SOP Final Report

ANALYSIS OF DIFFERENT MODELS FOR VALUATION OF INTANGIBLES.

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who gave me the possibility to work on this topic .I would like to thank Dr .Debasis Patnaik Sir for helping me choose this topic and guiding me throughout the course. He guided me throughout the project in finding out research papers & reviewing them. His constant encouragement helped me complete this project.

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1.INTRODUCTION

Proper valuation of assets helps to allocate resources well & hence speeds up the growth process. Proper attention & adequate funding to research will lead to better & efficient processes which will be beneficial to all. Human Capital valuation will ensure proper salary to be paid to the employees without any frenzy shelling out pink slips in the recession period. Standardized models for valuing the organization's intangible assets will help investors to invest properly .

Valuation of Intangible assets & in particular knowledge assets is a major challenge faced by the world economy. As Malhotra states valuation and measurement of assets is often based upon comparison of expected flows of expenditure with potential revenues. However pricing intangibles becomes difficult as the it is difficult to find expected flows of revenue & expenditure. Economic uncertainty about the flows is magnified in the case of 'knowledge assets'.

The valuation of intangibles depend upon the different parameters used to value them. Although there are many models available for valuation , none of them is accepted as a standard and hence a standardized & widely accepted model for valuing different assets is the need of the time.

The fundamental building material and engine of wealth of the modern corporation is the creation and utilization of knowledge. The real challenge in the Information Age is to understand how to accelerate the conversion of knowledge into money through understanding how to measure knowledge assets.(Housel and Nelson , 2005 ,pp-1).

Chen Bo (2010) says that the knowledge offer price is ex-ante decided by the seeker of knowledge and the market demand adjusts in response to the offer price.In order to study knowledge pricing it is necessary to develop a negotiation model between the buyer & seller.

According to Malhotra (2003) , Knowledge assessment is a tool for assisting countries to analyze their capabilities for participating in the knowledge revolution. It focuses on those areas which directly benefit from knowledge and learning . Knowledge assets represent a nation's competences and capabilities that are deemed essential for economic growth , competitive advantage , human development and quality of life.

According to Kasravi & Risov patent mining requires patent valuation metrics, such as inventive value, improvement value, and market value. Patent mining can discover and extract knowledge from patent repositories. The discovered knowledge can provide early indications of new market trends, recognition of top inventors, identification of ideal patent law firms, and more.

In recent time , a lot of research has gone to this field .This project tries to explore some of the different possible valuation schemes for a varied range of knowledge assets including corporate intellectual capital, patents, human capital etc. By analyzing, the various methods , the paper also aims to develop a simple model to value the knowledge assets

2.Objectives Of the study

- Understanding the importance of knowledge assets & their role in the outputs of an organization.
- To understand the various types of problematic in knowledge valuation .
- To explore the various domains of knowledge assets including the IT sector, Research & Development in organizations, ITES in other sectors, Education sector etc.
- To analyze some of the models which can be used in valuation of corporate knowledge assets, patents & human capital.
- To find relevant applications of the various models & study the similarities & dissimilarities between them
- To verify some of the models using real time data.

3.DIFFERENT MODELS FOR VALUING KNOWLEDGE ASSETS

3.1.Negotiation Model

This model was given by CHEN Bo , china in his paper " How to Price Knowledge Goods" presented in the 2010 International Conference on Management Science & Engineering (17th) held at Melbourne, Australia.
The model tries to price knowledge goods through a negotiation bargaining game or a double auction model.
For simplicity it assumes that there only 2 players in the economy 1 buyer & 1 seller are maximum 3 rounds of bargaining.
A perfect Nash Equilibrium Solution is assumed. Due to the impact of knowledge updating, the value of knowledge goods related to buyer will reduce day by day, in other words, the buyer will reduce his valuation on the knowledge goods for trade delay Reducing ratio of value of knowledge each day is same as knowledge update ratio (δ).
With two players , a buyer & a seller in economy let value of knowledge valuated by each player V_b and V_s , and the seller's innovation cost c_s. They will come to agreement when $V_b > C_s$ and the price $P \epsilon [C_s , V_b]$.
Proceed further with a negotiation between buyer and seller to find the price of the knowledge good.After each transaction the total gain decreases so both the seller & buyer will take minimum number of bids to maximize their gain.
Although the model gives theoretical insight of an auction market it is of not much practical use.

3.2KVA Methodology

KVA Methodology is introduced by Housel Thomas J & Nelson Sarah K.in "Knowledge Valuation Analysis—Applications for Organizational Intellectual Capital" published in the Journal of Intellectual Capital , Vol. 6 No. 4, 2005 (pp. 544-557).

The paper reviews KVA methodology which is capable of quantifying value creation by corporate intellectual capital through a case study measuring IT returns. The problem was to be able assign a benefit stream to justify IT spending. The concept of value addition is fundamental to KVA methodology.

The KVA theory was developed from the concept of fundamental unit of change. The units of change are described in anology with Units of Kolmogorov complexity as the knowledge required to make change . A process with predetermined output can be used to measure the return on investment of knowledge.

Humans & technology in organizations take inputs and change them into outputs through core processes.All process outputs can be put into common units of change as the knowledge required to get the output or Knowledge Unit (K_μ).

To estimate the amount of knowledge required to produce process outputs we have three measures : the time required to learn process, the number of process instructions & the length of sequence of binary questions required to complete the process.

To measure each of the above the baseline assumed is maximum process efficiency in an organization i.e shortest learning time per average learner, least number of process instructions or the shortest sequence of binary questions required to obtain the output.

However even this model has limitations which make it difficult to make use of it in accounting.

Only knowledge assets which show immediate outcome can be valued by KVA. Also due to the non-observable nature of "meta" knowledge, "meta" processes, and management/creative staff processes they are not properly accounted in KVA.No database of comparable historical KVA information is available to benchmark future work or provide broader-scale insights for current work.

3.3.Patent Mining

Patent mining helps us to effectively lead us to business insights.This idea is introduced by Kasravi Kas& Risov Maria in the paper " Patent Mining - Discover y of Business Value from Patent Repositories.
Patents are valued according to their inventive , usability & market value. Forward citations, backward citations , family size ,generality denoting patent span ,originality, number of inventors are used as indicators.

It is assumed that patent data freely available & properly segregated .Also forward citations show the innovative value of the patent. The patents can be valued by three modes: Inventive Value, Improvement Value and Market Value.

Inventive Value -
It can be measured in terms of its distance from any prior art, and at the same time inducing a flood of follow up inventions the most inventive patents accumulate large numbers of citations received, and in turn, lack extensive prior art citations

IPV = (ForwardRef + 1)/((BackwardRef + 1)*(0.23*Age + 0.3017)).

The numeric IPV values were sorted into the High(>=0.5), Medium(>=0.15, <0.5) , and Low (<0.15) bins

Improvement Value - Self-citations indicate a continuation of the idea development rather than a completely novel concept.

Market Value – Market value is the assessed value of a patent at which it can be sold, litigated.An average increase of one forward citation per patent in an organization's patent portfolio results in three percent increase in the market value of the patent portfolio.

However, data mining from the large patent databases & accurately finding out the forward & backward citations of various patents may be difficult.Also not all inventions are patented.

3.4.KP^3 Methodology

The KP^3 methodologyintroduced in "Valuation of Knowledge: A Business Performance-Oriented Methodology" by Ahn Jae-Hyeon & Chang Suk-Gwon & presented at the 35th Hawaii International Conference on System Sciences – 2002.

The paper tries to analyze the KP3 methodology & assess the contribution of knowledge to the business performance by employing product and process as intermediaries between the two .

KP^3 stands for knowledge, product, process & performance. The KP3 methodology tries to establish logical links between knowledge and business performance through product and process, and suggest various application areas for improving business performance.

Knowledge is divided as product knowledge & process knowledge.Product knowledge was classified into *Technology related, Operations management related, Market related*(concerned with very specific marketplace) & *Industry related*- concerned with more general and high-level knowledge on the marketplace .The Product knowledge deals with "know- what".

Process knowledge was also divided again into four categories *General and personal capability* (*G*), *Communications capability* (*C*), *Problem-solving capability* (*P*) & *Leadership and interpersonal capability* (*L*).The Process Knowledge deals with "know how".

To assess the business performance, organizational performance and financial performance are used in the model.

However cumulative knowledge of an organization may not be scalar addition of all individuals in the organization.Also proper division & rating scale may be needed for more accurate results.

3.5.Human Resource Accounting

A basic understanding of HRA was studied from the paper "ACCOUNTING FOR INTANGIBLES" by Neeru Banerjee (2009). The paper introduces HRA tool which can be used to justify the returns on Investment of HR. HRA helps to find the economic value of Human beings.Valuing Human Capital is necessary for efficient hiring, otherwise in boom many would be hired at higher salaries & later would be layed off in frenzy during recession.

HRA isolates the effects of HR program & converting these into monetary value is the biggest challenge. Employee time saved, preventing customer complaint, job satisfaction , improved public data etc are to be given monetary value.

Flamboltz model is based on notion that an individual generates value for an organization as he moves to different roles & renders services to the organization.

Lev & Schwartz model which is being applied in various Indian Organizations like BHEl, Infosys, IOC etc is

$$V_r = \frac{I(t)}{(1+r)^{t-r}}$$

Where, V_r = the value of an Individual r years old

I (t) = the individual's annual earnings up to retirement

t = retirement age

r = a discount rate specific to the cost of capital to the company.

However this model has some limitations , The valuations cannot be put directly in balance sheets as there is no industry standards.HRA not directly linked but indirectly linked to ROI, hence not taken seriously by many companies. The training expenses incurred by the company on its employees are not considered. The attrition rate in organization is also ignored. Also the value added by different type of employees may be different.

4. TESTING EMPIRICALLY THE RELATION BETWEEN PATENTS & MARKET VALUE.

Although we have studied the different models for valuing knowledge assets none of them is 100% accurate & each has its own limitations.
From the following real time data we observe that the number of patents rights a company has, alone, may not indicate its value.
For simplicity we have compared the pharmaceutical sector .The data for the number of patents is taken from the Indian Patent Office.Also the stock price values have been taken from BSE India website. Monthly average closing values of stock prices for the last 71 months from January , 2006 to November , 2011 have been used.

The data is plotted between the stock price of the three companies Cipla, Torrent Pharma , Glaxo Pharmaceuticals & Health Index.
The data is compared with the 2006 base price taken as 100 & then calculated.

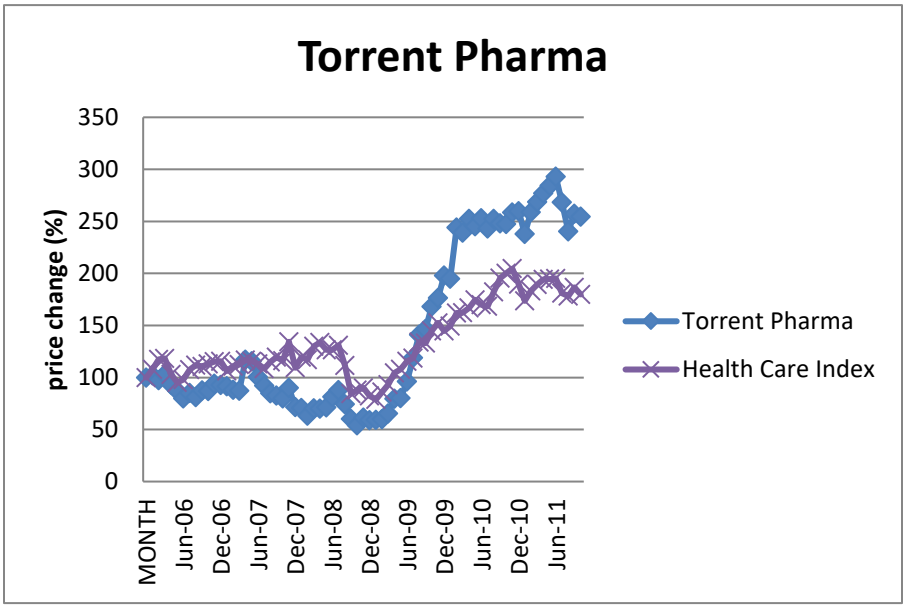
	Year	Torrent Pharma	CIPLA	Glaxo Group
Number of Patents Issued By the Indian Patent Office.	**2006**	**-**	**2**	**1**
	2007	**3**	**4**	**8**
	2008	**4**	**7**	**24**
	2009	**-**	**5**	**8**
	2010	**-**	**1**	**1**

Table 1: Total Patents Issued

Source :www.ipindia.nic.in

Torrent Pharma:

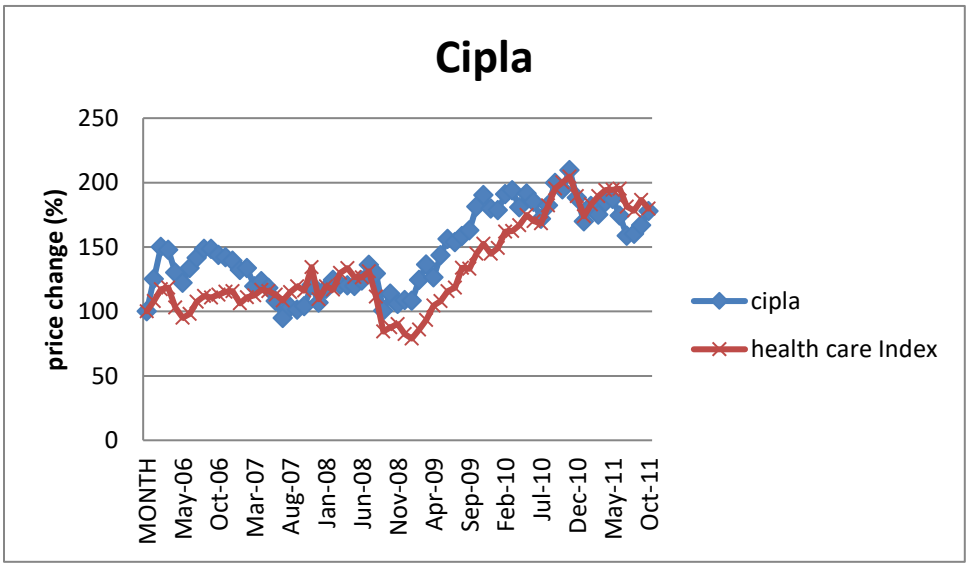
Although the company issued relatively less number of patents It rose more in 2009 compared to the January 2006 prices .



Source:www.bseindia.com

CIPLA:

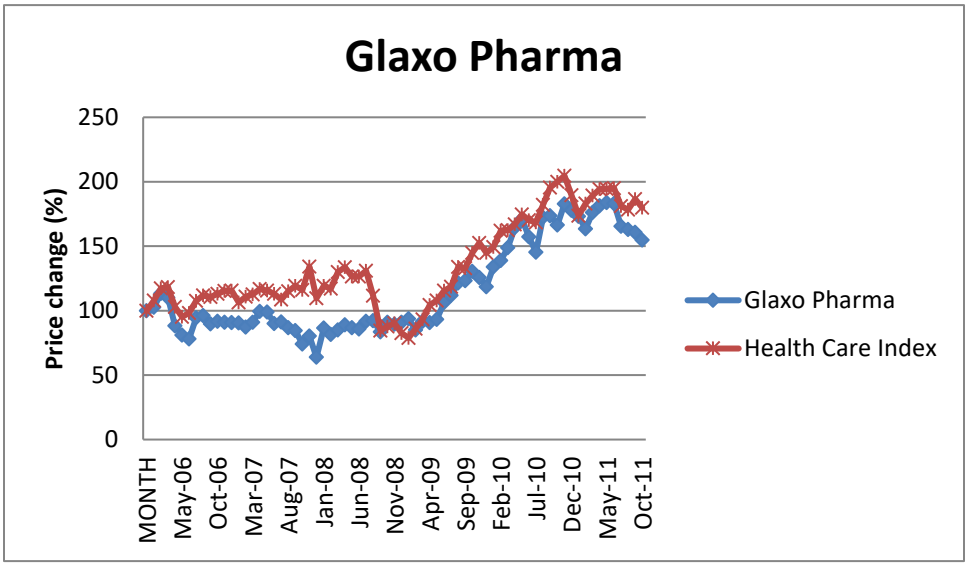
Although it had a decent number of patents it failed to have a comparative advantage with respect to the health care sector.



Source: www.bseindia.com

Glaxo Pharmaceuticals:

Although it had the most number of patents issued (in our study) it remained below the health care Index , with the base prices as January 2006 price.



SOURCE: www.bseindia.com

5.CONCLUSIONS & RECOMMENDATIONS :

A review of the literature indicates that all financial valuation models have similar limitations.IC assets must be valued as an aggregate with no ability to separately value individual assets (other than certain types of IP). There are differences in the national, industry, and firm accounting standards and policies that govern the recording of the IC assets create a lack of comparability of value estimates .An inability to define either exactly how much IC assets contribute to firm value or the process by which they do so. There is also difficulty in estimating the replacement cost of IC assets, their future cash flows, or the risk (volatility) and uncertainty (probabilities) associated with these cash flows. Also there is lack of historical data to use for benchmarking and forecasting.

The different qualitative models studied give an insight into possible valuation of knowledge assets. However these cannot be easily quantified. Also the measures are very subjective in nature.

From the above data analysis we see that knowledge assets are a complex & they cannot be valued easily. The Intellectual capital is divided into three main groups basically human capital, organizational capital & patents. The different types of intellectual capitals together help the organization to improve & give better results. When measured separately they will give wrong results & they must be measured with taking into consideration all the factors. Also the results indicate that only one type of intangibles do not help a firm to grow. An optimized allocation between tangibles & intangibles must be made for growth.

Thus valuation models for intangibles must include frameworks to include all the intangibles. All the models should be forward looking & should be able to value the intangibles according to their value & not the firms performance.

LITERATURE REVIEW

1.Housel Thomas & Nelson Sarah (2005) , Knowledge Valuation Analysis—Applications for Organizational Intellectual Capital (Journal of Intellectual Capital , Vol. 6 No. 4, 2005 ,pp. 544-557)

The paper reviews Knowledge Valuation Analysis methodology which is capable of quantifying value creation by corporate intellectual capital . It addresses the problem of assigning a benefit stream to justify IT spending through a case study measuring IT returns. The KVA theory was developed from the concept of fundamental unit of change[1]. A process with predetermined output can be used to measure the return on investment of knowledge. To estimate the amount of knowledge required to produce process outputs we have three parameters: time required to learn process, number of process instructions and length of sequence of binary questions required to complete the process.[2]

The case assumes that all process outputs can be put into common units of change as the knowledge required to get the output or Knowledge Unit (K_μ). The baseline assumed is maximum process efficiency in an organization[3].

Only knowledge assets which show immediate outcome can be valued by KVA. Due to the non-observable nature of "meta" knowledge, "meta" processes, and management/creative staff processes they are not properly accounted in KVA.

[1] The units of change are described in anology with Units of Kolmogorov complexity as the knowledge required to make change.The Kolmogorov complexity of an object is a measure of the computational resources needed to specify the object.

[2] Binary sequence of questions refers to the process instructions required to get the output.

[3] shortest learning time per average learner, least number of process instructions or the shortest sequence of binary questions required to obtain the output.

2. Kasravi Kas &Risov Maria (2007) , Patent Mining - Discover y of Business Value from Patent Repositories(Proceedings of the 40th Hawaii International Conference on System Sciences -2007)

The paper shows how patent data analysis can lead to useful business insights. It also gives useful patent valuation methods. The patents can be valued by three modes: Inventive Value[4], Improvement Value[5] and Market Value[6]. For the purpose of valuation forward citations[7], backward citations[8], family size[9] , generality denoting patent span, originality ,number of inventors all are used as indicators. For this type of valuation the patent data which is freely available should be mined properly.

3. CHEN Bo (2010),How to Price Knowledge Goods, 17th International Conference on Management Science & Engineering November 24-26, 2010 Melbourne, Australia

The paper tries to show the price discovery process of knowledge assets through a negotiation bargaining game or a double auction model.The paper first analyzes the knowledge pricing under the condition of complete information and then later it analyzes the knowledge pricing under the condition of incomplete information.

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[4] Inventive Value can be measured in terms of its distance from any prior art, and at the same time inducing a flood of followup inventions the most inventive patents accumulate large numbers of citations received, and in turn, lack extensive prior art citations

IPV = (ForwardRef + 1)/((BackwardRef + 1)*(0.23*Age + 0.3017)).

The numeric IPV values were sorted into the High(>=0.5), Medium(>=0.15, <0.5) , and Low (<0.15) bins.

[5] Self-citations indicate a continuation of the idea development rather than a completely novel concept.

[6]Market value is the assessed value of a patent at which it can be sold, litigated.An average increase of one forward citation per patent in an organization's patent portfolio results in three percent increase in the market value of the patent portfolio

[7] citations received from other patents

[8] citations made to other patents and nonpatent literature

[9] indicates filing in multiple countries

Under complete information[10] when both buyer & seller know each other's valuations & the innovation cost we see that the seller can only get one-fourth of the total payoff (surplus) (V_b-$C_{s)}$ utmost when the buyer is stronger than the seller.[11]

4. Ahn Jae-Hyeon & Chang Suk-Gwon(2002), Valuation of Knowledge: A Business Performance-Oriented Methodology, 35th Hawaii International Conference on System Sciences

The paper introduces the KP3 methodology which is developed in the paper & assesses the contribution of knowledge to the business performance by employing product and process as intermediaries between the two . The KP3 methodology tries to establish logical links between knowledge and business performance through product and process, and suggest various application areas for improving business performance.The basic building blocks of the KP3 methodology consist of four components: Knowledge, Process, Product, and Performance. Knowledge is divided as product knowledge[12] & process knowledge.[13] To assess the business performance, organizational performance and financial performance were used in this paper . It is assumed that each individual's knowledge could be added up across individuals to become the product division's knowledge.

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[10] With two players , a buyer & a seller in economy let value of knowledge valuated by each player V_b and V_s , and the seller's innovation cost $c_{s.}$ They will come to agreement when $V_b > C_s$ and the price $P \epsilon [C_s , V_b]$.
Proceed further with a negotiation between buyer and seller to find the price of the knowledge good.

[11] Assumptions :_Maximum 3 rounds of bargaining.Only 2 players in economy, 1 buyer & 1 seller where both are risk neutral. Solution is a perfect nash equilibrium, & negotiations end only in the third round ,Due to the impact of knowledge updating, the value of knowledge goods related to buyer will reduce day by day, in other words, the buyer will reduce his valuation on the knowledge goods for trade delay . Reducing ratio of value of knowledge each day or each auction is same as knowledge update ratio (δ)

[12] Product knowledgeis the 'know–what' knowledge and was classified Technology related,Operations management related,Market related(concerned with very specific marketplace) ,Industry related(concerned with more general and high-level knowledge on the marketplace). A rating scale of 7 levels was also assumed to measure product knowledge.

[13] Process knowledge is the 'know – how' knowledge & was divided into four categories:General and personal capability (G),Communications capability (C),Problem-solving capability (P), Leadership and interpersonal capability (L)

5. Sutton Stewart & Betser Joseph (2009) Knowledge Management Guided by Economic Valuation Models, Third IEEE International Conference on Space Mission Challenges for Information Technology.

This paper focuses on the value of Knowledge Management activities, and in particular on the value of social software[14] integration within Knowledge Management architectures.The paper develops an anology between the Kuznet's curve for economic inequality[15] & knowledge inequality . Seeing the anology & the knowledge inequality curve of an organization the importance of social software is highlighted to reduce the inequality so as to give better results.
For effective Knowledge management , knowledge inequality within an organization must reduce. The various procedures for the same are also discussed.

6. Claessen Eggert(2005), Strategic Use of IC Reporting in Small and Medium-Sized IT Companies—A Progress Report From a Nordic Project, Journal of Intellectual Capital ,Vol. 6 No. 4, 2005 ,pp. 558-569

This paper is a case study on how all the how IT sector organizations in all five Nordic countries have worked together to start a project PIP (Putting IC into Practice) on using intellectual capital (IC) reporting to improve strategy formulation in SMEs in the IT sector .The project was implemented to push for uniform reporting of intangibles in the sector.
The IT companies were chosen as IT Industry had a history of being IC dependent.
PIP project spans over 30 months & was divided into 4 phases.[16]
The IC indicators were then arranged into 15 categories along the three different dimensions of IC, i.e. human, structural and relational capital.

7. Banerjee Neeru (2009) , ACCOUNTING FOR INTANGIBLES, The Icfai University Press.

This paper introduces HRA(Human Resource Accounting) tool which can be used to justify the returns on Investment of HR. HRA helps to find the economic value of Human beings.Valuing Human Capital is necessary for efficient hiring, otherwise in boom many would be hired at

[14] softwares that supports group interaction
[15] Refer Appendix
[16] Phase 1:Identifying & defining indicators,Phase 2 : Implementing indicators & external reporting of results, Phase 3: Refining indicators and identifying proper management tools, Phase 4: Presenting the results in the final report

higher salaries & later would be layed off in frenzy during recession. HRA isolates the effects of HR program & converting these into monetary value is the biggest challenge. Employee time saved, preventing customer complaint, job satisfaction , improved public data etc are to be given monetary value. Flamboltz model[17] & Lev & Schwartz model[18] are two HRA models used widely in industries. HRA is not directly linked but indirectly linked to ROI, hence not taken seriously by many companies.[19]

8. Faulkner Terrence W. ,Appling 'Options Thinking' To R&D Valuation , Journal of Research Technology Management volume 39 (pp 50-56)

The paper discusses binomial tree method of options valuation.Options thinking is used to offset the problems associated with the discounted flow approach. The method is more visible & understandable so that counter intuitive outcomes become less surprising.Also it does not use any logarithmic scale to value uncertainty. However the descision tree approach is time consuming.Options thinking helps us to recognize situations in which uncertainty is good. The valuation by options thinking is higher than the discounted flow approach whenever the money required for commercialization of R&D projects is relatively larger than for the R& D expenditure.

[17] Flamboltz model is based on notion that an individual generates value for an organization as he moves to different roles & renders services to the organization

[18] Lev & Schwartz model which is being applied in various Indian Organizations like BHEl, Infosys, IOC etc is

$$V_r = \frac{I(t)}{(1+r)^{t-r}}$$

Where, V_r = the value of an Individual r years old

I (t) = the individual's annual earnings up to retirement

t = retirement age

r = a discount rate specific to the cost of capital to the company.

[19] The training expenses incurred by the company on its employees are not considered.The attrition rate in organization is also ignored. Experience gained by people is not accounted

9. Griliches Zvi (1984), R & D, Patents, and Productivity, National Bureau of Economic Research ,Volume ISBN: 0-226-30884-7

The model assumes that the value of firm's intellectual capital will show up in the firms market value.The market value depends on both the tangible & intangible assets a firm has.[20] Define market value by the tangible assets as Q (similar to tobin's Q=V/A). Hence by rearranging and taking log we might be able to estimate the value of intangibles . However the difficulty to measure overall firm effect[21] & market effect[22] will pose a problem.

[20] $V = q(A + K)$, where V is market value, A tangible assets, K intangible assets , q is the current market valuation coefficient of the firm's assets, reflecting its differential risk and monopoly position

$q_{it} = \exp(m_i + d_t + u_{it})$ where m_i is the permanent firm effect, d_t is the overall market effect at time *t*, and U_{it} is an individual annual disturbance or error term

[21].The size of firm affects the market price.This is an anamoly in the markets .Usually the smaller size firms the market values them higher.

[22] It refers to the market sentiments & movements

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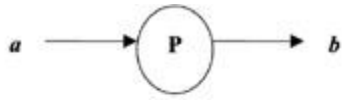
APPENDIX

1.Housel Thomas & Nelson Sarah (2005) , Knowledge Valuation Analysis—Applications for Organizational Intellectual Capital (Journal of Intellectual Capital , Vol. 6 No. 4, 2005 ,pp. 544-557)



Process ***P*** is a business process.
If input ***a*** is equal to output ***b***, no value has been added by process ***P***.
If input ***a*** is changed by process ***P*** into output ***b***, value has been added and is ∝ change.
Change can be measured by the amount of knowledge required to make the change.
This knowledge ∝ the amount of time it takes for an average learner to acquire the knowledge.
So, value added by process ∝ change ∝ knowledge required to produce the outputs ∝ K_n

Source: Housel and Kanevsky (1995)

Figure 1:Units of Change In A Process

- Resource-based view (RBV): a business management tool used to determine the strategic resources available to a company.
- Tobin's Q value: stock market value of firm ÷ replacement cost of assets
- Lev's (2001) Residual Income Model.: Subtract the after-tax earnings attributable to financial and physical assets from the firm's after-tax earnings to arrive at a residual, the knowledge earnings that can be capitalized at an appropriate discount rate. This model is a variant of the traditional financial valuation "Excess Earnings Approach."
- Brooking's (1996) Technology Broker Model: Uses an audit questionnaire to identify the firm's intellectual asset categories. Then apply traditional valuation approaches (market, income, or cost) to each category. The market approach uses market comparables as a benchmark for asset value. The income approach estimates the income-producing capability of the asset. The cost approach estimates value based on the asset's replacement cost.

- Market- or value-based approach: Takes the difference between the stock market value of the firm and the net market value of its assets.

- The Discounted Cash Flow Model: Estimate future asset cash flows and discount them using a market-determined discount rate. This model requires relatively stable, predictable cash flows and the ability to estimate an appropriate discount rate.

- Real Options Models: Use financial option pricing models to value intellectual assets, since intellectual assets are, in effect, real options created by the firm through such activities, investments, or acquisitions as: Investments in IT and human resources, customer relationship arrangements, intellectual property (IP), R&D, and practices and routines.

- Intellectual property: creations of mind like inventions, art, music etc which are protected by law
- Kolmogorov complexity: the Kolmogorov complexity of an object, such as a piece of text, is a measure of the computational resources needed to specify the object
- Tacit knowledge : is knowledge that is difficult to transfer to another person by means of writing it down or verbalising it.
- Explicit knowledge : is knowledge that has been or can be articulated, codified, and stored in certain media. It can be readily transmitted to others.

2. Kasravi Kas &Risov Maria (2007) , Patent Mining - Discover y of Business Value from Patent Repositories(Proceedings of the 40th Hawaii International Conference on System Sciences -2007)

- Patent : an instrument for recognizing innovation and protecting the interests of innovators.
- Trade secret : any secret formula or compilation of information used in an organization that provides competitive advantage. It is protected only to the extent that the secrecy is maintained.
- Design Patents: which only protect the ornamental aspects of an artifact

- Plant Patents : which protect new and distinct varieties of plants
- Utility Patents : which protect new and useful processes, machines, article of manufactures, or compositions of matter, or any new and useful improvement thereof.
- Forward citations: citations received from other patents
- Backward citations :citations made to other patents and nonpatent literature
- Family size of patents : indicates filing in multiple countries
- Generality: denoting the number of classes the patent spans
- Inventive Value - value of patent based on originality of the patented idea. It is measured only in terms of its distance from any prior art, and at the same time inducing a flood of followup inventions the most inventive patents accumulate large numbers of citations received, and in turn, lack extensive prior art citations
- Improvement Value: value measure that converts a brilliant, albeit unusable idea into a commercially viable technology.
- Market Value - assessed value of a patent at which it can be sold, litigated, or would bring indirect gains by stopping a competitor from occupying the same space

3. CHEN Bo (2010),How to Price Knowledge Goods, 17th International Conference on Management Science & Engineering November 24-26, 2010 Melbourne, Australia

- Credence good : a good whose utility impact is difficult or impossible for the consumer to ascertain. The utility gain or loss of credence goods is difficult to measure after consumption as well.
- Experience good : a product or service where product characteristics such as quality or price are difficult to observe in advance, but these characteristics can be ascertained upon consumption.
- Information asymmetry : occurs when one party has more or better information than the other.
- Double auction : is a process of buying and selling goods when potential buyers submit their bids and potential sellers simultaneously submit their ask prices to an auctioneer, and then an auctioneer chooses some price p that clears the market: all the sellers who asked less than p sell and all buyers who bid more than p buy at this price p.

- Nash equilibrium is a solution concept of a game involving two or more players, in which each player is assumed to know the equilibrium strategies of the other players, and no player has anything to gain by changing only his own strategy unilaterally. If each player has chosen a strategy and no player can benefit by changing his or her strategy while the other players keep their strategy unchanged, then the current set of strategy choices and the corresponding payoffs constitute a Nash equilibrium
- Knowledge assets: stocks of knowledge from which services are expected to flow for a period of time
- Knowledge Society: society in which there is a relatively high proportion of knowledge workers.
- Social capital is a sociological concept, which refers to connections within and between social networks
- ICT Information and communications technology: stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers, middleware as well as necessary software, storage- and audio-visual systems, which enable users to create, access, store, transmit, and manipulate information
- SCANDIA NAVIGATOR **:** A valuation model which divides the intellectual capital of an organization into three basic forms: human capital, structural capital and customer capital. This model focused on five areas for improvement: financial, customer, process, renewal and development, and human capital
- Balance Score Card: model which aims to balance the traditional perspective of accounting for intangibles by adding four perspectives related to: innovation and learning, business process improvement, customer relationships, and, value creation in financial and intangible terms.
- Intangible Assets Monitor :defines three types of intangible assets that account for the book value-to-market value discrepancy in the valuation of a firm. The 'residual' that is not accounted or by the book value is attributed to individual competence of employees, internal structure, and external structure

4**. Ahn Jae-Hyeon & Chang Suk-Gwon(2002),** **Valuation of Knowledge: A Business Performance-Oriented Methodology, 35th Hawaii International Conference on System Sciences**

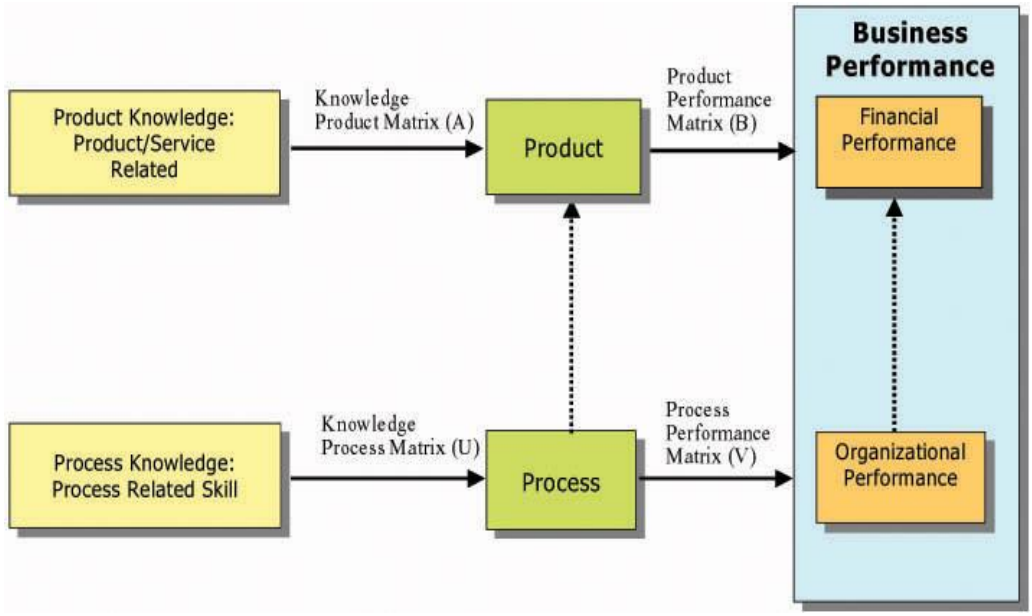


Figure 2 : Overview of the KP3 Methodology

Knowledge in KP^3 methodology	
Product Knowledge	Technology-related knowledge
	Operations-related knowledge
	Market-related knowledge
Process Knowledge	Leadership capability
	Problem solving capability
	Communication capability
	Learning capability

Table 1: Product & Process Knowledge in KP3

Process Knowledge	Category
Motivation	G
Verbal Communications Skill	C
Ambition	G
Personal Fit	G
Decision Making	P
Self Discipline	G
Problem Solving	P
Ability to Organize	L
Work in Teams Well	L
Practical Work Experience	P
Leadership	L
Time Management Skills	G
Creativity	P
Quantitative Skills	P
Writing Ability	C
Selling Skills	C
New Technology Skills	P
Negotiation Skills	C
Foreign Language	C

Table 2 :Individual's capabilities as process knowledge

General and personal capability (G), Communications capability (C), (3) Problem-solving capability (P), Leadership and interpersonal capability (L)

- Process knowledge is the knowledge associated with the activities performed in each stage of a value chain from inbound logistics to customer care.
- Market related knowledge: concerned with very specific marketplace
- Industry related knowledge: concerned with more general and high-level knowledge on the marketplace
- Product knowledge: 'know–what' knowledge

5. Sutton Stewart & Betser Joseph (2009) Knowledge Management Guided by Economic Valuation Models, Third IEEE International Conference on Space Mission Challenges for Information Technology.

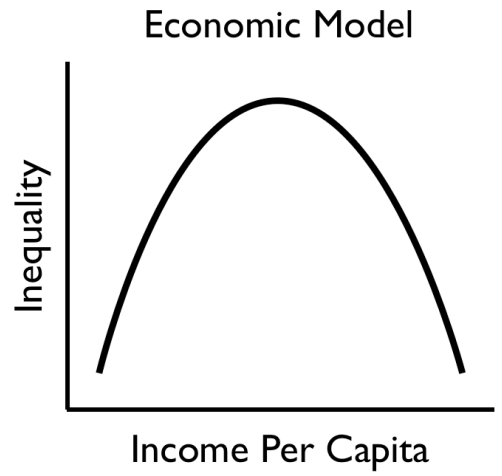


Figure 3: Kuznet's CURVE

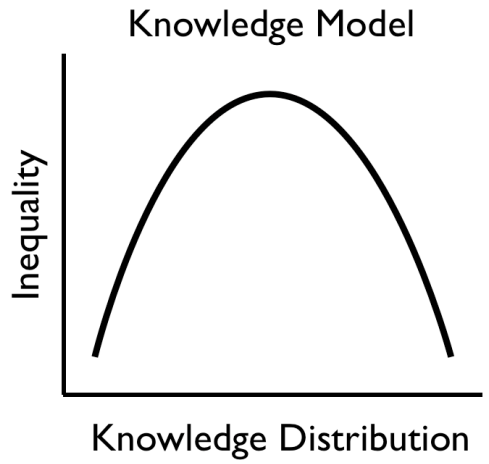


Figure 4: Knowledge Distribution Model Based On Kuznet's Curve

- Community of practice (CoP): a group of people who share an interest, a craft, and/or a profession. The group can evolve naturally because of the members' common interest in a particular domain or area, or it can be created specifically with the goal of gaining knowledge related to their field.
- SocialSoftware : a label for software that supports group interaction

- Knowledge economy : a term that refers either to an economy of knowledge focused on the production and management of knowledge in the frame of economic constraints
- Knowledge aggregation: is the problem of taking information from multiple heterogeneous sources and aggregating it into a unified knowledge base.
- Prescriptive knowledge: knowledge that can be used to improve a situation. It is knowledge about techniques or the tribal knowledge within the organization.
- Propositional knowledge : knowledge about natural phenomenon and regularities.
- Tribal knowledge : any unwritten information that is known within a tribe but often unknown outside of it. A tribe may be a group or subgroup of people that share a common knowledge.
- Knowledge Tightness : Tightness is a measure of consensus/acceptance of a piece of knowledge. It is the willingness of the people to act on the knowleddge.
- Kuznets curve is a representation of Simon Kuznets's theory that economic inequality increases over time while a country is developing, then after a critical average income is attained, begins to decrease.
- Authoritative Knowledge: legitimate & consequential knowledge

6. Claessen Eggert(2005), Strategic Use of IC Reporting in Small and Medium-Sized IT Companies—A Progress Report From a Nordic Project, Journal of Intellectual Capital ,Vol. 6 No. 4, 2005 ,pp. 558-569

Human capital	Structural capital	Relational capital
Employees	Information systems	Customers
Staff turnover and recruiting	Quality management	Market and image
Skills and competence	Innovativeness	Visibility of expertise
Employee satisfaction and attitude	Competence development	Networks
Executive competency	Working conditions	
	Governance	

Table 3: IC Indicators Divided In 15 Categories used In the NORDIC Project

- Nordic Countries: The Nordic countries make up a region in Northern Europe and the North Atlantic which consists of Denmark, Finland, Iceland, Norway and Sweden and their associated territories
- Critical Success Factors: element that is necessary for an organization or project to achieve its mission

7. Banerjee Neeru (2009) , ACCOUNTING FOR INTANGIBLES, The Icfai University Press.

- HRA(Human Resource Accounting): a method to measure the effectiveness of personnel management activities and the use of people in an organization.
- sssReplacement Cost : measure of cost to replace firm's existing resources
- ROI: Return on Investment

$$ROI = \frac{(\text{Gain from Investment} - \text{Cost of Investment})}{\text{Cost of Investment}}$$

APPENDIX 2

Stock Market Data: Source www.bseindia.com

	TORRENT PHARMA		CIPLA		GLAXO PHARMA		HEAL CARE INDEX	
MONTH		% change	Close Price	% change	Close Pric	% change	Close price	% change
Jan-06	223.45	100	441.3	100	1281.05	100	3,290.65	100
Feb-06	228.05	102.0586	551.9	125.0623	1314.6	102.6189	3,553.78	107.9963
Mar-06	217.6	97.38196	661.95	150	1450.6	113.2352	3,858.10	117.2443
Apr-06	229.7	102.797	652	147.7453	1409.95	110.0621	3,894.84	118.3608
May-06	207.75	92.97382	573.75	130.0136	1130	88.20889	3,387.94	102.9566
Jun-06	195.3	87.4021	539.5	122.2524	1036.85	80.93751	3,132.42	95.19153
Jul-06	178.35	79.81651	590	133.6959	999.55	78.02584	3,227.22	98.07242
Aug-06	190.25	85.14209	624.875	141.5987	1211	94.53183	3,538.50	107.5319
Sep-06	181.1	81.04721	655.625	148.5667	1233.3	96.27259	3,684.44	111.9669
Oct-06	195.35	87.42448	655.125	148.4534	1149.4	89.72327	3,641.60	110.6651
Nov-06	193.95	86.79794	634.625	143.8081	1173.95	91.63967	3,720.61	113.0661
Dec-06	210.2	94.07026	626.75	142.0236	1164.45	90.89809	3,792.05	115.2371
Jan-07	207.6	92.90669	614.5	139.2477	1162.4	90.73807	3,804.30	115.6094
Feb-07	204.55	91.54173	583.25	132.1663	1158.85	90.46095	3,498.93	106.3294
Mar-07	197.2	88.25241	589.25	133.5259	1117	87.1941	3,649.43	110.903
Apr-07	195.05	87.29022	527.125	119.4482	1166.75	91.07763	3,702.69	112.5215
May-07	261.6	117.0732	544.125	123.3005	1274.75	99.50822	3,841.84	116.7502
Jun-07	257.95	115.4397	521.125	118.0886	1268.1	98.98911	3,805.70	115.6519
Jul-07	224.4	100.4252	476.75	108.0331	1154.2	90.09797	3,718.26	112.9947
Aug-07	206	92.19065	418.375	94.80512	1169.6	91.30011	3,572.82	108.5749
Sep-07	189.25	84.69456	456	103.3311	1112.1	86.8116	3,784.21	114.9989
Oct-07	184.9	82.74782	446.875	101.2633	1081.4	84.41513	3,928.94	119.3971
Nov-07	178.3	79.79414	458.625	103.9259	947.85	73.99009	3,822.90	116.1746
Dec-07	201.2	90.04252	531.5	120.4396	1029.95	80.39889	4,418.65	134.2789
Jan-08	159.65	71.44775	471.125	106.7584	817.7	63.83045	3,603.52	109.5078
Feb-08	157.7	70.57507	518.125	117.4088	1109.4	86.60084	3,928.78	119.3922
Mar-08	141.4	63.28038	549.375	124.4901	1045.35	81.60103	3,848.11	116.9407
Apr-08	157.45	70.46319	532.625	120.6945	1090.05	85.09036	4,275.10	129.9166
May-08	156.7	70.12755	530.125	120.128	1138.85	88.89973	4,395.99	133.5903
Jun-08	159.55	71.403	527.75	119.5898	1110.5	86.6867	4,164.33	126.5504
Jul-08	181.8	81.36048	546.75	123.8953	1100	85.86706	4,162.03	126.4805
Aug-08	196.15	87.7825	600.5	136.0752	1175.25	91.74115	4,311.73	131.0297
Sep-08	166.35	74.44618	571.375	129.4754	1180.1	92.11975	3,672.18	111.5944
Oct-08	134.75	60.30432	443.625	100.5269	1070.35	83.55255	2,778.64	84.44046
Nov-08	120.65	53.99418	501.375	113.6132	1166.35	91.04641	2,887.83	87.75865

	TORRENT PHARMA		CIPLA		GLAXO PHARMA		HEAL CARE INDEX	
MONTH		% change	Close Pric	% change	Close Pric	% change	Close price	% change
Dec-08	137.25	61.42314	467.25	105.8804	1147	89.53593	2,966.19	90.13994
Jan-09	132.1	59.11837	480	108.7695	1165.8	91.00347	2,713.84	82.47124
Feb-09	132.4	59.25263	477.75	108.2597	1199.95	93.66926	2,597.00	78.92058
Mar-09	134.05	59.99105	549.375	124.4901	1088.05	84.93423	2,830.11	86.00459
Apr-09	145.95	65.31663	601.75	136.3585	1173.95	91.63967	3,067.98	93.23325
May-09	177.8	79.57037	557.375	126.303	1163.3	90.80832	3,435.95	104.4155
Jun-09	179.15	80.17454	633.25	143.4965	1194.2	93.22041	3,551.87	107.9382
Jul-09	215.2	96.3079	689.25	156.1863	1361.55	106.2839	3,805.05	115.6322
Aug-09	265.7	118.908	678.75	153.8069	1433.3	111.8848	3,900.93	118.5459
Sep-09	315.2	141.0606	699.375	158.4806	1556.8	121.5253	4,404.26	133.8416
Oct-09	327.8	146.6995	719.375	163.0127	1578.3	123.2036	4,377.20	133.0193
Nov-09	375.7	168.136	800.375	181.3676	1670.75	130.4204	4,767.41	144.8775
Dec-09	394.4	176.5048	839	190.1201	1610.05	125.6821	5,018.33	152.5027
Jan-10	442.3	197.9414	793.25	179.753	1520.15	118.6644	4,765.14	144.8085
Feb-10	435.15	194.7416	788.25	178.62	1715.5	133.9136	4,912.98	149.3012
Mar-10	545.15	243.9696	842.75	190.9699	1777.85	138.7807	5,328.37	161.9245
Apr-10	534.3	239.1139	856.375	194.0573	1905.05	148.71	5,344.71	162.4211
May-10	563.8	252.316	797.375	180.6877	2105.95	164.3925	5,490.27	166.8445
Jun-10	548.2	245.3345	844.375	191.3381	2190.75	171.0121	5,748.78	174.7004
Jul-10	565.6	253.1215	816.5	185.0215	2015.8	157.3553	5,597.19	170.0938
Aug-10	543.35	243.164	758.375	171.8502	1861.2	145.2871	5,543.93	168.4752
Sep-10	564.2	252.495	804.125	182.2173	2209.7	172.4913	5,995.71	182.2044
Oct-10	554.35	248.0868	880.625	199.5525	2224.1	173.6154	6,433.24	195.5006
Nov-10	552.65	247.326	859.25	194.7088	2133.65	166.5548	6,582.86	200.0474
Dec-10	578	258.6708	924.75	209.5513	2342.6	182.8656	6,734.19	204.6462
Jan-11	580.65	259.8568	830.625	188.2223	2279.05	177.9048	6,236.88	189.5334
Feb-11	531.55	237.8832	749.25	169.7825	2217.2	173.0768	5,717.96	173.7638
Mar-11	578.35	258.8275	802.625	181.8774	2094.45	163.4948	6,023.63	183.0529
Apr-11	600.3	268.6507	772.125	174.966	2256.15	176.1172	6,232.55	189.4018
May-11	619.15	277.0866	815.25	184.7383	2322.5	181.2966	6,393.02	194.2783
Jun-11	635.3	284.3142	825.875	187.1459	2353.85	183.7438	6,397.96	194.4285
Jul-11	654.65	292.9738	769.625	174.3995	2346.4	183.1622	6,420.74	195.1207
Aug-11	599.45	268.2703	700	158.6223	2120.3	165.5127	5,962.26	181.1879
Sep-11	537.1	240.367	706.75	160.1518	2089.1	163.0772	5,867.80	178.3174
Oct-11	575	257.3283	736.375	166.8649	2060.45	160.8407	6,136.23	186.4747
Nov-11	569.05	254.6655	784.375	177.7419	1983.65	154.8456	5,918.53	179.859