_0^2 Q_0^2$	$R_1^2 = p_1^2 Q_1^2$	$R_2^2 = p_2^2 Q_2^2$	...	$R_n^2 = p_n^2 Q_n^2$
...	...	...	...	...
$R_0^k = p_0^k Q_0^k$	$R_1^k = p_1^k Q_1^k$	$R_2^k = p_2^k Q_2^k$		
$R_n^k = p_n^k Q_n^k$				

The sum of the revenues for all types of sales quantities with their respective prices at any particular year will be the sum of the columns of the above array for revenues. In general, the total revenues for any year *t* is:

$$(Tot.Rev)_k = R_t^1 + R_t^2 + \dots + R_t^k = \sum_{s=1}^{k} R_t^s = \sum_{s=1}^{k} p_t^s Q_t^s$$

On the above array, the revenues for Y_0 are supposed to be zero since no sales quantity has been produced, i.e. $Q_0^s = 0\ for\ any\ s$ which is why R_0^s is not included in the above summands but it is included in the array as an aid for understanding of the general pattern.

On the other hand the total revenues obtained for one type of sales quantity, say the $s^{th}\ type$ for the whole planning horizon is:

$$(Tot.Rev)_n = R_1^s + R_2^s + \dots + R_n^s = \sum_{t=0}^{n} R_t^s = \sum_{t=0}^{n} p_t^s Q_t^s$$

which is the sum of any row of the array for revenues above. With similar reason as above, R_0^s is omitted from the above formula. We also note that the two summands for revenues presented above differ as the former $(Tot.Rev)_k$ sums up the revenues generated from all *k* different types of sales quantity in just one year, whereas the latter $(Tot.Rev)_n$ sums up the revenues of one type of sales quantity for all the *n* years of the planning horizon.

5.3.2 Net profit contribution

The net profit contribution $(NPC)_t$ can be obtained by subtracting the variable costs from the revenues at any year *t*, i.e. the total revenues when summing up a column of the array for revenues.

$$(NPC)_t = (Tot.Rev)_k - V_t^C = \left(\sum_{s=1}^{k} R_t^s\right) - V_t^C$$

Note that when net profit contribution is required, we use the formula for the total revenues when columns are added.

5.3.3 Operating surplus (EBITDA)

The next important component in this model sheet is the operating surplus commonly known as the EBITDA. This will be the basis for the cash flow sheet that will be developed in the next section. The EBITDA for any year *t* is given by the formula below where fixed costs and diverse taxes are subtracted from the net profit contribution.

$$(EBITDA)_t = (NPC)_t - [F_t^C + (DTax)_t]\text{, but since } (DTax)_t = 0$$

$$(EBITDA)_t = (NPC)_t - F_t^C = \left(\sum_{s=1}^{k} R_t^s\right) - [V_t^C - F_t^C]$$

Since net profit contribution was already derived then with the method of substitution, we can always express new quantities like EBITDA in terms of the old ones already derived thereby giving us a new way of looking at a problem or a formula. In the Jensson Model, diverse taxes were assumed to be zero throughout the planning horizon. In that case we are able to see that EBITDA is the contribution from operation after the variable and fixed costs are deducted. The same applies to any other formula that has been correctly derived either from assumptions or from any previously calculated result.

5.3.4 Operating gain or loss (EBIT)

The next quantity to consider is the operating gain or loss commonly known as the EBIT. The EBIT is obtained by subtracting depreciation (for all types in any one year) from the EBITDA.

$$(EBIT)_t = (EBITDA)_t - \sum_{j=1}^{m} w_j C_0^j = \left(\sum_{s=1}^{k} R_t^s\right) - [V_t^C - F_t^C] - \sum_{j=1}^{m} w_j C_0^j$$

From the above, depreciation, the non cash revenues, have been subtracted. Financial costs and income tax are the next items to be deducted so that profit can be obtained.

5.3.5 Profit before tax

The next two important items to consider are the profit before tax P_{BTAX} and the profit after tax P_{ATAX}. The profit before tax is obtained by subtracting the financial costs (LMF and interests paid on loan) from the EBIT i.e.:

$$[\![(P]\!]_{BTAX})_t = (EBIT)_t - \ (interests\ on\ Loan + LMF)$$

The interests on the principal amount of the loan in any year Y_t is the interest rate *i* multiplied by the principal of the previous year Y_{t-1}. The LMF as calculated before is fL and the profit before tax is:

$$[\![(P]\!]_{BTAX})_t = (EBIT)_t - iL\left(\frac{t_* - (t-2)}{t_*}\right) - LMF, \qquad 2 \leq t \leq t_* + 1$$

$$where\ LMF = \begin{cases} fL, & for\ \ t = 0 \\ 0, & t = 1,2, \dots .. \end{cases}$$

5.3.6 Loss transfer and taxable profit

In order to work out the "profit after tax" the tax calculation must be done first and then subtracted from the above amount before claiming that we have a "profit after tax". The problem is to determine which income is taxable and at what time. Tax laws and regulations in most countries allow companies which have been operating at a loss to transfer the losses of the current year and add them on to "the profit before tax" of the following year. In that way, companies can defer payment of taxes until they operate profitably and above all is that the loss of the current year when transferred will significantly reduce the taxable income of the following year. The Jensson Model also takes this consideration into account. The following procedures determine the income which is taxable.

Financial costs are considered as a loss at the beginning of Y_0 when the loan was processed at a time when there were no revenues generated, since operation effectively started in Y_1. This loss (usually a negative number) is transferred and added to the profit before tax of the following year Y_1. This process of adding the "loss" of the previous year to the "profit before tax" of the next year is successively applied for future consecutive years. If this sum results in a positive amount, it means that there is no loss to be transferred to the following year, and so:

$$(LT)_t = 0\ where\ LT\ stands\ for\ Loss\ Transfer.$$

If the sum turns out to be less than zero (interpreted as a loss), then we carry that result (negative number) forward and add it to the profit before tax $[\![(P]\!]_{BTAX})$ of the following year. So the choices for loss transfer in the Jensson Model is either zero when the sum is positive or the negative number itself if the sum is negative. So the loss transfer amount is the minimum value of the two choices above. Mathematically, this is expressed as:

$$(\mathrm{LT})_t = \min[0, (LT)_{t-1} + (P_{BTAX})_t]$$

With the same line of reasoning, the taxable profit $(Taxable\ P)_t$ requires that the sum should be positive (implying no loss to be transferred) so that tax can be charged. If the sum is zero or negative (implying a loss), we will have to do the transfer as explained above. Hence taxable profit is obtained by taking the maximum value of the above choices using the formula:

$$(\textbf{Taxable P})_t = \max[\mathbf{0}, (LT)_{t-1} + (P_{BTAX})_t]$$

Note that "loss transfer" and "taxable profit" take the minimum and maximum values of the same formula respectively. The number zero in the argument of the formula serves as a bench mark which determines a loss transfer if less than zero or taxable profit to be taken if greater than zero.

5.3.7 Income tax

The income tax $(Inc\ Tax)_t$ can now be easily obtained by multiplying the "taxable profit" with the rate assumed in J1 which is $q\ \%\ of\ (Taxable\ P)_t$ i.e.:

$$(Inc\ Tax)_t = q(\textbf{Taxable P})_t$$

$$= q\max[0, (LT)_{t-1} + (P_{BTAX})_t]\, q \max[0, (LT)_{t-1} + (P_{BTAX})_t]$$

$$= q \max[0, (P_{BTAX})_t] = q(P_{BTAX})_t \qquad since\ (LT)_{t-1} = 0$$

$$\therefore\ (Inc\ Tax)_t = q(P_{BTAX})_t$$

5.3.8 Profit after tax

Since income tax is now determined using the above formula, we are now in a position to work out the profit after tax. The "profit after tax" is determined by subtracting "income tax", which is to be paid to the government, from the "profit before tax", i.e.:

$$(P_{ATAX})_t = (P_{BTAX})_t - (Inc\ Tax)_t$$

$$= (P_{BTAX})_t - q(P_{BTAX})_t$$

$$= (P_{BTAX})_t\ (1 - q)\ where\ q\ is\ the\ income\ tax\ rate$$

5.3.9 Dividend

The next quantity to be determined is the dividend that the company must pay to the shareholders. This quantity (as a cost to the company) is like income tax above, which is payable, only when there is a profit earned by the company, after all expenses are being deducted from the revenues. The payment of dividend therefore depends on the "profit after tax" whether it is positive or negative. It will be seen later that the "profit and loss balance" as it appears on the balance sheet is large enough to accommodate such payments. If the "profit after tax" is positive, then the company pays the dividend to the stakeholders using the rate assumed in J1, which is $z\,\%\,of\ \llbracket(P\rrbracket_{ATAX})_t\ or\ simply\ z\llbracket(P\rrbracket_{ATAX})_t$. If a negative value is obtained, then payment of dividend will be deferred until a positive contribution is achieved. Therefore, the dividend is the maximum value of the two choices above. The dividend to be paid to the stakeholders is:

$$Div_t = \max\left[\,0\,, z\llbracket(P\rrbracket_{ATAX}\,)_t\right] = z\llbracket(P\rrbracket_{ATAX}\,)_t$$

5.3.10 Net profit/loss

The last quantity to be determined in this Model sheet is the net profit or net loss which is obtained by subtracting the dividend paid to the shareholders from the profit after tax. A net profit P_{NET} is achieved if the difference between the two quantities is greater than zero and a net loss L_{NET} if the difference is less than zero.

$$P_{NET}\frac{\square}{\square}L_{NET} = \llbracket(P\rrbracket_{ATAX})_t - Div_t = \llbracket(P\rrbracket_{ATAX})_t - z\llbracket(P\rrbracket_{ATAX}\,)_t = (1-z)\llbracket(P\rrbracket_{ATAX}\,)_t$$

$$But\ since\ \llbracket(P\rrbracket_{ATAX})_t = (1-q)(P_{BTAX})_t$$

$$\therefore\ P_{NET}\frac{\square}{\square}L_{NET} = (1-q)(1-z)\llbracket(P\rrbracket_{BTAX}\,)_t$$

The other option to consider is when the difference is equal to zero, i.e. $\llbracket(P\rrbracket_{ATAX})_t - Div_t = 0$, then neither P_{NET} nor L_{NET} is realised.

5.4 Cash flow (J4)

The cash flow sheet is required by the Jensson Model primarily to show the cash movement and above all to be used as a tool for measuring profitability (to be explained later). The cash flow sheet will start with the operating surplus (EBITDA) and this will be the basis for almost all the calculations on the cash flow sheet. EBITDA, as has been shown before, is the final result when all operational costs are deducted from revenues. Other costs which are not directly related to operation, but merely as company obligations such as tax and repayment of loans, interest and other financial costs will be shown here and how they affect the cash flow. We will start with the "cash flow before tax."

5.4.1 Cash flow before tax

The cash flow before tax at any year *t* denoted by $\llbracket (CF \rrbracket_{BTAX})_t$ is an attempt to look at the movement of cash within the company without the influence of tax. The only new quantities involved apart from the EBITDA are the changes in accounts receivables (debtor's changes), the changes in accounts payable (creditors' changes) and the inventory. Notations for these new quantities are also presented below as they appear on the equation.

$$\llbracket (CF \rrbracket_{BTAX})_t = (EBITDA)_t - \Delta DR_t + \Delta CR_t - (INVENT)_t$$

$$\Delta DR_t \, is\ the\ changes\ in\ the\ Accounts\ Receivable, i.e. \quad \Delta DR_t = DR_t - DR_{t-1}$$

$$and\ \Delta CR_t \, is\ the\ changes\ in\ the\ Accounts\ Payable, i.e. \quad \Delta CR_t = CR_t - CR_{t-1}$$

The inventory build-up is denoted by $(INVENT)_t$

On the Jensson Model, ΔDR_t *and* ΔCR_t cannot be determined at this stage until the balance sheet is prepared. This is because both items belong to the balance sheet with ΔDR_t as an asset item and ΔCR_t as a liability item. Furthermore, they represent cash moving in and out of the company which in that nature, should also be reflected on the cash flow sheet. Once they are recorded on the balance sheet, then they would be transferred back to this cash flow sheet.

The inventory build-up as it appears on the Jensson Model is the amount of goods in stock to be on sale or equipment/spare parts to be used in production etc. In both cases, inventory is an asset item to the company and its value is recorded on the cash flow sheet only once in the first year of operation. It will be shown later on the balance sheet that inventory build-up is recorded at every year of the planning horizon since its value in the current year must be transferred to be the opening balance for the following year.

5.4.2 Cash flow after tax

The cash flow after tax $\llbracket (CF \rrbracket_{ATAX})_t$ in any year *t* is calculated by subtracting the income tax from $\llbracket (CF \rrbracket_{BTAX})_t$, the "cash flow before tax". Income tax has been determined in the operation sheet J2 as:

$$(Inc\ Tax)_t = q \max[0, (LT)_{t-1} + (P_{BTAX})_t] = q(P_{BTAX})_t$$

Therefore $\llbracket (CF \rrbracket_{ATAX})_t = \llbracket (CF \rrbracket_{BTAX})_t - (Inc\ Tax)_t$

$$= \llbracket (CF \rrbracket_{BTAX})_t - q(P_{BTAX})_t$$

Such an equation would be useful for interpretations later especially when and why income tax is zero. It is also interesting to see that both cash flows, before and after tax, are the same quantities without income tax.

5.4.3 Net (free) cash flow

The net cash flow which will be denoted by $〚(CF〛_{NET})_t$ in the Jensson Model is obtained by subtracting the financial costs (LMF and interest) and the repayment of loan from the "cash flow after tax". On previous sheets of the model, the LMF was paid in full at the beginning Y_0. Repayment of loan was exempted on the first year as it was a grace period and full payback of the loan that commences in the second year of operation until it was fully paid at $t = t_* + 1$. Similarly, interest was paid in the first year of operation until it was fully paid at the same time as loan repayment above. We will consider the case when $t \geq 2$ for the following reasons.

At
$t = 0, \quad the\ LMF\ was\ paid. At\ t = 1, only\ the\ interest\ on\ the\ loan\ was\ paid.$
It was not until the second year of operation that the payback of loan and interest without LMF actually started. The calculation of net cash flow is as follows:

$$〚(CF〛_{NET})_t = 〚(CF〛_{ATAX})_t - (Loan\ Repayment)_t - (Financial\ Cost)_t$$

where the financial costs consist of the interest only because LMF is zero at $t \geq 2$, and:

$$〚(CF〛_{NET})_t = 〚(CF〛_{ATAX})_t - \frac{L}{t_*} - iL\left(\frac{t_* - (t-2)}{t_*}\right)$$

$$〚= (CF〛_{ATAX})_t - \frac{L}{t_*}(1 + it_* - it + 2i)$$

$$〚= (CF〛_{ATAX})_t - \frac{L}{t_*}((2i + 1) + i(t_* - t))$$

5.4.4 Cash movement

The cash movement at year *t* denoted by CM_t, is the last component of the cash flow sheet. Its annual cumulative total will form the cash account to be entered later into the balance sheet. The working capital W which was assumed in MS1 will be added to the net cash flow $〚(CF〛_{NET})_t$ only at Y_0 since it was introduce only at the beginning to start up the business. There was no injection of any other type of working capital in later years as the company is assumed to be self sustainable with the given amount of working capital right from the start of operation. The only other part that must be subtracted is the dividend that we pay to the stakeholders. The cash movement is:

$$CM_t = 〚(CF〛_{NET})_t + W - Div_t = 〚(CF〛_{NET})_t - Div_t\ for\ t \geq 1$$

5.5 Balance sheet (J5)

The balance sheet as presented in the Jensson Model consists of three components. These components are assets, debts and capital which eventually will balance out according to the accounting equation $Asset = Debts + Capital$ if all entries are correctly calculated.

5.5.1 Assets

Assets are recorded according to normal accounting practices as current and fixed assets. The current assets are comprised of the cash account, debtors or receivables and the inventory. Fixed assets are all the types of capital goods that were part of the initial outlay. They will be shown on this model sheet as they depreciate during the planning horizon. These values are the booked values of each of the capital goods in the respective years where they belong. Both types of assets will be added together to obtain the total assets that the company owns. As has been said earlier, the cash account is the cumulative total of the cash movement as recorded on the cash flow sheet J4. In J4, the cash movement at year *t* was CM_t. The cash account will be denoted by CA_t and is the sum of all cash movement from year zero up to year *t*, i.e.:

$$CA_t = \sum_{j=0}^{t} CM_j = CM_0 + CM_1 + CM_2 + \cdots + CM_t$$

The debtors was:

$x\ \%\ of\ Revenue\ for\ all\ types\ of\ Sales\ Quantity\ in\ any\ year\ t.$

$$DR_t = x \sum_{s=1}^{k} R_t^s = \sum_{s=1}^{k} xR_t^s$$

The inventory as assumed at MS1 is maintained at a certain level and is a constant throughout the planning horizon. So inventory is denoted by $(Invent)_t$ and our fixed assets would be the total booked values for all types of capital goods at any year t which is:

$$Total\ Booked\ Values = \sum_{j=1}^{m} C_0^j\,(1 - tw_j)$$

Therefore total assets = current assets + fixed assets, or:

$$\begin{aligned} Total\ Assets &= CA_t + DR_t + (Invent)_t + \sum_{j=1}^{m} C_0^j\,(1 - tw_j) \\ &= \sum_{j=0}^{t} CM_j + \sum_{s=1}^{k} xR_t^s + \left[\sum_{j=1}^{m} C_0^j\,(1 - tw_j)\right] + (Invent)_t \end{aligned}$$

5.5.2 Debts

Debts or liabilities will be the sum of the current and long term liabilities. The current liabilities are dividend, income tax, creditors and the loan repayments for the following year. Each and every one of them has been calculated before and we only need to add them up in this part of the Jensson Model.

Dividend

$$Div_t = z[\![(P]\!]_{ATAX})_t = z\left([\![(P]\!]_{BTAX})_t(1-q)\right) = z(1-q)[\![(P]\!]_{BTAX})_t$$

Income tax $\quad (Inc\ Tax)_t = q(P_{BTAX})_t$

Creditors $CR_t = yV_t^C$

Loan repayment $L\left(\frac{t_* - (t+1)}{t_*}\right)$, and the total debts is

$$T.D = z(1-q)[\![(P]\!]_{BTAX})_t + q(P_{BTAX})_t + yV_t^C + L\left(\frac{t_* - (t+1)}{t_*}\right)$$

$$= [z(1-q) + q][\![(P]\!]_{BTAX})_t + yV_t^C + L\left(\frac{t_* - (t+1)}{t_*}\right)$$

5.5.3 Capital

The two components that make up the capital are the "equity" and the "profit and loss balance". The latter is the cumulative total of the net profit or net loss which has been recorded on the cash flow sheet MS4. Therefore, the total capital is:

$$Tot\ Capital = E + Profit\ and\ Loss\ Balance = E + \sum_{j=0}^{t}(1-q)(1-z)[\![(P]\!]_{BTAX})_j$$

5.6 Source and allocation of funds (J6)

The source and allocation of funds is an optional sheet in the Jensson Model and may be used as a supplement to the cash flow sheet presented earlier in J4. The main components of this sheet are the sources or how/where the funds were acquired, the second deal with how the funds were allocated and the last part is simply to show the changes that result.

5.6.1 Sources of funds

There are two main sources and they are funds acquired from operation and the other is the drawdown of equity and loan from the bank. The former comes from profit before tax and depreciation, $[\![(P]\!]_{BTAX})_t$ and $\sum_{j=1}^{m} w_j\, C_0^j$ and the latter comes from the drawdown of loan and equity. The profit before tax is the net revenue from operation after all direct operation costs have been deducted.

$$Funds\ from\ Operation = [\![(P]\!]_{BTAX})_t + \sum_{j=1}^{m} w_j\, C_0^j \quad Loan\ and\ Equity\ is\ I = E + L$$

$$Tot.Funds\ to\ be\ allocated = I + [\![(P]\!]_{BTAX})_t + \sum_{j=1}^{m} w_j\, C_0^j$$

5.6.2 Allocation of funds

The total funds that were available to be allocated are as shown in 4.6.1 above. How they were allocated is as follows. The first part is the amount that was allocated for purchasing of capital goods as part of the initial outlay. This is the sum of all the m-types of capital goods at year zero Y_0 prior to commencement of operation. The second part was allocated for payment of company's obligations such as loan repayment, payment of taxes and the dividend to be paid to shareholders. The total allocation is therefore given by:

$$Tot.Allocation = \sum_{j=1}^{m} C_0^j + (Inc\ Tax)_t + \frac{L}{t_*} + Div_t$$

Income tax and dividend can be expressed in terms of profit before tax as derived earlier i.e.:

$$(Inc\ Tax)_t = q(P_{BTAX})_t\ and\ Div_t = z[\![(P]\!]_{ATAX})_t = z(1-q)[\![(P]\!]_{BTAX})_t$$

Therefore the total allocation of the funds can be expressed as:

$$Tot.Allocation = \sum_{j=1}^{m} C_0^j + q(P_{BTAX})_t + \frac{L}{t_*} + z(1-q)[\![(P]\!]_{BTAX})_t$$

$$= \sum_{j=1}^{m} C_0^j + \frac{L}{t_*} + [z(1-q)+q][(P]_{BTAX})_t$$

The change in the net current assets is the difference between total funds that were available and total allocation or how the funds were allocated, i.e.:

$$Tot.Funds - Tot.Allocation$$

$$= I + [(P]_{BTAX})_t + \sum_{j=1}^{m} w_j C_0^j - \sum_{j=1}^{m} C_0^j - \frac{L}{t_*} - [z(1-q)+q][(P]_{BTAX})_t$$

$$= I + \sum_{j=1}^{m} [[[C]_0^j (w_j] - 1)] + (1-q)(1-z)[(P]_{BTAX})_t - \frac{L}{t_*}$$

$$\textbf{Changes in Net Current Assets} \quad = I + \sum_{j=1}^{m} [[[C]_0^j (w_j] - 1)] + P_{NET} - \frac{L}{t_*}$$

$$\textbf{where} \ \ P_{NET} = (1-q)(1-z)[(P]_{BTAX})_t$$

5.6.3 Analysis of changes

The last part of this section is to show the changes that took place for each year of the planning horizon in relation to the allocation of the funds that were available to be used by the business. The Jensson Model takes this result to be exactly the same as that which was recorded in 4.6.2. The other point worth mentioning is that this is another way of looking at the net changes in the current assets as calculated above.

First is to look at the changes in the cash account. The change in the cash account is worked out to be the difference between the cash at the beginning of the year and the cash at the end of the year. It is also important to note that with any accounting system, the point in time defined as the end of the current year is precisely the same point in time defined as the beginning of the following year.

The cash account at the beginning and end of the year was accounted for on the balance sheet and we have to transfer those entries over to this sheet J6 of the Jensson Model. This will be recorded as the total changes in the cash account.

$$Total\ Changes\ in\ Cash\ Account = CA_{t+1} - CA_t\ for\ any\ year\ t.$$

Note that $at\ Y_0\ i.e.at\ t = 0,$

$we\ have\ \ CA_1 - CA_0\ \ where\ CA_1\ represent\ end\ of\ Y_0\ and\ beginning\ of\ Y_1$

5.6.4 Total debtor's changes and inventory movement

The change in the debtor's account was recorded on the cash flow sheet J4 as $\Delta DR_t = DR_t - DR_{t-1}$ and it was obtained from considering the changes that were entered into the balance sheet. Inventory movements or simply inventory was recorded only in the first year of operation and zero for the rest of the planning horizon. Therefore, the total changes in debtors and inventory is the sum of the above quantities i.e.:

$$\text{Tot. Debtor's Changes and Inventory} = \Delta DR_t + (INVENT)_t$$

$$Tot\ Changes\ in\ Curr.Assets = CA_{t+1} - CA_t + \Delta DR_t + (INVENT)_t$$

So the total changes in the cash account plus the changes in debtors and inventory would be recorded as the changes in the current assets. The only other component to be considered is the creditor's changes which will be subtracted from the total changes in current assets to get the net value. Therefore:

$$Changes\ in\ Net\ Curr.Assets = CA_{t+1} - CA_t + \Delta DR_t - \Delta CR_t + (INVENT)_t$$

5.7 Measurement of profitability and financial ratios (J7)

5.7.1 NPV and IIRR of total cash flow/net cash flow

The Jensson Model works out the profitability of the investment by considering two measures. The first is the NPV together with a discounting rate or factor chosen by the user which in the Jensson Model is represented by r%. The second measure is the IRR. Both measurements are applied to two types of cash flows:

1. Total capital $(I = E + L)$ invested and the cash flow after tax $(CF_{ATAX})_t$
2. Equity E and the net cash flow $(CF_{NET})_t$

The NPV for cash flows no. 1 and 2 will be calculated using the formula introduced in J1. The NPV for the first is:

$$NPV = \sum_{t=0}^{n} \frac{(CF_{ATAX})_t}{(1+r)^t} \quad where\ we\ take\ (CF_{ATAX})_0 = -I$$

and the NPV for the second Cash Flow is:

$$NPV = \sum_{t=0}^{n} \frac{(CF_{NET})_t}{(1+r)^t} \quad where\ we\ take\ (CF_{NET})_0 = -E$$

To find the NPV in Microsoft Excel the syntax is "$= NPV(r, value1, value2, \ldots)$

To find the IRR in Microsoft Excel the syntax is "$= IRR(values, guess)$"

The last point of interest regarding the NPV calculation in the Jensson Model is the range of values for the summation index t . In Excel, the initial value for the index t is 1 (by default) whereas in the Jensson Model, we require that the index t starts from zero as shown in the formula above. The Microsoft Excel formula that effect this change is $=(1+r)*NPV(r,value1,value2,\ldots)$.

5.7.2 Financial ratios

There are many ways in which an analyst can assess the performance of a company and even many different tools that he utilises for that purpose. One of the most indispensable theoretical tools is financial ratios. Financial ratios are easy to calculate as they are just simple fractions, but a very powerful and profound indicator of the nature of the business. For example, liquidity ratios measure the ability of a company to meet its obligations and profitability ratios measure how profitable the company was in the past few years.

Financial ratios can be used to assess the company's past performance in relation to other similar businesses or to the industry to which it belongs. It can also be used to identify its current problems, and suggest strategies of how to find solutions to its problems. There are many financial ratios with different purposes and how they are utilised and the methods vary slightly depending on the type of quantity that is measured and the type of business that it is applied to.

In the Jensson Model, only a few ratios would be highlighted and other ratios can be explored by the user if needs arise. The ratios and their respective formulas or how they were obtained are as follows:

1	Return on investment	$\frac{EBIT_t}{D_{t-1}+C_{t-1}}$
2	Return on equity	$\frac{(P_{ATAX})_t}{C_{t-1}}$
3	Turnover ratio no.1	$\frac{R_t}{D_{t-1}+C_{t-1}}$
4	Turnover ratio no.2	$\frac{C_t}{D_t+C_t}$
5	Net current ratio	$\frac{(A_{CURR})_t}{(L_{CURR})_t}$
6	Liquid current ratio	$\frac{(A_{CURR})_t-(INVENT)_t}{(L_{INT})_t}$
7	Internal value of shares	$\frac{C_t}{E_t}$
8	Debt service coverage	$\frac{(CF_{ATAX})_t}{(L_{INT})_t+(L_{REP})_t}$

5.7.3 Weighted average cost of capital (WACC)

Although not directly related to profitability measurements, the weighted average cost of capital is the minimum rate of return that is required to cover the total capital and its associated costs. It is also important to ensure that the costs of having capital available for investment are also covered together with the capital at the end of the life time of the business. In order to do this, we reason as follows. The two sources of capital are equity and bank loans. The cost of having a loan available for use is the interest rate charged on the loan and the cost of having the equity available for use is the IRR of equity. The loan being regarded as debt, the after tax rate is taken up as well to ensure that the after tax amount is used. In the Jensson Model, the weighted average cost of capital is worked out as follows:

$$WACC = \frac{E}{I}(IRR\ of\ Equity) + \frac{L}{I}(i)(1-q)$$

$$where\ I = E + L, \qquad where\ E\ is\ Equity\ and\ L\ is\ Loan$$

$$\frac{E}{I}\ and\ \frac{L}{I}\ are\ the\ percentages\ of\ Financing\ that\ is\ Equity\ and\ Loan\ resp.$$

6 APPLICATION OF THE JENSSON MODEL ON A TUNA LONG LINER

6.1 Revenue and cost budget

The revenue and cost budget for a tuna long liner was prepared using assumptions based on the following items:

The vessel, fishing operation and crew: The ideal size anticipated for a tuna long line vessel in Tonga is one which is capable of fishing for more than 15 days and less than 28 days. A vessel which can only fish for less than 15 days cannot target albacore (the most abundant tuna species). Those which can fish for more than 28 days are too expensive to operate. A long liner which is capable of fishing for the above period of time must at least have the following:

- A fuel tank capacity of 42,000 litres in which the daily fuel consumption rate for both the main and auxiliary engines is 1,500 litres. It also includes fuel allowance for emergency purposes.

- The number of fishing days per trip is 25 (22 fishing days and 3 steaming days to and from the fishing ground). The number of fishing days equals the number of sets of the main line (1 set/day)

- There will be 12 trips per year and the detail of breakdown of days is shown on the budget.

- The average number of hooks per set is 3,200 which amounts to 70,400 hooks per trip (22 days).

- The average Catch Per Unit Effort (CPUE), although slightly different according to fishing ground and fish species, is assumed in this budget to be 0.38 i.e. CPUE = 0.38 kg/hook (average for albacore).

- There will be 12 crew members on board including the captain who is also the master fisherman.

Revenue estimate: There are three types of markets under consideration with three different average prices. The market for fresh whole tuna (big eye and yellowfin) is Japan and the west coast of the United States and the average price is set at TOP$14.10/kg. The fish cannery at Pagopago (American Samoa) is the market for albacore and the average price is set at TOP$5.85/kg. The third market is the local market where most of the by catch is sold and the average price is set at TOP$5.60/kg. The volume of catch is worked out by multiplying the number of hooks per trip by the average CPUE. The total revenue therefore is obtained by multiplying the catch volume by the price depending on the market price for that product.

Cost budget: The first cost item is the variable costs which consist of those that directly depend on the volume of production. This includes the captain's remuneration, air freight charges, processing fees etc. The second cost item is fixed costs which are comprised of all other costs apart from the variable costs. This will include fuel, bait, administration, wages etc. The other component of the cost budget is the total investment (equipment only) which consists of the price of the fishing vessel, fishing gears, freezer truck and ice machines for producing ice. The other part of the investment (others) consists of setting up of onshore facilities and consultant fees.

Table 3: The main investment items consisting of capital goods and "others"

Main Investments/Capital Goods	
Equipments	
Vessel (Long Liner)	700,000
Fishing Gears on Board	70,000
Freezer Truck	25,000
Ice Machines	100,000
Total	**895,000**
Others	
Set up of Onshore Facilities	80,000
Consultant Fees	20,000
Total	**100,000**

Note: The currency assumed here is Tongan Pa'anga (TOP)

The table below is part of the assumptions from which the revenue and cost budget will be based. Since revenue depends on the volume of catch and price, volume will be determined by the *effort* which will be the number of hooks that can be deployed in one set. This will be multiplied by the number of sets in one trip which will in turn be used in forecasting of revenue.

The number of hooks for a set and hence a trip will also be used in estimating the amount of bait required for a trip.

Table 4: An estimated number of fishing days, sets and hooks

Fishing Days, No. of Sets & Hooks Deployed			
An estimate of the days for operation	**Days per Trip**	**Trips per Year**	**Days per Year**
Fishing	22	12	264
Steaming to/from Fishing Grounds	3	12	36
Loading and Unloading	2	12	24
Breakdowns/Life Saving Missions	1	12	12
Bad Weather	2	12	24
Annual Drydocking/Maintenance	0.42	12	5
Total	**30.42**		**365**
Number of Sets per Trip			22
Number of Hooks per Set			3,200
Number of Hooks per Trip			70,400
Captain and No. of Crews on Board			12

Table 5: The revenue and cost budget

Assumptions/Revenue & Cost Budget								
Average Price (TOP)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Fresh Fish-Export	13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70
Frozen Albacore	5.05	5.25	5.45	5.65	5.85	6.05	6.25	6.45
Local Maket	4.80	5.00	5.20	5.40	5.60	5.80	6.00	6.20
Volume of Catch (Kg)								
Fresh Fish-Export	35,897	30,716	28,477	25,907	30,814	29,300	26,534	28,068
Frozen Albacore	365,376	350,592	357,914	377,555	354,182	353,197	348,128	341,299
Local Maket	77,546	75,497	75,624	74,561	74,349	86,951	73,997	59,439
Annual Revenue	2,694,797	2,632,752	2,734,004	2,895,924	2,922,802	3,060,154	3,004,524	2,982,507
Variable Costs	428,982	389,886	377,207	368,906	391,503	382,402	361,188	367,889
Fixed Costs	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.2 Summary: assumptions and results (J1)

The first sheet of the Jensson Model highlights the main items which will be the main assumptions to be input into the model. It also includes the revenues and costs from the Revenue and Cost Budget prepared earlier. The other items on this sheet are the main results sought which are the NPV, IRR and the breakdown of costs. The weighted average cost of capital (WACC) and the minimum cash requirement are also shown. Presenting both assumptions and results on J1 enables the user to change various parameters of assumptions and automatically see the results on the same screen.

Investment and planning jorizon: The investment component consist of "capital equipment" which is a long line fishing vessel, fishing gears, ice machines and a freezer truck whose total value is $895,000. Under the title "others" we have the set up costs and consultation fees which amount to a total of $100,000. An amount was also set aside as working capital which was $180,000. All the items above make up the total investment component which is $1,175,000 and the economic lifetime of the business is set at eight years. The repayment of loans is to be completed within five years with the first year taken as a grace period offered by the bank.

Sources of finance: There are two sources of finance anticipated in this model. The first part (40%) comes from the shareholder's equity and the rest (60%) will be a loan from the bank. The loan is planned to be fully settled within five years together with interests and loan management fees. The revenues generated from operation are assumed to be re-invested into the business to ensure that there is no need for another injection of capital. The inventory build-up is assumed to be $50,000.

Percentage rates: The following quantities are to be calculated using the following rates.

- Debtors - 20% of the total sales (turnover)
- Creditors - 10% of variable costs
- Dividend – 12% of profit
- Loan Interest – 12.5% of loan principal amount
- Income Tax – 18% of taxable income
- Depreciation of equipment – 15% and depreciation of "others" – 10%

Revenues and costs: The revenues and costs as recorded in sheet J1 have been automatically generated from the revenue and cost budget that was prepared in the previous section. The sales quantity for each type of product per year is recorded in kilograms and the price for each type of product per year in dollars. Both the variable costs and the fixed costs are also tabulated in J1 for easy reference when comparison is required.

Weighted average cost of capital (WACC): The weighted average cost of capital is calculated using the following formula:

$$WACC = \frac{E}{I}(IRR\ of\ Equity) + \frac{L}{I}(i)(1-q)$$

$$= 40\%(39.63\%) + 60\%(12.5\%)(1-18\%) = 22\%$$

This is the minimum rate that would guarantee that the capital and its associated costs will be recovered at the end of the planning horizon. Any rate below 22% will result in a decrease in wealth for shareholders.

Table 6: A summary of the main assumptions and results (J1).

					ASSUMPTIONS AND RESULTS					
OPERATIONS			**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Sales Quantity	Fresh	100%	35,897	30,716	28,477	25,907	30,814	29,300	26,534	28,068
	Frozen	100%	365,376	350,592	357,914	377,555	354,182	353,197	348,128	341,299
	Local	100%	77,546	75,497	75,624	74,561	74,349	86,951	73,997	59,439
Sales Price	Fresh	100%	13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70
	Frozen	100%	5.05	5.25	5.45	5.65	5.85	6.05	6.25	6.45
	Local	100%	4.80	5.00	5.20	5.40	5.60	5.80	6.00	6.20
Variable Cost			428,982	389,886	377,207	368,906	391,503	382,402	361,188	367,889
Fixed Cost			1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867
WACC		22%		Equity		40%	470,000		**Tot Cap.**	**Equity**
Discount Rate (or MARR)		10%		Loan		60%	705,000	**NPV**	1,416,708	1,347,835
Planning Horizon		8	Years	Loan Int. & Repayment		12.50%	5 Years	**IRR**	30%	40%
Income Tax	18%			**Investment/Capital Goods**				**Breakdown of Costs**		
Debtors	20%		Min Cash Account			1,662	Variable Cost		3,067,963	14%
Creditors	10%		Inventory Build - up			50000	Fixed Cost		14,366,938	64%
Dividend	12%		Equipments		100%	895,000	Paid Taxes		617,709	3%
Loan Management Fee	2%		Others		100%	100,000	Financial Cost		366,600	2%
Depreciation (Eqpt)	15%		Total Cap Goods		100%	995,000	Loan Repayment		705,000	3%
Depreciation (Others)	10%		Working Capital			180,000	Paid Dividend		339,373	2%
			TOT Investment & Financing			**1,175,000**	Cash Account		3,034,171	13%

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.3 Investment and financing (J2)

The investment and financing sheet consists of three main items. The first one is capital goods and they are shown as they depreciate during the planning horizon. There are only two components of the capital goods used as an illustration (equipments and "others") but the Jensson Model allows this field to increase to include as many as the user would like.

The second part of this model sheet shows how depreciation is calculated using the rates assumed in (J1). The value of each capital item will depreciate to scrap value but not less than zero. In such a case it is important to note when the value of the capital item does not depreciate any more.

The last part of this model sheet shows how the project is financed which is taken to come from equity and a bank loan. A schedule for the repayment of loans plus interest is created and the loan management fee is also shown.

Table 7: Investment, depreciation and financing (J2)

						INVESTMENT					
Investment and Financing		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
		Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	
Investment (Capital Goods)											
Equipment		895,000	760,750	626,500	492,250	358,000	223,750	89,500	89,500	89,500	
Others		100,000	90,000	80,000	70,000	60,000	50,000	40,000	30,000	20,000	
Booked Value		**995,000**	**850,750**	**706,500**	**562,250**	**418,000**	**273,750**	**129,500**	**119,500**	**109,500**	
Depreciation											
Depreciation of Equipment	15%		134,250	134,250	134,250	134,250	134,250	134,250			**805,500**
Depreciation of Others	10%		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	**80,000**
Total Depreciation			**144,250**	**144,250**	**144,250**	**144,250**	**144,250**	**144,250**	**10,000**	**10,000**	**885,500**
Financing											
Total Investment + Working Capital		1,175,000									
Equity	40%	470,000									
Loans	60%	705,000									
Repayment	5		0	141,000	141,000	141,000	141,000	141,000	0	0	**705,000**
Principal		705,000	705,000	564,000	423,000	282,000	141,000	0	0	0	
Interest	12.50%		88,125	88,125	70,500	52,875	35,250	17,625	0	0	**352,500**
Loan Management Fee	2.00%	14,100									**14,100**

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.4 Operations statement (J3)

The operations statement is designed to keep track of how all the costs associated with the investment are deducted and eventually the appropriation of profit. First, the sales quantities and their respective prices are imported from J1 so that revenues can be available for each period. The variable cost is then deducted from revenues to obtain the net profit contribution (NPC) for each period.

EBITDA: The EBITDA is the operating surplus which is obtained by subtracting the fixed costs and diverse taxes from the NPC above. Diverse taxes are given the value zero but can be replaced with the appropriate values if there are any. The EBITDA will be the basis of all calculations to be done on the cash flow sheet in the next section.

EBIT: The EBIT is the operating gain or loss and is obtained by subtracting depreciation and inventory movement from the EBITDA. Note that inventory movement is zero throughout as there have been no movements recorded during each period.

Profit: The first profit is the "*profit before tax*" which is obtained by subtracting all the financial costs (loan interest and loan management fees) from the EBIT. The second type of profit is the "*profit after tax"* which is the result of subtracting the income tax (18% of taxable profit) from the "*profit before tax"* and finally the "*net profit or net loss"* which is obtained from subtracting the dividend from the "*profit after tax"*.

The only minor complication involved here is determining the *taxable profit* and *loss transfer* upon which the tax calculation is based. The operation statement below shows that during the year 2009 an expense item occurred as financial costs with an amount of $14,100. Since there were no revenues generated that year to offset this amount, it was recorded as a loss (shown as a negative value of *profit after tax*). This amount is regarded as a loss transfer in the sense that it is simply a *loss* for the period (2009) and will be transferred to the following period (2010) as part of the profit before tax. Since it was a loss, the taxable income is zero and tax cannot be charged. In 2010, the *profit before tax* $255,478 was reduced by the addition of the loss transfer of the previous period which was -$14,100 to $241,378, which is a positive amount and is taxable. The income tax rate of 18% is charge and the income tax payable is $43,448. This process is repeated for every year of the planning horizon. The other important point to note is that the loss transfer is zero after 2009 meaning that there was no loss to be transferred. In such cases, the taxable profit will always be the *profit after tax* amount as shown from 2011 onwards. The detail method for determining the taxable income and loss transfer has been covered in Chapter 4, Section 4.3.6 using the maximum and minimum functions.

Table 8: The operations statement (J3)

OPERATIONS											
Operations Statement		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
		Y_0	**Y_1**	**Y_2**	**Y_3**	**Y_4**	**Y_5**	**Y_6**	**Y_7**	**Y_8**	
Sales Quantity	Fresh		35,897	30,716	28,477	25,907	30,814	29,300	26,534	28,068	**235,713**
	Frozen		365,376	350,592	357,914	377,555	354,182	353,197	348,128	341,299	**2,848,243**
	Bycatch		77,546	75,497	75,624	74,561	74,349	86,951	73,997	59,439	**597,964**
Sales Price	Fresh		13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70	
	Frozen		5.05	5.25	5.45	5.65	5.85	6.05	6.25	6.45	
	Bycatch		4.80	5.00	5.20	5.40	5.60	5.80	6.00	6.20	
REVENUE			**2,694,797**	**2,632,752**	**2,734,004**	**2,895,924**	**2,922,802**	**3,060,154**	**3,004,524**	**2,982,507**	**22,927,465**
Variable Cost			428,982	389,886	377,207	368,906	391,503	382,402	361,188	367,889	**3,067,963**
Net Profit Contribution			**2,265,815**	**2,242,867**	**2,356,797**	**2,527,019**	**2,531,299**	**2,677,751**	**2,643,337**	**2,614,618**	**19,859,502**
Fixed Cost			1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	1,795,867	**14,366,938**
Diverse Taxes			0	0	0	0	0	0	0	0	**0**
Operating Surplus (EBITDA)			**469,948**	**447,000**	**560,930**	**731,152**	**735,432**	**881,884**	**847,469**	**818,750**	**5,492,565**
Inventory Movement											
Depreciation			144,250	144,250	144,250	144,250	144,250	144,250	10,000	10,000	**885,500**
Operating Gain/Loss (EBIT)			**325,698**	**302,750**	**416,680**	**586,902**	**591,182**	**737,634**	**837,469**	**808,750**	**4,607,065**
Financial Costs (Interest & LMF)		14,100	88,125	88,125	70,500	52,875	35,250	17,625	0	0	**352,500**
Profit before Tax		**-14,100**	**237,573**	**214,625**	**346,180**	**534,027**	**555,932**	**720,009**	**837,469**	**808,750**	**4,254,565**
Loss Transfer	0	-14,100	0	0	0	0	0	0	0	0	
Taxable Profit		0	223,473	214,625	346,180	534,027	555,932	720,009	837,469	808,750	**4,240,465**
Income Tax	18%	0	40,225	38,632	62,312	96,125	100,068	129,602	150,744	145,575	**763,284**
Profit after Tax		**-14,100**	**197,348**	**175,992**	**283,868**	**437,902**	**455,864**	**590,407**	**686,725**	**663,175**	**3,491,281**
Divident	12%	0	23,682	21,119	34,064	52,548	54,704	70,849	82,407	79,581	**418,954**
Net Profit/Loss		**-14,100**	**173,666**	**154,873**	**249,804**	**385,354**	**401,160**	**519,558**	**604,318**	**583,594**	**3,072,327**

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.5 Cash flow (J4)

The operating surplus (EBITDA) is imported from the statement of operation as the basis for the cash flow calculations. The main results expected from this cash flow sheet were to determine the cash movement during the planning horizon. To determine this result, we need to know the cash flow before tax, the cash flow after tax and the net cash flow (or free cash flow).

As can be seen from the cash flow sheet, the debtor's and creditor's changes are both required as they both represent changes in the cash flow but because they also belong to the balance sheet, they won't be available until the balance sheet is prepared. The Jensson Model keeps track of these changes as debtor/creditor of current year minus the debtor/creditor of the previous year. The cash flow before tax calculation is as follows:

Cash flow before tax = EBITDA – change in debtor + change in creditor – inventory. As shown in section 4.4.1, the formula is:

$$[\![(CF]\!]_{BTAX})_t = (EBITDA)_t - \Delta DR_t + \Delta CR_t - (INVENT)_t .$$

The next cash flow is to determine is the cash flow after tax. The income tax as worked out in the operation statement is imported into the cash flow sheet. This amount is then subtracted from the cash flow before tax to obtain the cash after tax. The calculation is cash flow after tax = cash flow before tax – income tax. This was also developed in section 4.4.1 as:

$$[\![(CF]\!]_{ATAX})_t = [\![(CF]\!]_{BTAX})_t - (Inc.Tax)_t$$

Now that we have subtracted the income tax from our cash flow, we need to subtract other company obligations which are the financial costs incurred and the repayment of loans. Once this is done, we then have a net cash flow for the company. The free cash flow is the important cash flow as it shows that the company is able to meet its obligation which are external to itself. The dividend is the only payment to be made which is regarded as internal to the company and can be put down on the cash flow sheet to get the complete picture of the cash movement for each period.

Table 9: The cash flow (J4)

CASH FLOW											
Cash Flow		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
		Y_0	**Y_1**	**Y_2**	**Y_3**	**Y_4**	**Y_5**	**Y_6**	**Y_7**	**Y_8**	
Operating Surplus (EBITDA)		0	469,948	447,000	560,930	731,152	735,432	881,884	847,469	818,750	5,492,565
Debtors Changes			538,959	-12,409	20,250	32,384	5,376	27,470	-11,126	-4,404	596,501
Creditor's Changes	10%		42,898	-3,910	-1,268	-830	2,260	-910	-2,121	670	36,789
Inventory Build up			50,000								50,000
Cash Flow before Tax		**0**	**-76,113**	**455,499**	**539,412**	**697,938**	**732,316**	**853,504**	**856,474**	**823,824**	**4,882,852**
Paid Taxes			0	40,225	38,632	62,312	96,125	100,068	129,602	150,744	617,709
Cash Flow after Tax			**-76,113**	**415,274**	**500,779**	**635,625**	**636,191**	**753,436**	**726,872**	**673,080**	**4,265,144**
Financial Cost (Interest + LMF)		14,100	88,125	88,125	70,500	52,875	35,250	17,625	0	0	366,600
Repayent of Loan		0	0	141,000	141,000	141,000	141,000	141,000	0	0	705,000
Net (Free) Cash Flow		**-14,100**	**-164,238**	**186,149**	**289,279**	**441,750**	**459,941**	**594,811**	**726,872**	**673,080**	**3,193,544**
Paid Dividend			0	23,682	21,119	34,064	52,548	54,704	70,849	82,407	339,373
Financing Expenditure (Working Capital)		180,000									
Cash Movement		**165,900**	**-164,238**	**162,467**	**268,160**	**407,686**	**407,393**	**540,107**	**656,023**	**590,673**	**3,034,171**

Note: The currency assumed here is Tongan Pa’anga (TOP)

6.6 Balance sheet (J5)

One of the strengths of the Jensson Model is its ability to develop a balance sheet to keep track of the changes that happen to a company’s assets, debts and capital which is usually regarded as a tedious task when performed manually.

As shown below, the balance sheet is almost self explanatory as there are only three main items which must satisfy the accounting equation. All the three items listed are tabulated separately with their corresponding totals and we note that assets = debts + capital, for every period of the planning horizon and hence for the whole lifetime of the investment.

The changes in debtors and creditors from the balance sheet will be transferred to the cash flow (J4) so that the cash flow sheet of the Jensson Model is always updated.

The check line, which must always be zero, is designed as a warning signal for the user if the above equation is not balanced. Any non-zero value which shows up on the check line indicates an imbalance on the accounting equation and therefore one has to check which of the entries in the model is incorrect.

Table 10: The balance sheet (J5)

BALANCE SHEET										
Balance Sheet		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
		Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
Assets										
Cash Account	0	165,900	1,662	164,129	432,289	839,975	1,247,368	1,787,475	2,443,499	3,034,171
Debtors (Accounts Receivables)	20%	0	538,959	526,550	546,801	579,185	584,560	612,031	600,905	596,501
Inventory	0	0	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Current Assets		**165,900**	**590,621**	**740,679**	**1,029,090**	**1,469,160**	**1,881,929**	**2,449,506**	**3,094,403**	**3,680,672**
Fixed Assets (Booked Values)		995,000	850,750	706,500	562,250	418,000	273,750	129,500	119,500	109,500
Total Assets		**1,160,900**	**1,441,371**	**1,447,179**	**1,591,340**	**1,887,160**	**2,155,679**	**2,579,006**	**3,213,903**	**3,790,172**
Debts										
Dividend Payable		0	23,682	21,119	34,064	52,548	54,704	70,849	82,407	79,581
Taxes Payable		0	40,225	38,632	62,312	96,125	100,068	129,602	150,744	145,575
Creditors (Accounts Payable)	10%	0	42,898	38,989	37,721	36,891	39,150	38,240	36,119	36,789
Next Year Repayment		0	141,000	141,000	141,000	141,000	141,000	0	0	
Current Liabilities (Short Term Debts)		**0**	**247,805**	**239,740**	**275,097**	**326,564**	**334,922**	**238,691**	**269,270**	**261,945**
Long Term Loans		705,000	564,000	423,000	282,000	141,000	0	0	0	
Total Debt		**705,000**	**811,805**	**662,740**	**557,097**	**467,564**	**334,922**	**238,691**	**269,270**	**261,945**
Capital										
Equity	0	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000	470,000
Profit and Loss Balance	0	-14,100	159,566	314,439	564,243	949,596	1,350,757	1,870,315	2,474,633	3,058,227
Total Capital		**455,900**	**629,566**	**784,439**	**1,034,243**	**1,419,596**	**1,820,757**	**2,340,315**	**2,944,633**	**3,528,227**
Debts + Capital		**1,160,900**	**1,441,371**	**1,447,179**	**1,591,340**	**1,887,160**	**2,155,679**	**2,579,006**	**3,213,903**	**3,790,172**
Check Line		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.7 Sources and allocation of funds (J6)

The sources and allocation sheet as shown below serves two purposes. The first is that it summarises where the funds came from, how they were allocated, the purpose for their utilisation and at the same time records the changes in the current assets that occur as a result of the allocation. The second purpose is that it also serves as a balance sheet that keeps track of the changes with a check line that serves the same purpose as in the balance sheet (J5).

Table 11: Source and allocation of funds (J6)

SOURCE AND ALLOCATION OF FUNDS										
Source and Allocation	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	
SOURCE OF FUNDS										
1. Funds from Operation										
Profit before Tax	-14,100	237,573	214,625	346,180	534,027	555,932	720,009	837,469	808,750	4,240,465
Depreciation	0	144,250	144,250	144,250	144,250	144,250	144,250	10,000	10,000	885,500
Total Funds from Operation	**-14,100**	**381,823**	**358,875**	**490,430**	**678,277**	**700,182**	**864,259**	**847,469**	**818,750**	**5,125,965**
2. Funds from Loan & Equity										
Loan Drawdown	705,000	0	0	0	0	0	0	0	0	705,000
Equity Drawdown	470,000	0	0	0	0	0	0	0	0	470,000
Total (Funds from Loan & Equity)	1,175,000	0	0	0	0	0	0	0	0	1,175,000
Total Funds from Loan and Equity	**1,160,900**	**381,823**	**358,875**	**490,430**	**678,277**	**700,182**	**864,259**	**847,469**	**818,750**	**6,300,965**
ALLOCATION OF FUNDS										
1. Investment	995,000									995,000
2. Repayment	0	0	141,000	141,000	141,000	141,000	141,000	0	0	705,000
3. Paid Taxes	0	0	40,225	38,632	62,312	96,125	100,068	129,602	150,744	617,709
4. Paid Dividend	0	0	23,682	21,119	34,064	52,548	54,704	70,849	82,407	339,373
Total Allocation	995,000	0	204,907	200,751	237,377	289,673	295,771	200,451	233,151	2,657,081
Changes in Net Current Assets	**165,900**	**381,823**	**153,968**	**289,679**	**440,900**	**410,509**	**568,488**	**647,019**	**585,599**	**3,643,884**
ANALYSIS OF CHANGES										
Current Assets										
Cash at start of year	0	165,900	1,662	164,129	432,289	839,975	1,247,368	1,787,475	2,443,499	7,082,297
Cash at end of year	165,900	1,662	164,129	432,289	839,975	1,247,368	1,787,475	2,443,499	3,034,171	10,116,468
Total Changes in Cash	**165,900**	**-164,238**	**162,467**	**268,160**	**407,686**	**407,393**	**540,107**	**656,023**	**590,673**	**3,034,171**
Debtor changes	0	538,959	-12,409	20,250	32,384	5,376	27,470	-11,126	-4,404	**596,501**
Inventory Movements	0	50,000	0	0	0	0	0	0	0	**50,000**
Total-Debtor's Changes and Inventory	0	588,959	-12,409	20,250	32,384	5,376	27,470	-11,126	-4,404	646,501
Changes in Net Current Assets	**165,900**	**424,721**	**150,058**	**288,411**	**440,070**	**412,769**	**567,577**	**644,897**	**586,269**	**3,680,672**
Liabilities										
Creditor changes	0	42,898	-3,910	-1,268	-830	2,260	-910	-2,121	670	36,789
Changes in Net Current Assets	**165,900**	**381,823**	**153,968**	**289,679**	**440,900**	**410,509**	**568,488**	**647,019**	**585,599**	**3,643,884**
Check Line	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: The currency assumed here is Tongan Pa'anga (TOP)

6.8 Profitability and financial ratios (J7)

The main tool for measuring profitability as shown in this sheet is the NPV and the IRR. Both of them are applied to the total cash flow after tax and also to the net cash flow or the free cash flow.

The NPV and IRR of the total cash flow will be the NPV and IRR of the total capital. The total capital amount -$1,175,000 is set at the beginning of the planning horizon together with the cash flow after tax for each period. At the end of the planning horizon, the NPV is $1,416,708 indicating a 30% IRR. Similarly the net cash flow includes at the beginning of the period the equity amount -$470,000 together with the net cash flow and the NPV at the end is $1,347,835 indicating a 40% IRR.

The financial ratios presented by the Jensson Model are the ones that are directly relevant to this particular investment but the user can also use other ratios depending on the investment under consideration.

Table 12: The NPV and IRR as measures of profitability (J7)

PROFITABILITY											
Profitability Measurements		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
		Y_0	**Y_1**	**Y_2**	**Y_3**	**Y_4**	**Y_5**	**Y_6**	**Y_7**	**Y_8**	
NPV and IRR of Total Cash Flow											
Cash Flow after Taxes		0	-76,113	415,274	500,779	635,625	636,191	753,436	726,872	673,080	4,265,144
Loans		-705,000									-705,000
Equity		-470,000									-470,000
Total Cash Flow and Capital		**-1,175,000**	**-76,113**	**415,274**	**500,779**	**635,625**	**636,191**	**753,436**	**726,872**	**673,080**	**3,090,144**
NPV of Total Cash Flow	10%	-1,175,000	-1,244,194	-900,992	-524,749	-90,609	304,416	729,711	1,102,711	1,416,708	
IRR of Total Cash Flow		0%	0%	0%	0%	7%	17%	24%	27%	30%	
NPV and IRR of Net Cash Flow											
Net (Free) Cash Flow		-14,100	-164,238	186,149	289,279	441,750	459,941	594,811	726,872	673,080	3,193,544
Equity		-470,000									-470,000
Net Cash Flow and Equity		**-484,100**	**-164,238**	**186,149**	**289,279**	**441,750**	**459,941**	**594,811**	**726,872**	**673,080**	**2,723,544**
NPV of Net Cash Flow	10%	-484,100	-633,408	-479,566	-262,226	39,496	325,083	660,838	1,033,839	1,347,835	
IRR of Net Cash Flow		0%	0%	0%	0%	12%	24%	32%	37%	40%	
FINANCIAL RATIOS											
ROI			0.28	0.21	0.29	0.37	0.31	0.34	0.32	0.25	
ROE			0.52	0.34	0.44	0.52	0.39	0.40	0.36	0.27	
Turnover Ratio			2.32	1.83	1.89	1.82	1.55	1.42	1.16	0.93	
Capital/Debt+Capital			0.44	0.54	0.65	0.75	0.84	0.91	0.92	0.93	
Net Current Ratio			2.38	3.09	3.74	4.50	5.62	10.26	11.49	14.05	
Liquid Current Ratio			2.18	2.88	3.56	4.35	5.47	10.05	11.31	13.86	
Internal Value of Shares			1.34	1.67	2.20	3.02	3.87	4.98	6.27	7.51	
Debt Service Coverage			-0.86	1.81	2.37	3.28	3.61	4.75	0.00	0.00	
Acceptable Citeria			1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	

Note: The currency assumed here is Tongan Pa’anga (TOP)

7 RESULTS AND ANALYSIS

7.1 The 3-point method of estimation

The 3-point method of estimation will be used to estimate the cost of capital goods in a much more advanced way apart from the contingency method of estimation. The method assumes the beta probability distribution which will be approximated by the triangle probability distribution.

Basically the method starts by the user choosing three points (or estimated values) which can be characterised as the “best estimate”, the “most likely” and the “worst estimate” for an item whether it is a cost item, revenue or price etc. These estimates may be derived from experience or some related historical facts which the user may think it are appropriate for the situation under consideration. The estimates can be revised using other values or may be an improvement on previous ones, which ever ones the user thinks are the closest to reality. The triangle probability distribution is one with the following properties.

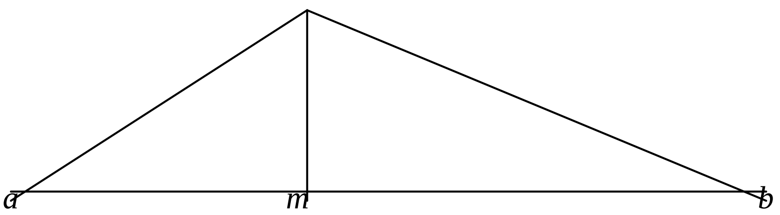

Figure 3: The triangle probability distribution

Let *a* be the “best estimate”, *m* the “most likely” and *b* the “worst estimate”. The beta distribution (approximated here with the triangle distribution) is a continuous probability distribution whose mean or expected value, standard deviation and variance are given by the following:

$$Mean\ is\quad t = \frac{a + 4m + b}{6}, \qquad the\ Std.Dev.is\ s = \frac{b - a}{6}\quad and\ the\ \ Variance\ is\ v = s^2$$

Since we are working with more than two items, the overall expected value is the sum of the expected values of each item and the overall variance is the sum of the variances of each item. The overall standard deviation of the total however, is not the sum of the standard deviations like the previous two items but the square-root of the variance.

The central limit theorem of statistics states that if more items are to be included then the distribution will converge (getting closer) to the normal distribution even though the items under consideration are not normally distributed. This is the reason why the normal distribution will be used to approximate the distribution of the total. The lower and upper bounds for the estimate are obtained by considering a confidence interval chosen by the user whether it is 90%, 95% or 98% confidence etc. The Z-values are determined by the confidence level using the standardised normal distribution table.

$$Lower\ Bound\ (LB) = \ Expected\ Value\ (t) - (Z\ value)(\mathbf{Standard}\ Deviation)$$

$$Upper\ Bound\ (UB) = \ Expected\ Value\ (t) + (Z\ value)(\mathbf{Standard}\ Deviation)$$

$$LB \leq Expected\ Total\ Cost \leq UB\ \ \mathbf{or}\ \ t - Zs \leq Expected\ Total\ Cost \leq t + Zs$$

The following table summarises an estimate of the costs of capital goods assumed in the budget for a long liner using the 3-point estimate explained above. The confidence level is taken to be 98%.

Table 13: The 3-point estimate for capital goods

Three Points Estimate of Costs										
COST ITEMS	Best Case Estimate a	Most Likely Estimate m	Worst Case Estimate b	Expected Value t = (a + 4m + b)/6	STD DEV s = (b - a)/6	Variance $v = s^2$	Conf. Level %	Norm. Distr. Z-Value	Confidence Interval LB	UB
EQUIPMENTS										
Vessel	650,000	700,000	880,000	721,667	38,333	1,469,444,444	98%	2.054	642,940	800,394
Ice Machines	85,000	100,000	105,000	98,333	3,333	11,111,111	98%	2.054	91,488	105,179
Fishing Gears	60,000	70,000	84,000	70,667	4,000	16,000,000	98%	2.054	62,452	78,882
Freezer Truck	10,000	25,000	27,000	22,833	2,833	8,027,778	98%	2.054	17,014	28,652
Total	**805,000**	**895,000**	**1,096,000**	**913,500**	**38,789**	**1,504,583,333**	**98%**	**2.054**	**833,837**	**993,163**
OTHERS										
Set up Onshore Facilities	65,000	80,000	88,000	78,833	3,833	14,694,444	98%	2.054	70,961	86,706
Consultation Fees	16,000	20,000	25,000	20,167	1,500	2,250,000	98%	2.054	17,086	23,247
Total	**81,000**	**100,000**	**113,000**	**99,000**	**4,116**	**16,944,444**	**98%**	**2.054**	**90,546**	**107,454**
Total Capital	**886,000**	**995,000**	**1,209,000**	**1,012,500**	**39,007**	**1,521,527,778**	**98%**	**2.054**	**932,390**	**1,092,610**

Note: The currency assumed here is Tongan Pa'anga (TOP)

The most likely estimate for total capital is $995,000 compared to the expected value offered by the 3-point method which is $1,012,500 and that is 1.75%, slightly higher than the "mostly likely" value. Also note that at a 98% confidence level, the estimate for the total capital investment fluctuates between the lower bound $932,390 and the upper bound $1,092,610. The 98% confidence level gave rise to the above bounds and different confidence level will give different values for z and hence different lower and upper bounds as shown below. One obvious choice but important to be understood is when the confidence level is 50%, we get exactly the mean (or expected value) given by the normal distribution.

Table 14: Different confidence levels for the 3-point estimate

Tot. Capital	Expected Value t = (a + 4m + b)/6	STD DEV s = (b - a)/6	Conf. Level % Level	Norm. Distr. Z - Value	Confidence Interval LB	UB
995,000	1,012,500	39,007	98%	2.054	932,390	1,092,610
995,000	1,012,500	39,007	95%	1.645	948,340	1,076,660
995,000	1,012,500	39,007	90%	1.282	962,511	1,062,489
995,000	1,012,500	39,007	50%	0.000	1,012,500	1,012,500

Note: The currency assumed here is Tongan Pa'anga (TOP)

It is customary practice, that when we estimate the costs, we must always consider the highest possible value within the range of our estimate as described above and for that reason we usually choose the upper bounds. If, on the other hand, we were to estimate revenues, it would be best to choose the lowest possible revenues that could be generated within the range of our estimates.

7.2 Sensitivity analysis

There are three types of sensitivity analysis that will be applied in the Jensson Model as explained in section 3.4.2. They were impact analysis, scenario analysis and a Monte Carlo simulation. What can be shown here is how each and every one of the above are applied in the Jensson Model.

7.2.1 Impact analysis

The three items chosen for this analysis are capital, sales volume of frozen albacore and the price of fresh fish. The sales volume of frozen albacore is chosen since it can be a determinant factor on the IRR as more than 75% of the saleable volume is frozen albacore. The price of fresh fish is also chosen since it is at least two times higher than any other price. The aim is to find out which of the above have the major impact on the IRR on equity. This is done using the Microsoft Excel "what-if" analysis tool which will eventually, yield a graph showing how each item impacts the IRR on equity. Finally we can read off the results from the graph. The same line of reasoning can be applied to find out which one of them impacts the NPV most, which can be performed by the user following the same method outlined above. The impact analysis on the IRR and NPV on capital is probably important for the analyst, but from a shareholder's point of view, he or she might not be interested in such a case since part of the capital is a loan which belongs to the bank and not to the shareholder(s). The other important point to note is precisely the point of intersection where the three items coincide revealing the IRR (40%) when all three items are at 100%. A slight deviation on either one of them from the 100% mark will result in a different IRR.

Deviations	Total Capital		Sales Vol. Frozen Fish		Sales Price Fresh Fish	
		40%		**40%**		**40%**
-25%	75%	50%	75%	-9%	75%	29%
-20%	80%	48%	80%	1%	80%	31%
-15%	85%	46%	85%	11%	85%	33%
-10%	90%	44%	90%	20%	90%	35%
-5%	95%	42%	95%	30%	95%	37%
0%	**100%**	**40%**	**100%**	**40%**	**100%**	**40%**
5%	105%	38%	105%	50%	105%	42%
10%	110%	36%	110%	60%	110%	44%
15%	115%	34%	115%	71%	115%	46%
20%	120%	33%	120%	82%	120%	48%
25%	125%	31%	125%	93%	125%	51%

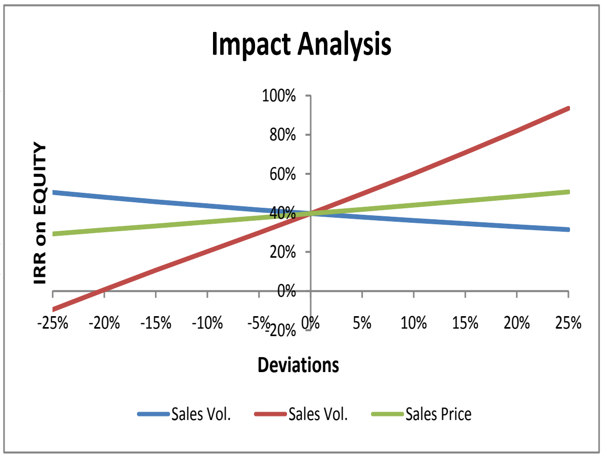

Figure 4: The impact analysis of some cost items on the IRR

The graph above shows that when the total capital increases from 75% to 125%, the IRR decreases from 50% to 31%. On the contrary, when the sales volume and price increase from 75% to 125%, the IRR proportionally increases as well. The greatest impact on IRR is shown by the sales volume of frozen fish as its corresponding curve has the greatest gradient compared to the other two items. The same type of analysis can also be performed by considering their impact on the NPV.

The last point of interest is that all the three items chosen are considered as uncertainties since there is no guarantee that the estimates from which they were derived in the budget and hence in the cash flow will match that of reality. The best that a manager can do is to consider a range of possible values for the uncertain items. If, however, there exists such a range of possible values for the uncertain items (random variable) then it follows that there must be a range of possible values for the output (NPV or IRR) which we want to measure. This line of reasoning will be explored when we use Monte Carlo simulation and choosing a probability distribution (range of possible values) for the uncertainties.

7.2.2 Scenario analysis

Scenario analysis looks more closely at occasions or future possible outcomes when the key variables (cost items, price etc.) are altered. In a scenario analysis, one can deal with more than one uncertain item simultaneously and the usual choices are categorised as worst-case, most likely and best-case scenarios or something similar such as a current, optimistic and pessimistic cases as shown in the summary below. It all stems from the fact that a manager would always like to know how bad a situation can be or how good can it possibly get. The scenario manager offered by Microsoft Excel is the tool that is used here. The changing cells on the scenario summary or the input cells identify the uncertain items that the user would like to consider and the result cells show how the output under consideration is changing. In an optimistic case, the sales quantity is increased by 10% and the other two items are decreased by 20% and both IRR for total cash flow and equity increases. The pessimistic case shows a 10% drop in sales quantity and a 20% increase in the other two items revealing a dramatic drop in the IRR.

With scenario analysis, a better picture of the future can be visualised and the span of possibilities for decision making can be narrowed down.

Table 15: The scenario summary for the IRR

SCENARIO SUMMARY				
		CURRENT VALUES	OPTIMISTIC CASE	PESSIMISTIC CASE
Changing Cells:				
	Sales_Qty_Frozen	100%	110%	90%
	Total_Cost_of_Operation	100%	80%	120%
	Equipment	100%	80%	120%
Result Cells:				
	IRR_Total	30%	47%	15%
	IRR_of_EQUITY	40%	70%	16%

The scenario summary below shows the same situation as above except that the dollar value for the NPV of total cash flow and equity are shown instead of the IRR.

Table 16: The scenario summary for the NPV

Scenario Summary				
		CURRENT VALUES	OPTIMISTIC CASE	PESSIMISTIC CASE
Changing Cells:				
	Sales_Qty_Frozen	100%	110%	90%
	Total_Cost_of_Operation	100%	80%	120%
	Equipment	100%	80%	120%
Result Cells:				
	NPV_Total_Cash_Flow	1,416,708	2,447,702	385,504
	NPV_of_Equity	1,347,835	2,389,322	306,140

Note: The currency assumed here is Tongan Pa'anga (TOP)

7.2.3 Monte Carlo simulation

The methods described in the previous sections, impact and scenario analysis, are considered as deterministic modelling using a single point estimate. This means that each uncertain variable is assigned an estimated value characterised as best, mostly likely and a worst case estimates and the user then forms various combinations of these uncertain items with the above estimates recording the results using the Microsoft Excel scenario manager and data-table for an impact analysis.

The Monte Carlo simulation method in a way chooses the opposite direction by offering not a single point estimate but a many-points estimate. It can be described as an algorithm that uses random numbers as values of a random variable chosen from a probability distribution as model input. These inputs will produce thousands of possible outputs instead of only a few discrete scenarios. Since the volume of calculations involved in a simulation is far too great, computers are an indispensable tool for such an approach. Microsoft Excel and other computational tools are therefore required to handle the complexity and the massive volumes of calculations involved. The histogram below was the result of a 100 iterations of the IRR when the price of fresh fish was randomly selected from a probability distribution.

IRR of EQUITY	FREQUENCY
10%	0
20%	3
30%	24
40%	25
50%	22
60%	22
70%	4
80%	0
90%	0
100%	0
Total	**100**

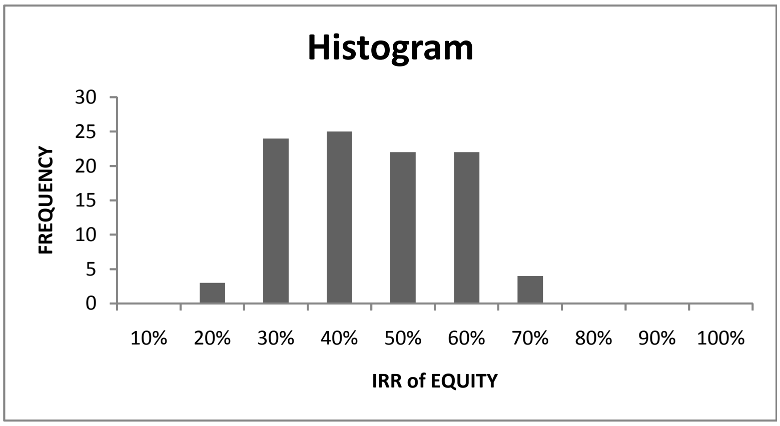

Figure 5: The histogram of the IRR

If the user thinks that an IRR = 40% is a critical value, then he/she knows that the probability of getting an IRR of 40% is approximately 0.25 and the same interpretation applies to any other values. The overall picture given by the histogram above is that the price of fresh fish estimated in the budget will always yield an IRR between 20% and 70% with an IRR = 40% as the most probable one. Note that it is highly unlikely that the IRR will reach 70% unless we change the price structure. To take another example, the probability of getting an IRR of less than 20% is, according to our histogram, only 3% which we conclude is highly unlikely.

The Monte Carlo simulation technique will reveal a better picture using the @RISK Add-in as can be seen in the following examples. The capital goods items in the budget have been assigned the beta probability distribution approximated by the 3-point methods. Similarly, the different prices of all products have been assigned the normal probability distribution. So all of these items in their various cells in Excel have been assigned a probability distribution, so that when the IRR or the NPV is simulated, these cells feed into the IRR or NPV formula and the risks in any of those uncertain items are automatically included in the simulation. The results of the simulation using 1,000 iterations are the charts below.

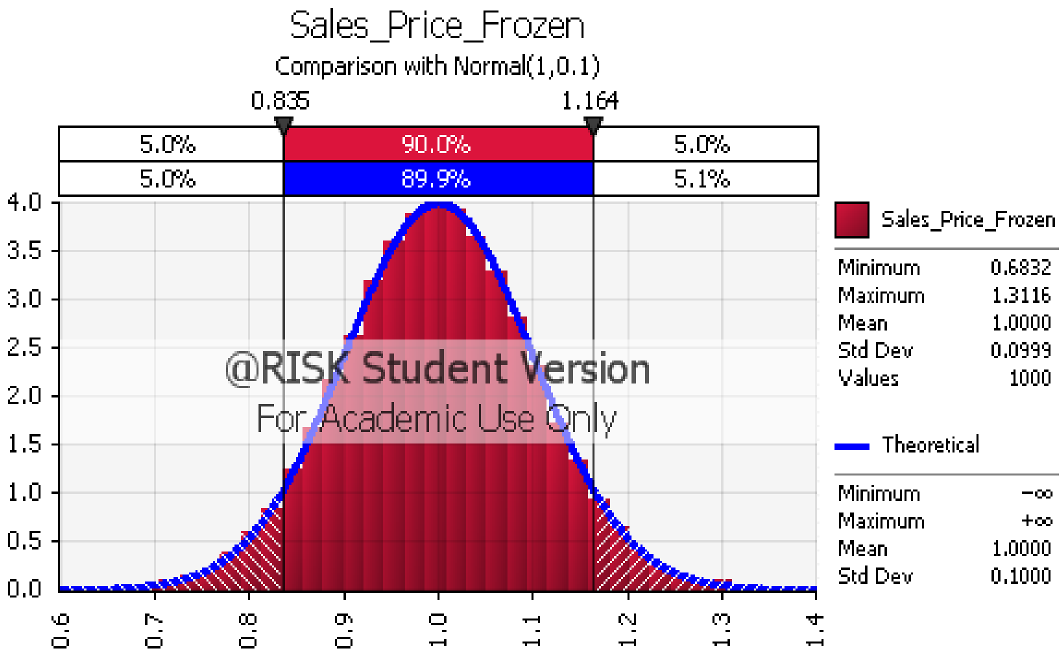

Figure 6: Normal distribution for sales price of frozen fish

All the sales prices were assigned with the normal distribution with mean 100% and slightly different standard deviations for each one but with frozen fish a deviation of 10% was assumed and the results are shown above as an example. We can reason as follows: at a 90% confidence interval, the left hand side of the mean shows that the risk of reducing the price by 16.5% (1- 0.835) is 5% and similar reasoning applies to the right hand side of the mean.

Figure 7: Triangle distribution for the price of a fishing vessel

All capital equipment was assigned with the triangle distribution with different means and standard deviations depending on the type of capital goods under consideration. The cost of a vessel was estimated with the most likely value of $700,000. The best price was assumed to be $650,000 and the (worst) highest that it could get was $880,000. After simulation, the probability (risk) of getting a value higher than $834,000 is 5% and a value less than $674,000 is also 5%.

The uncertainties in prices and the cost of capital equipment have been considered above with their various distributions. When the IRR or the NPV are simulated, all the above uncertainties are included and the effect is as shown on the chart below.

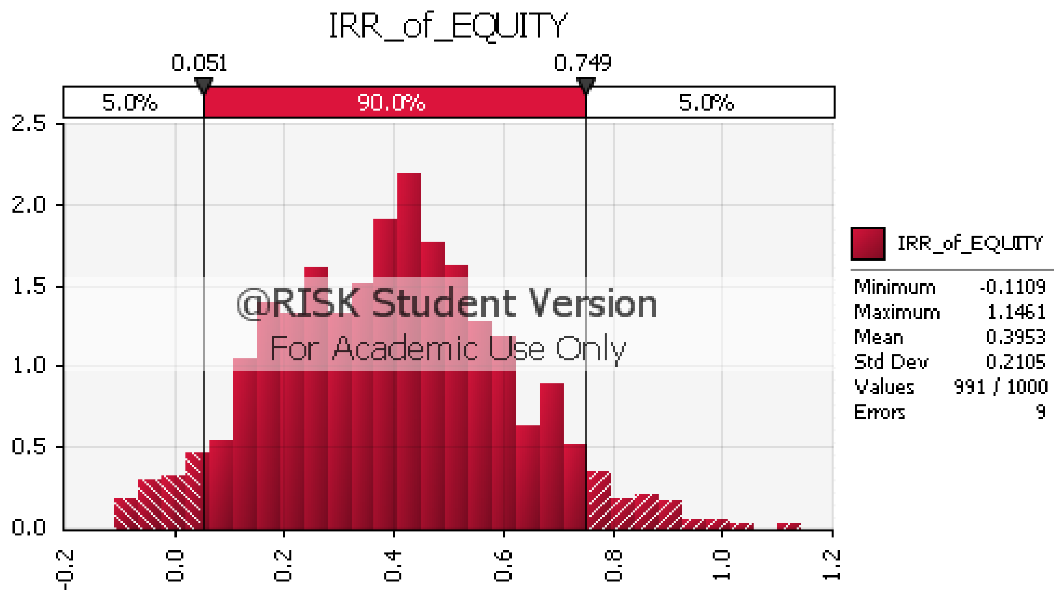

Figure 7: IRR of equity

The IRR of equity is the output when all uncertain items have been taken into account. At a 90% confidence level, the IRR of equity fluctuates between 5.1% and 74.9%. The probability (risk) of having an IRR less than 5.1% is 0.05 (5%) and similarly the probability of having an IRR greater than 74.9% is again 5%.

7.3 Discussion

The main hypothesis in this research was to measure profitability and assess the risk involved in a small fishing company that specialises in long line fishing particularly in Tonga and other parts of the Pacific. From experience, it is one of the riskiest fishing activities that can be carried out in the Pacific region compared to other fisheries. The cost of operation is comparatively high as to the sources of funds available for such an industry. The situation is even worse when the uncertainties in catch, weather and even with the economic crisis that reverberates globally are taken into account. Therefore, the need to manage risk and constantly measure profitability is a major task and an important management issue in such an environment. The Jensson Model and the @RISK software are powerful enough to measure profitability and manage risk. In businesses of small and medium size, the Jensson Model and the Microsoft Excel Add-in @RISK are both indispensable tools appropriate for small companies involved in long line fishing. Despite the difficulties experienced in relation to the uncertainties enumerated above, small islands in the Pacific involved in the fishing business can prosper with good management decisions.

At the beginning of this paper it was assumed that the lack of a proper management tool for measuring profitability and assessment of risks can be one of the major reasons why most local fishing companies went out of business. Operating a long line fishing vessel involves a lot of risk, but risk has never been addressed in a more advanced way apart from the usual contingency methods of approximation taking into account only a few discrete scenarios. The techniques that have been outlined in this paper are a possible solution for the problem as they take into consideration not just a few discrete scenarios but all that can possibly happen. It can only be made possible if reasonable assumptions are formulated in such a way that it includes all uncertainties that can possibly be involved. All the uncertain items such as catch volume, market price, the required capital and many more are now being given a probability distribution so that a range of possible values for each item can be scrutinised. Armed with the techniques provided by the Jensson Model and the powerful computational tools offered by the @RISK add-in, the manager is now capable of making reasonable estimates and forecasting. He is able to assess the risks in any situation under consideration as he has the whole picture in front of him at all times. From such an approach coupled with strict adherence to ethical rules and standards in management and accounting, profitability is just at his fingertips.

The Jensson Model in its present form and capability can be applied to other businesses apart from the fishing businesses only. It encompasses all that is needed, from a carefully worked out budget one can build up an investment plan, a statement of operation to a cash flow projection and simultaneously develop a balance sheet. With this structure, profitability and risk can be evaluated in a systematic way yielding a clearer picture of the future. Last but not the least is that the Jensson Model has the potential of being applied to much more complicated situations and other bigger business organisations. It is, therefore, open for all users to develop and have additional features that may enhance its present form.

7.4 Conclusion

At the beginning of this project, it was hypothesised that the reasons why most small scale fishing companies went bankrupt were due to many factors and ranging from company inefficiencies in not performing their basic duties to natural problems beyond human control. Mismanagement was pointed out in conjunction with the absence of the proper tools to guide management in measuring profitability and assessment of risk. Most operators of long liners do not conform to the standard ethical practices in managing a fishing company which have been directly addressed in this project.

The profitability of long line fishing companies, therefore, depends to a certain extend on the ability of management to make reasonable decisions, but reasonable decisions in turn depend on the ability to make reasonable estimates. This is precisely the conclusion that has been argued throughout this report. The low catch rate, fuel crisis and price fluctuations can no longer be a threat since the manager is now taking good care of those uncertain items. The manager is now learning in advance about his/her chances of succeeding and can allocate the available resources accordingly.

ACKNOWLEDGEMENTS

I am most grateful to my supervisor, Professor Pall Jensson, for his advise, support and guidance since I started this project. Your expertise and patience constantly encouraged and kept me on the right track, and not to mention your efforts in designing the computer model that benefitted me most during my study in Iceland.

This research would not have been realised without the financial assistance offered by the United Natons University – Fishing Training Programme administered by the Marine Resarch Institute in Reykjavik, Iceland. I would like to thank the Director, Dr. Tumi Tomasson, Deputy Director, Mr. Thor H. Asgeirsson, and the rest of the staff of the UNU-FTP for their tireless effort in ensuring that the end result of this project was attained. To Sigga in particular for having to go through the hard work in arranging transport, trips, flights etc. for all of us.

I would also like to thank the executives and staff of Global Fishing Co. Ltd., particularly Mrs. Lucy Anna Ilaiu and Mr. Siotame Taunaholo for looking after the well being of my family by supporting them financially during my six month absence from Tonga. Your support would never go unmentioned.

I would also like to mention that I would never have had the chance to carry out this very interesting research if not for the advise and professional assistance provided by Mr. Semisi Fakahau who was instrumental in arranging for my enrollment in the United Nations University – Fishing Training Program. I thank you Semisi for your support.

I would also like to thank all my lecturers at the University of Akureyri particularly to Professor Helgi Gestsson for the comprehensive and inspiring lectures on management and accounting during the intensive training part of my project.

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