

The GH-Method

Viscoelastic or Viscoplastic Glucose Theory (VGT #155): A Corporate Business and Finance Management Study of Annual Revenue versus Salesforce Resource (Salesforce Headcount) and Sales Results (Number of Accounts) Along with R&D Engineering Resource (R&D Engineer Headcount) and R&D Results (Number of Products) Over 8 Years from Y1994 to Y2001, Using 3 Different Energy Analysis Models of Time Domain, Space Domain, and Frequency Domain Based on the GH-Method: Math-Physical Medicine (No. 748)

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Keywords: Viscoelastic; Viscoplastic; Time domain; Space domain; Frequency domain; Fast Fourier transform

Abbreviations: FFT: fast Fourier transform; FD: frequency domain; SD: space domain; TD: time domain; MPM: math-physical medicine

1. INTRODUCTION

The author has initiated a self-study and research on internal medicine and biomedical complications beginning in Y2010. Currently, he has written and published a total of 747 papers, including 6 papers related to economics. In Paper No. 747, he conducted a combined study to compare the similarity of data waveform patterns and interpretation of results between certain selected biomedical and economic variables using his developed math-physical medicine research (MPM) methodology. After completing that particular article, he wondered whether the MPM methodology can be applied to certain corporate and finance management investigations.

The author, who was an entrepreneur, failed seven times trying to build thriving technology companies over 20 years. On his 8th try, he finally became successful in founding a billion-dollar revenue semiconductor company in Silicon Valley during a period of 8 years from 1994 to 2002.

By the end of 2001, he had suffered from severe type 2 diabetes, kidney complications, and several cardiac episodes. Therefore, near the end of 2001, he decided to sell his well-established semiconductor business because of his life-threatening from the high stress and poor lifestyle associated with his successful business career. After making that decision and taking the necessary follow-up actions, he entered into the non-profit health research field, including psychology for mental health and internal medicine for physical health.

The above career-change event happen more than 2 decades ago. Since then many detailed real data of that publicly-traded high-tech company have either been lost or difficult to retrieve; therefore, he had to reconstruct his high-tech corporate business model and its related financial data by relying solely on his memory. The data he used in this article are not exactly identical to the real data that happened between 1994 and 2002. However, its business model, data structure, data

pattern, and data moving trend are preserved and very close to the real picture.

For example, he still remembers that his revenue for the first year of 1994 was around \$1 million with about 20 employees. The 1995 revenue reached ~\$6 million when his start-up company went through the public offering on the NASDAQ of Wall Street stock market at \$26 per share. By the last operating year in 2001, before he sold his business, his corporate revenue finally reached approximately \$1 billion level. He does not retain the exact revenue numbers in his brain regarding the middle period from 1996 to 2000. His established Silicon Valley company was cited in the Wall Street Journal as the top performer which maintained a non-stop straight-line growth in both revenue and profit for 36 continuous quarters. As a result, he was also mentioned in the San Jose Mercury News as the highest-ranking CEO in Silicon Valley from 1999 to 2001. Most importantly, he still vividly remembers his “business model”, i.e. revenue/cost structure, high quality of hired employees, compensation philosophy and salary structures, tax bracket, and net income after taxes % range. Based on this vital information, he can re-construct the database he needs for this particular study.

The author has spent 39 years of his adult life studying and learning 10 different academic disciplines, including mathematics, physics, engineering (mechanical, structural, ocean), finance, marketing, psychology, food nutrition, and internal medicine. Within the 8-years of the semiconductor era, he hired about one thousand Ph.D. engineers from 6 top-notch universities in the US. They frequently told him that “the product can sell itself”. At the same time, the Wall Street MBA analysts also stated to him that “marketing and sales is the king”. There is no need to debate as it is extremely difficult to prove which side is correct. Nevertheless, being a long-time struggling entrepreneur and a seasoned businessman later, he has learned his own painful lessons and valuable experiences. The correct answer is that “both sides of the arguments are correct and important, the difficult part is how to balance them to achieve the ultimate corporate success.” This particular article attempts to shed some light on this debate.

All data of these 5 variables, i.e. total revenue, head-counts of salespeople and engineers, numbers of business accounts, and developed products are “time-dependent”. Because of this time-dependent dynamic characteristic, the viscoelastic and viscoplastic behavior analysis tools can be then applied to this study.

To aim the subject as to which side, sales or engineering, is more important to the business success, he decides to conduct two separate cases of “energy study”. The first case uses the most important single output in the corporate business, i.e. total revenue dollars, with two inputs, salesforce headcount, and R&D engineer headcount. The second case utilizes the same output in the corporate business, i.e. total revenue dollars, with two different inputs, the number of customer accounts resulting from salesforce, and the number of developed products resulting from R&D engineers.

After completing his data preparation task, the actual data processing work itself is 100% dependent on his recently developed VGT software tool on the iPhone which has reduced his data processing time from a normal 5-6 hours to less than 1 minute. Therefore, he can spend this saved amount of extra time to conduct a deeper investigation and/or explore a better interpretation of his observed phenomena and findings.

Regarding the energy associated with both single output and multiple inputs, the author has decided to use the following three energy models described in some detailed manner in the section of methods.

The first time-domain (TD) model uses a rudimentary physics definition of energy associated with a wave that is directly proportional to the square of wave amplitude. The second space-domain (SD) model utilizes the hysteresis loop area of the time-dependent strain-stress curve with viscoelastic and viscoplastic engineering material behaviors. The third frequency-domain (FD) model uses his defined new variable of strain (output) multiplying with stress (stress input is the strain change rate multiplying with the normalized viscosity input) and the fast Fourier transform (FFT) operation of wave theory in physics.

Initially, he displayed his corporate business model with some vital percentages in Figure 1. There are two main purposes of this study: (1) comparison of waveforms of original data of both output and inputs as shown in Figure 2; and (2) comparison of energy associated with the selected output and inputs as shown in Figure 3.

In summary, there are 3 noticeable findings from the multiple energy studies, i.e. business model, waveforms, and SD-VGT energy results:

(1) Business model: His simplified business model can be expressed via plain English as follows: "Total revenue minus total cost (labor cost with an overhead % plus equipment) equals to net income before taxes (NIBT) which further minus the total corporate taxes (he paid the highest 39% corporate tax rate) to get the net income after tax (NIAT). NIAT is then divided by the number of outstanding corporate shares to get the earnings per share (EPS). Using EPS multiplied by Wall Street's price/earning ratio (P/E Ratio) to get the market value of this corporate's total market worth. It is noted his cost ratio is quite low, only 47% (mainly headcount cost, very little equipment cost which is a standard software business model). He paid the highest US corporate tax rate of 39% because this resulted from his long-time personal belief to not avoid US taxes. He has always been grateful to the US since this country offered him all kinds of opportunities to fulfill every dream he has had thus far. His NIAT, i.e. pure and net profit, is very high at 32%. Actually, he has maintained his corporate profit between 30% to 49% for the entire era of 8-9 years. In other words, judging from this balance sheet or this simplified business model, his established semiconductor company was an extremely well-managed and very successful business entity."

(2) Waveforms of 1 output and 4 inputs: The revenue curve is almost an upward straight line after 1995. The software industry used to practice the "one-time purchased permanent license" model. In 1995, the author got an idea from the car leasing industry and the wholesales industry to combine them and create a new software subscription license model of "discounted volume purchase with installed payment plan". This creative pricing model has become the software industry's standard business practice that

continues today. Because of this newly invented software pricing and payment model, his revenue flow became stabilized after 1995. Besides, through this installed payment arrangement, high-quality salespeople are retained easier. This explains why his revenue curve became an upward straight line after 1995. His product pricing ranged from \$20k to \$2M per license copy. He also established a stringent sales rule that each salesperson's annual quota is \$1 million minimum. This \$1M would support ~3 employees plus equipment and overhead which still proves >30% of net profit. Due to this sales quota arrangement, his salesforce headcount and sales revenue have a 100% correlation. He also maintained his R&D staffing at a level of around 65%-75% of his salesforce staffing. The correlations between revenue versus accounts number, and the products number are 98%-99%. The above statements offer an explanation of why these 5 curves (1 output and 4 inputs) behave in a pseudo-linear nature.

(3) SD-VGT Energy results: Figure 3 showed the results from two parts of this SD-VGT analysis. The first part is revenue versus sales headcount and R&D headcount which has an energy ratio of: Sales # = 49.8%; R&D # = 50.2%. The second part is revenue versus accounts number and products number which has an energy ratio of: Accounts # = 50.2%; Products # = 49.8%. It is obvious that these two sets of energy ratios are almost identical to each other which indicates both sales and R&D are equally important for this corporation's revenue and success. However, if we take a further detailed time-zone examination, from the upper diagram of Figure 3, we can see that the R&D headcount is slightly more important than the sales headcount during the earlier period of 1994-1996. During the earlier years, corporate needed smart engineers and higher productivity to develop successful products. But in the later years of 2000-2001, the corporate had already built a sufficient scale of the economy; therefore, it attracts many talented salespeople, and therefore the influence of salesforce headcount was slightly less. Inside the lower diagram of Figure 3 of revenue versus accounts number and products number, the products contribute more than the accounts which resulted from better quality and more driven start-up engineers during the earlier years of 1994-1997. However, after the economic scale was

established, the corporation became more attractive to strong salespeople who have better sales skills; therefore, the accounts number contributed more to revenue.

In conclusion, both sales and R&D are equally important for building up a successful company with strong revenue growth. A businessperson cannot afford to have a biased attitude with the inclination towards either “product can sell itself” or “sales and marketing are kings of business”. These two SD-VGT energy diagrams have the capability not only to reveal some important “quantitative information”, such as the calculated percentages of contribution or influence of each input on revenue; but also reveal some important “qualitative information”, such as the importance of revenue growth in earlier years from better-quality R&D engineers who were attracted to the corporation’s start-up working environment (due to higher stock shares to start-up engineers), and revenue growth in later years from better-quality salespeople who were attracted to the corporation’s scale of the economy (due to higher commission to salespeople). This is why the author values this academic tool of viscoplastic and viscoplastic analyses for time-dependent variables.

2. METHODS

2.1 TD, SD, and FD analysis tools

This section has brief descriptions of TD correlation analysis with other observational results, SD VGT analysis with hysteresis loop area’s energy results, and FD analysis with frequency curve area’s energy results.

First of all, by using a TD analysis tool, we can examine the curves’ moving trend and pattern visually along with their correlation numerically. We can also study the extremely high or low data values in the dataset. The visual observation or calculation-derived interpretations are a part of statistical analysis results which can indeed provide some useful hints or even derive some accurate conclusions. However, we must be aware of the limitations of the selected data-size and time-window and also be cautious of the appropriate statistics tool we choose.

Regarding the TD energy, we can apply the rudimentary definition of physics that “the wave carried energy is directly proportional to the square of wave’s amplitude”. However, the data quantity % of each wave category should be considered and included in order to obtain a more accurate TD energy value.

The author would like to describe the essence of his developed “hybrid model” that combines both the SD viscoelastic/plastic VGT analysis method and FD fast Fourier transform (FFT) analysis method together with a comparison against the traditional time-domain statistical correlation analysis.

It is described in 10 steps in the English language instead of using mathematical equations to explain it. In this article, he has applied both the SD-VGT operations (steps 1-7) and the FD-FFT operations (steps 8-10). As a result, it is aimed at readers who do not have an extensive background in those academic subjects of engineering, physics & mathematics.

The first step is to collect the output data or symptom (strain or ϵ) on a time scale. The second step is to calculate the output change rate with time ($d\epsilon/dt$), i.e. the change rate of strain or symptom over each period. The third step is to gather the input data or cause (viscosity or η) on a time scale. The fourth step is to calculate the time-dependent input or cause (time-dependent stress or σ) by multiplying $d\epsilon/dt$ and η together. The “time-dependent input or cause equation” of “stress $\sigma = \text{strain change rate of } d\epsilon/dt * \text{viscosity } \eta$ ” is the essential part of this “time dependency”. The fifth step is to plot the input-output (i.e. stress-strain or cause-symptom) curve in a two-dimensional space-domain or SD (x-axis versus y-axis) with strain (output or symptom) on the x-axis and stresses (time-dependent inputs, causes, or stresses) on the y-axis.

The sixth step is to calculate the total enclosed area within these stress-strain curves or input-output curves (i.e. the hysteresis loops), which is also an indicator of associated energies (either created energy or dissipated energy) of this input and output dataset. These energy values can also be considered as the degrees of influence on output by inputs. The seventh step is the assembly of the area values of the selected periods to compare the “historical

progression and contribution of medical condition” over certain time periods. For the frequency domain, the eighth step is to define a “hybrid input variable” by using “strain*stress” which yields another accurate estimation of the energy ratio similar to the SD-VGT energy ratio associated with the hysteresis loop. The ninth step is to present these hybrid models’ results of (strain*stress) in TD and then perform the FFT operation to convert them into FD. The enclosed area of the frequency curve (where the x-axis is the frequency and the y-axis is the amplitude of energy) can be used to estimate the total FD-FFT energy. The tenth step is to compare these FD energy results against the SD-VGT energy results, or even TD energy results.

After providing the above 10-step description, the author would still like to use the following set of VGT stress-strain mathematical equations in a two-dimensional SD to address the selected medical variables:

Strain

= ϵ (time-dependency characteristics of individual strain value at the present time duration)

Stress

= σ (based on the change rate of strain multiplying with a chosen viscosity factor η)
 = $\eta * (d\epsilon/dt)$
 = $\eta * (d\text{-strain}/d\text{-time})$
 = (viscosity factor η using individual viscosity factor at present time duration) * (strain at present quarter - strain at previous time duration)

Some of these inputs (causes or viscosity factors) are further normalized by dividing them or being divided by a normalization factor using certain established health standards or medical pieces of knowledge. Some examples of normalization factors are 6.0 for HbA1C, 120 mg/dL for glucose, 25 for body mass index (BMI), 4,000 steps after each meal, 10,000 or 12,000 steps for daily walking exercise depending on time-period selection, 13 grams to 20 grams of carbs/sugar intake amount per meal depends on time-period selection. If using the originally collected data, i.e. the non-normalized data, it would distort the numerical comparison of the hysteresis loop areas. Using this “normalization process”, we can remove the dependency of the individual unit or certain unique characteristics associated with each

viscosity factor. This process allows us to convert the originally collected variables into a set of “dimensionless variables” for easier numerical comparison and result interpretation.

Note: For a more detailed description, please refer to the “consolidated method” section which is given at the beginning of the special issue.

3. RESULTS

Figure 1 displays the business model of this corporation.

Figure 2 reflects waveforms of both single output and 4 multiple inputs.

Figure 3 depicts the SD-VGT analysis results of two cases.

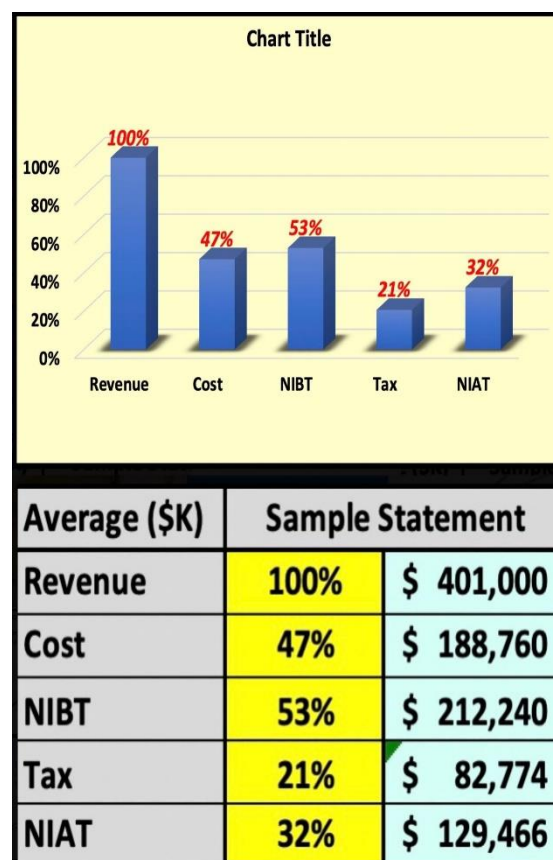


Figure 1: Business model.

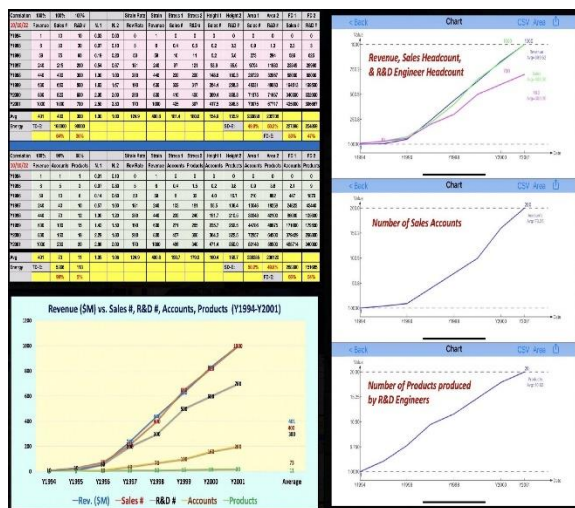


Figure 2: Waveforms of 1 output and 4 inputs.

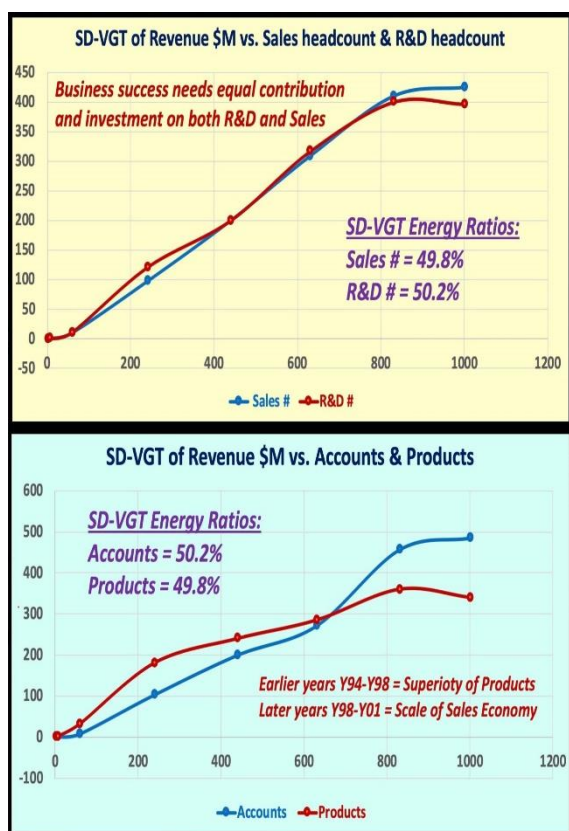


Figure 3: SD-VGT analysis results.

4. CONCLUSION

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5. REFERENCES

For editing purposes, the majority of the references in this paper, which are self-references, have been removed. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclaircmd.com.

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- (1) Special Issue. The GH-Method. (<https://www.theghmethod.com>).
- (2) Journal of Applied Material Science & Engineering Research (contact: Catherine).
- (3) Advances in Bioengineering and Biomedical Science Research (contact: Sony Hazi).

Viscoelastic and Viscoplastic Glucose Theory Application in Medicine

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