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# Optimized Capacity Management Drives Financial Clusters Approach to Linear Programming

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**Abstract**

This paper discusses methods for directly incorporating relationships in resource capacity optimization model. Developing a stable financial cluster needs the economic competitiveness in accumulation income of joint actions from all of the financial industry's participants. To develop the competitiveness growth of the social capital capacity, discovering the new approaches to enhance the market assets is needed. The linear programming approach is one of the quantitative decision-making techniques to find the most efficient use of established business capacities management drives financial clusters. The case study of insurtech in Quebec of Canada and analyses of the earning impact as a criteria provided important insights on the system cost optimize can be located even while the number of clients and working time are limited. The market constrains are developed for optimum use of capacity on the basis of the clustering data of the local financial advisors and agents. According to the model, it is determined that a variety of problems using linear programming, which allows reliable solvability of even very large models, regarding the environmental factors into their decisions in financial industries.

**Keywords:** Financial cluster; Eco-industrial cluster; Optimization Approach; Linear programming; Earnings Impacts; Decision-making; Economic Management; Insurtech.

## 1. Introduction

Industrial clusters are the geographical concentrations of business units engaged in the same sector to benefit from joint actions and collaboration networks. [1] But the other important identification is the development of the industrial clusters that the governmental policies and the collaborative network have an important role to achieve this goal.[2] In the last years, sustainable development became a new topic for industrial clusters. Hence, the eco-industrial cluster is the result of a fundamental organizing framework incorporated under the concepts of economies integrating the principles of industrial ecology, environmental coordination to survive and increase revenue, value and prosperity. [3]

The industrial clusters are in a long way to optimize the economies, and income and eco-industrial clusters, affect the regional and national economy to removes the environmental concerns.[4] One of the main tools of this new approach is the innovative optimization approaches that entered in practical ways. In addition, the cultivation of industrial clusters has become an important point of regional development, consisting of a sufficient number of financial businesses to stimulate and sustain growth are connected to an existing market base, resource, and competitiveness. [5] The business entities in the financial clustering market and services involved in the saving, investment, Funds, Insurance, tax and accounting all are engaged in the pooling of risk. Fees are based on the expected incidence of the risk and the expected return on investment. [6]

Regarding the industry classifications include the North American Industry Classification System (NAICS), financial cluster engaged in financial assets and transactions, they raise funds with respect to scale and risk. Canada has 68 clustering subjects as 51 clusters in a particular locale, concentrated only in concentrated regions. [7] The employment number is not in the large regions, however, it can be found even in smaller regions. [8]

The financial cluster in Montreal was created in 2010 by institutions in the financial services industry to bring together the professionals and to develop and promote Québec's financial services industry.[9] The organization works to enhance Montreal's reputation as an international financial hub and to attract foreign investment in Montreal by promoting various fiscal incentives. To foster the cooperation range of the industry's growth to cultivate an environment to accessing capital for innovative financial entrepreneurship. [10]

The young graduates from and the foreign financial entities in Quebec have competitive information technologic access for finance. The local, national and international influence of Montréal's financial services industry, made a great cluster data analysis because of changes in methodology for business counts over time, and also for the insurance services, as a part of the financial cluster, technology innovations designed to make the current insurance model more efficient. Using technology such as data analysis and artificial intelligence, allows products to be priced more competitively.[11]

## 2. Literature Review

The financial group includes some separated sections as Retirement management, derivatives market. IT services applied to finance, Investment Capital, Entrepreneurship, and engages in international business development activities to attract foreign investment. Due to Montreal has access to a pool of talent that's fed by a world-class education system by more than 200,000 university students, the region is home to 277,000 workers in fields related to science, technology, engineering and mathematics, 136,000 in creation and 341,000 in management and administration positions. But as many other clusters through economy perspectives are not suitable for growth of the national economy but they are evaluable for economy of the region, industry or own economy. [12]

The financial cluster in Montreal has a wide cooperation among a vast range of institutions in the financial services industry as the local, national and international influence of the financial services industry. In addition, ranked 13th in the 2018 Global Financial Centers Index, makes Montreal as an ideal location to set up an intelligent service center for financial institutions. The local business environment facilitates cost efficiencies while leveraging top talent to operate digital transformation by an environment conducive to accessing capital for innovative initiatives and high-performance tools. [13]

Montreal's intelligent financial service location proposition as a large financial ecosystem offers a constant pool of young graduates from universities. This intel88888888ligent hub covers the business environment details, and technologic needs by together.[14] Insurtech identified as the technology designed to boost the efficiency of the current insurance industry by exploring avenues that insurance firms have less motivation, such as using new streams of data, or income optimization. insurtech also is looking to analysis the inputs allowing products to be competitive in risk and price management.[15]

insurtech should also test the potential mathematical models to handle the tasks of brokers and agents to find the right platform for time and income management by a peer-to-peer model to optimize the incentivize positive choices through decision-making processes. [16] The financial industries shift from complex products to optimized methods by time-efficiency. Insurers are creating plans that optimize the additional agents' value on a continuing basis. Continuous agent engagement will start to replace earning impact as the key selling criterion. Due to financial advisers are in a hard and stressful job and a smart platform will provide a transparent, and comprehensive succession plan.[17]

Financial industries are in a phase of digital revolution replacing and data analytics infrastructure to meet the transform digitally with all the value chain partners. An agent has a major role to forecast the customer needs, providing information or training and assessing their risk parameters to get the best quotes. The agents also should interactively evaluate plan options with their managers and the solution is integrated into the big data platform. To manage agents' income in a transparent, and validated by the earning impact aims to revolutionize the way businesses manage and to combine the expertise of the agents and brokers with an innovative technology platform. These new approaches optimize insurance marketing and sell with benchmarking tools that provide a real-time interface to track and manage the financial market. [18]

The earning impact plans act as a catalyst for efficient interaction for helping insurance companies to improve their business and optimize the cost and revenues. They provide agents with new approaches to better choices. The ability to optimize income capacity is expected to be accepted widely in the near future. To manage and to build predictive models of earning an impact. There are numerous models offering solutions to avoid the risk of falling behind the data to manage financial product offerings and provide accurate rate quotes matched to the potential market. [19]

## 3. Methodology and Measurement

The conventional business requirements scheduling systems have gained wide acceptance among production management and control. In this paper, we consider further an aggregate optimization model for the usual assumption that the availability of financial production schedule for most profitable operation subject to various capacity constraints by linear programming. [20] To this end, we gather data of the survey and interview from 45 financial advisors in three subjects of insurance, investment and mortgage advisers in financial institutionsin Quebec.

We designed the questionnaires and we considered the replies to understand that in Canada the financial industries have an affordable market due to the high risk in investment and also the problems related to tax and budgeting in Canada. Then we used the normal scale of linear programing, our model is developed to cover a substantial time horizon to consider and to optimize the financial market conditions, requirements, capacities, and management principles in Quebec. Problem formulation is a process to translating a problem into a mathematical model. [21]

We need to plan a model to optimize selling schedule based in the various assumptions concerning for general economic conditions. Where T is considered as T-norm a minimum sample of agents yielded the number of working hours in three months is taking bythe sum of the absolute frequencies (N) as N=$\sum_{i=1}^{n} f_i$, and the cumulative frequency ($F_i$) in ordered activity list of the function as$F_i = f_i + F_{i-1}$. Then the sample mean by $\bar{x} = \sum_{i=1}^{n} x_i$/n. We reached a time table as follows (table 1), we classified the two different financial products by insurance products (U) and investment and saving (V), that how many hours spend to give a suitable service to a client from marketing process till after sales service step.

**Table 1. Activities comparison**

| | The actions needed to finale a financial deal or service | U/h | V/h |
|---|---|---|---|
| 1 | finding clients, prospecting, presentation, first financial assessment | 5 | 2 |
| 2 | second and other appointment, preparing the information, needs analysis | 4 | 2.5 |
| 3 | preparing the documentation, contract, medical tests, underwriting | 4 | 5 |
| 4 | Inspection, finalizing, and also delivering the contract and aftersales services | 1 | 1 |
| | Total: | 13.3 | 12 |

Then by sample variance of $s^2 = \sum_{i=1}^{n} (x_i - \bar{x})^2$/n-1, and s = $\sqrt{\sum (x - \bar{x})^2 f(x)}$, lead us to find the weight of the criteria of $\sqrt{3.10 - 1.60}$ = 1.5 for the insurance products and $\sqrt{2.90 - 1.89} \approx 1$ for investing product.All the relative frequency of the number of defective items produced per day for a sample of 45 agents in three months is 66 working days. And we compute the standard deviation of the number defective items produced per day is 8 hours, and totally 528 hours. This duration is in 3 months and the ratios of these four main activities. The result is as follows:

**Table 2. Monthly schedule of activities**

| | The actions needed to finale a financial deal or service | Monthly |
|---|---|---|
| 1 | finding clients, prospecting, presentation, first financial assessment | 160 |
| 2 | second and other appointment, preparing the information, needs analysis | 150 |
| 3 | preparing the documentation, contract, medical tests, underwriting | 180 |
| 4 | Inspection, finalizing, and also delivering the contract and aftersales services | 38 |
| | Total Monthly time: | 528 |

Hence, the current capacity management approaches applicable to this methodology involve closed-form analytical calculations, to highlight the ways that various financial industries can benefit from different approaches to capacity management. This method also includes the creative use of full range of advantages, and potential applications to human capacity estimation is discussing in next section. [22]

## 4. Results

Linear programming formulations are given for various levels of model complexity, ranging from a basic product-mix problem to a global aggregate production planning problem.[20] We examine stage-wise decomposition from the point of view of practical computational feasibility and study the robustness of this decomposition. Finally, simplified numerical results are provided as illustrations. The point of a discussion, and in view of result of findings, after interviews and interpret the questionnaires, all the interviews approximately agreed that they are working in a half capacity and they were not satisfied with their revenue.

We analyzed all the data and assign relevant variables in two financial product groups of insurance and also the saving, and investment in last section. Regarding the statistical measures, the criteria weighting of 1.5 for each insurance product and 1 for each saving, and investment was for revenue impact of financial advisers in Quebec. A mathematical model is determined by the number of the two products to maximize the total profit contribution of the agents as: $P = 1.5\ U + 1\ V$, P: Total profit Contribution ($P \geq 0$), U: Insurance Products ($U \geq 0$), V: Saving, Investment and retirement ($V \geq 0$). Hence, the optimization of P can be an objective function of the decision variables of U and V thus:$f(P) = \text{Max}\ (1.5\ U + 1\ V)$

Problem formulation data is based on the results from answers of financial advisers in questionnaires as the average of time to spend for clients in the two product groups. To make a quantities analysis model at financial industries, we need an algorithm as a decision analytical tool, as a quantities method. Regarding the followed algorithm we can make a comprehensive input – output system functioning.

```
The input - output system functioning Algorithm

*M, N are the survey feedback, reply and answering series. *
01: Input at least M of N conditions m1,m2, . . . , mn are fulfilled.
/*M = (1,n), and where the part of the rule after IF is the premise
and the part after THEN is the conclusion or action.*/
/*C1,C2, . . . , CN are the facts that describe the current state of
the activity area.*/
02: IF the agent time > the user established period, THEN k = k + 1
(holding of agent procedures);
03: IF the same object has more than one general product, THEN k =
k+1 (holding of agent procedures);
04: IF the same object has more than one agreement, THEN k = k + 1
(holding of agent procedures);
05: IF the status of object corresponds to “in underwriter: delayed”,
THEN k = k+1 (waiting period);
06: IF the volume of financing < the volume of spent financial means,
THEN k =k + 1 (Amount of financing);
07: IF the amount of financing < the amount of spent financial means,
THEN k = k + 1 (Defects in the project).
08: Get result and send database table results to the experts.
```

Thus now we have the inequalities (constrain of functions), by Time used ≤ Time available, as:

- $5.30 \times U + 2.30 \times V \leq 160$, thus, U= 30.7, V= 70
- $3.75 \times U + 2.50 \times V \leq 150$, thus, U= 40.0, V= 60
- $4.00 \times U + 5.00 \times V \leq 180$, thus, U= 45.0, V= 35
- $1.00 \times U + 1.00 \times V \leq 38$, thus, U= 38.0, V= 38

We can solve this inequivalent system to get the result as U = 25 and V = 18. Regarding the value of feasible solutions, to find the product mix, and yields a value for the objective function, we apply the mathematical linear function of the decision variables due to each variable has a separate term and has an exponent of 1.

## 5. Discussion

Most financial unities and institutions have a hard time minimizing the discrepancies between their capacity and the demands of the market, and most of them are under-utilizing resources. The contribution to the optimized function and the limits should be proportional to the value of all decision variable. The values can correspond to a possible solution. We always fail to balance capacity and to optimize the capacity plan without planning for feasibility.

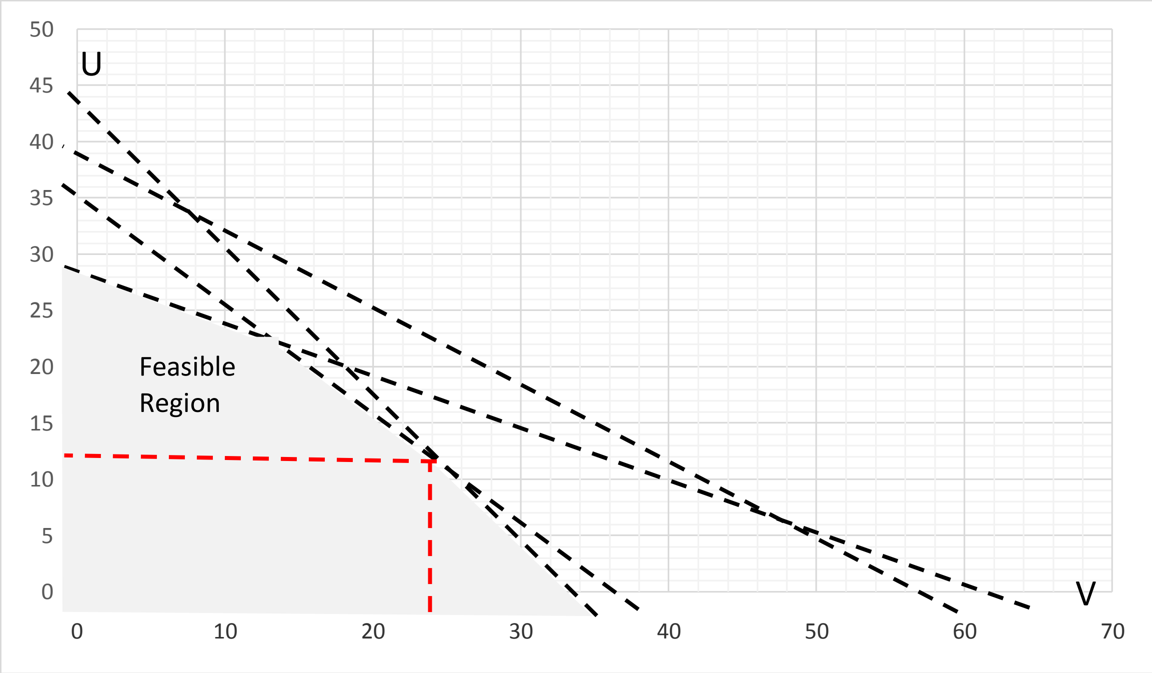


**Figure 1. linear programing for 4 activities**

An integrated planning for production, and working capacity is the key factor to determine the best possible combination of required capacity. For a multi-product industry like financial industry to optimize the available capacity and determine the ideal model uses linear programming to reduce the manufacturing cost guide us to achieve the best combination of capacity, worktime, and market size. In a linear programming problem, a series of linear constraints produces a feasible region of possible values for those variables. [20] The graph of the solution region may be constructed to reflect the new requirements. The shaded area in section A depicts those points satisfying the constraints on the availability of time.

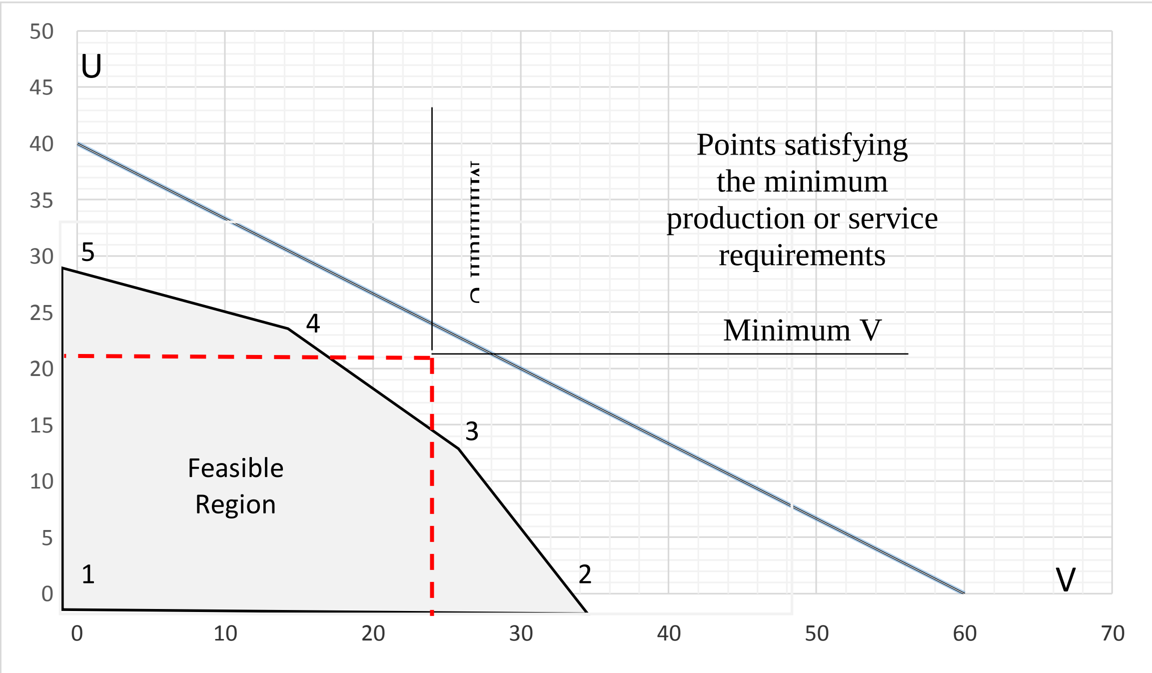


**Figure 2. The feasible reason and the minimum requirements**

In the two-variable case this region is in the shape of a simple polygon. One approach to finding the optimal solution would be to evaluate an arbitrary value for profit contribution and identify all the feasible solutions that yield the selected value. Regarding Figure 2, the shaded area in section B depicts those points satisfying the minimum production requirements, however no points satisfy both sets of constraints. Thus, we see that if management imposes these minimum production requirements, no feasible region exists for the problem. It is due to the resources available is not possible to answer all demands. Thus we have P = 1.5 U + 1 V ⇒ V= 1.5 U – P.

The financial advisers declared that market of Canada has the capacity to have an agent's revenue with new income about yearly 96,000$ gross. Thus, for three months would be 24,000$ income from new clients, thus: 24000 = 1.5 U + 1 V as we had by V= 24000 - 1.5 U. But to find the point in the feasible region that lies on the highest profit line of the decision variables is the optimal solution to the linear program that concludes the optimal combination consists of approximately 17 U and 21 V, then (1.5×25) + 18 = 37.5 + 18 = 55.5 is resulting as profit contribution.

For a linear programming problem with two decision variables, the exact values of the decision variables can be to identify the optimal solution point [23] and then solving the two simultaneous constraint equations associated with it, but for U = 20 and V = 18 we would have:

**Table 3. Redundant constraint**

| | | | | | Required hours | Available hours | Unused hours |
|---|---|---|---|---|---|---|---|
| **1)** | **5.3 × 25** | **+** | **2.3 × 18** | **=** | **160** | **160** | **0** |
| **2)** | **3.75 × 25** | **+** | **2.5 × 18** | **=** | **140** | **150** | **10** |
| **3)** | **4 × 25** | **+** | **5 × 18** | **=** | **144** | **180** | **36** |
| **4)** | **1 × 25** | **+** | **1 × 18** | **=** | **38** | **38** | **0** |

In table 3, No. 3 is a redundant constraint in our decisions. In linear programming terminology, the complete solution tells management that the 10 hours and 36 hours will remain unused, referred to as slack variables makes no contribution to profit; thus, slack variables have coefficients of zero in the objective function. In the standard-form coefficients for slack variables are zero, due to they are unused resources, and they do not affect the value of the decision variables.

But, the financial advisers presented that the insurance products need so much advertisement costs, cancellation, and commissions that should be paid to the introducers. Hence the other extreme points can be the other optimal points on the feasible region. This model also is suitable for input / output method by linear programming to forecast and illustrate the evaluation, and the diversity of applications by optimizing the quantities as an objective. The financial analyst's portfolio problem should restrict the economic capacity limits and potential constraints. Also, the investment funds, resource capacity, the earning impact and budgeting

But due to the Canadian society has a huge level of immigrants and the cultural factors will affect to the model. It means the different origins and cultures takes the different time. In addition, the Location Quotient is a ratio measure of the concentration of a cluster in a particular location relative to the national average, as a measure of an industry's level of concentration within a location, with an LQ > 1 indicating higher than average concentration in that location. Hence, we should affect the environmental positions because of changes in methodology for business counts over time.

## 6. Conclusion

The financial clusters end up paying for costly overall performance of a financial services, and capacity planning is a feasible and optimal for them. In addition, the financial entrepreneurship and global companies, the presence and the development of foreign financial institutions, the promotion of fiscal incentives including tax credit and also the competitive information technology sector for finance can be the other advantages of the optimization of capacities.

In this study, the results demonstrated that an optimized model has evolved and considered three different types of production costs in financial industry and especially in insurance new technics (Instech) along with market demand cost. This model is true when the temporary agents, brokers and advisers are working out of a banking system as the permanent employee. Regarding all constraints, especially the setup of duration of different activities, to find the global optimal solution, the linear programing model is the most appropriate tool to solve the capacity planning problem.

In addition, future studies may extend the proposed model by altering or adding to the points of the value for the significant keys of decision variables to provide a comprehensive solution. Further extension of this research to develop a multi-product solution approach. Here we have considered only linear relations as constraints, but most of the problems seen in practice are non-linear in nature. The non-linear relationship must be added (i.e. inventory and setup cost constraints) among the constraints, as cultural, environmental and social factors.

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