Journal of Turkish Operations Management

RESTRUCTURING GOVERNMENTS USING A GEOMETRIC RATIO TECHNIQUE AND ITS MULTIPLE EFFECTS

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ARTICLE INFO

Article History
Received:29.09.2018
Revised:21.12.2018
Accepted:27.12.2018

Research Article

Keywords:
Geometric Series, Restructuring Organizations, Change Management, Golden Ratio, Geometric Ratio, Strategic Management, Redistribution of Wealth, Budget Cuts, Economic Growths, Governments

ABSTRACT

In this study, restructuring of states according to a Geometric Ratio Technique (GRT) is proposed for future developments. To visualise and simulate the restructuring, a pyramid figure is used with four layers. These layers are identified as 1L, 2L, 3L and 4L from top to down. The layer 1L shows the core size of a state government with all its staff. The power multiplier is 1 and the personnel size is found to be 1.562% of its population. The Layer 2L is generally constituted of security. Within this layer, there are three groups of security namely military, police and others. These security sectors are represented as a whole with a top management. The power multiplier of this layer is 3 and the personnel size is found to be 4.687%. The third layer 3L is research and development (R&D) layer. Currently, R&D layer is institutionally not established well in state governments worldwide. The power multiplier of this layer is 12 and its personnel size is found to be 18.75%. This layer is extremely important for the future. In terms of creating added value, it has 4 fold effects on the economy in positive or negative ways. On the other hand, it has 0.3 fold upward effect on state governments. Sectoral R&Ds in this layer are (a) agriculture, food, forestry, animal husbandry and associated industries, (b) IT, electronics and defence and (c) the remaining sectors. Proportional sizes of these sectors are assumed to be equal. The last layer 4L is production layer. Production of goods and services based on the R&Ds are done at this layer. Again, sectors in this layer are assumed to be equal in terms of quantity and importance. This layer is constituted of skilled and unskilled employees. The power multiplier of the fourth layer is 48 and the personnel size is found to be 75%. Any production beyond the identification of this study is also considered within this layer. A GRT is used to calculate these layers and associated segments. The geometric ratio used is like the golden ratio with 3.39% error. The geometric sequence (2N + 1) is used in expanding and shrinking the layers. Sectors studied in this article are assumed to have equal size and importance. Consequently, extending and reducing rates are also assumed to be the same. Agriculture, food, animal husbandry, forestry and associated industries are studied as an integrated unified

single sector. Finally, current and future developments would require states and large companied to be restructured. Budget cuts, new investments, growths, changes, etc. are always strategic issues of governments. Establishments may expand or shrink their structures. This article shows how such restructuring could be performed according to a GRT. Furthermore, effects and consequences are also calculated with respect to changes in different segments.

INTRODUCTION

Industry_4.0 can be identified as an appropriate combination of IT and electronic defence technologies for various sectors [1-4]. The most basic resource of such industry is a well-trained human resource. In the absence of it there is not much things to do. Financial resources in this case, can only contribute to purchase of the ready-made goods and services. Because of the high competition, only new products offer good margins for the market. The most obvious example of this case is today's smartphones. Only limited number of countries are making the products, but numerous countries are producing their software and spare parts. They are marketing them all overy the World. This could only be possible with a well-structured R&D establishment together with well trained personnel. Hence, governments and large organisations should manage to restructure their states to stay competitive in the future world.

Concepts of the ‘Internet of Things, IoT’ is used by Kevin Ashton in 1999 and the ‘Cyber Physical Systems, CPS’ is used by Helen Gill in 2006, NSF (National Science Foundation) [2,4-9]. CPS will constitute of infrastructures for the IoT for the future industries [11-13]. Currently, many countries are getting prepared for the future manufacturing world by different concepts. Some of these concepts can be stated as Industry_4.0 (Germany), Smart Manufacturing Leadership Coalition (USA), Sustainable Process Industry through Resource and Energy Efficiency (EU), Society 5.0 (Japan), High Value Manufacturing (UK) etc. Whatever the name used, automatic systems and robotics will be highly used in the future. Hence safety, security, quality, reliability, durability (SSQRD) will naturally have greater importance. Then, more personnel should require to be educated and employed in these areas [14-15]. More science and technology will stand out in the next century. The strength of countries will be measured by the ability of technological capabilities and productions.

HORIZONTAL PARALLEL LAYERS

For the next century, we propose building a triangular pyramid structure as sustainable future administrations. The main reason for this is assumptions of "Industry_4.0" and “Cyber Physical Systems”. They mandate also managements of the future. Within this context, there is a certain impact ratio between the two structures i.e. the state and the economy. It is used as a force multiplier for the computations in this study. This multiplier has two effects. One is downward, from the top to the bottom and the other effect is upward that is from the bottom to the top. The general structure can be depicted as a triangular shape as shown in Figure 1 below.

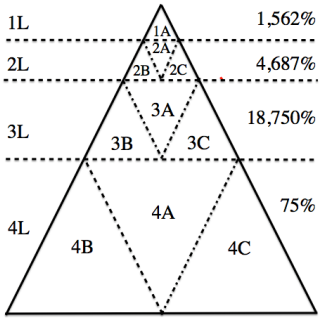

Figure 1. Horizontal Parallel Layers and Related Ratios

Proportional sizes of horizontal layers for the future administrations are generally as follows:

1L: Government-Administration and Staff,

2L: Security,

3L: R&D, Science and Technology,

4L: General economy/Production.

The multiplier ratios of these layers in the overall size are 1,3,12 and 48 respectively. These values are multiples of the golden ratio values with 3,395% error. They can then be assumed roughly as golden values.

If the number of inner layers is to be increased from top to bottom, (2N + 1) series are used. This is also a division by the same golden ratio. N represents the number of layers. If N = 1, the number of units within the layer is 3.

1L: Government-Administration and Staff (1A)

This layer represents the size of a state within a whole economy. Percentage ratio in overall size is 1.562 and force multiplier effect is 1.

2L: Security (2A, 2B, 2C)

The sectors in this layer are;

2A: Army,

2B: Police Force,

2C: Other security related units.

There are three types of security units. Army and police force are established for the security of the public. But the other security organizations can be private and public security institutions with different duties. For example, food safety inspections are carried out by municipalities, private institutions as well as by various ministry staff. The number of security personnel will be higher for this unit. Percentage ratio in overall size is 4.687 and force multiplier downward effect is 3.

3L: R&D Science and Technology (3A, 3B, 3C)

This layer represents a scale of research that has to be done in a country. Multiplier force represents all technological production, techniques and scientists who are engaged in the R&D. The percentage of overall size is 18.72 and the multiplier force downward effect is 12.

R&D departments in this layer are;

3A: IT, Electronics and Defence Sector,

3B: Agriculture, Food, Forestry, Animal Husbandry and Industry,

3C: Other sectors.

The main purpose of this layer is to make R&D, to solve problems and to introduce new products to the 4L layer namely economy and production.

4L: Economy – Production (4A, 4B, 4C)

This layer represents all production sectors in a country. It encompasses 75% of the overall size. In the model there are three basic economic sectors. These are as follows;

4A: IT, Electronics and Defence Sector,

4B: Agriculture, Food, Forestry, Animal Husbandry and associated Industry,

4C: Other sectors like manufacturing, construction, finance, banking, transportation, marines etc.

Percentage ratio in overall size is 75 and force multiplier downward effect is 48.

VERTICAL LAYERS

5A, 5B, 5C, 6A, 7A: Interference of Different Sectors

As shown in Figure 2, there are also interference areas between layers and sectors. It means that sectors are sometimes intertwined. A sector can use many sectors as suppliers or customers. An example is car manufacturing. All parts of a car are produced in many different sectors and assembled as one unified product; a car.

Interference Units:

- 5A: Unit constituted by hmp area
- 5A-1: Unit constituted by $hknl$ area
- 5B: Unit constituted by $fbmg$ area
- 5C: Unit constituted by $fpcg$ area
- 6A: Unit constituted by $afhg$ area
- 7A: Unit constituted by $adne$ area

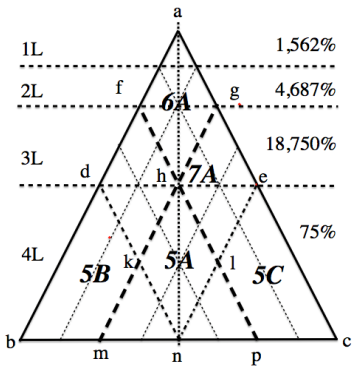

Figure.2: Formation of Vertical Layers

As shown in Figure 2, there are indeed uncertain areas in which sectors cannot be separated from each other at certain intervals. Initiatives in these areas show that sectors actually interact with other sectors and that they receive goods and services from other sectors. Another meaning is that these sectors are made up of sectors that use goods and services that many other sectors have produced. In other words, if the sectors that provide goods and services to these sectors are disappearing, these sectors are going to disappear as well. For this reason, the basic sectors need to be well defined and supported. There are some areas that are independent. Generally, those independent areas represent the basic sectors.

LAYER - 1L

1A: State-Management and Personnel (SMP)

This layer represents top level administration and the staff of all institutions of a state. This is important in terms of personnel management and size. The value in percentage terms corresponds to 1,562%. That is, only 1,562% of the active workforce should be in this unit.

For example, population of Turkey is 80 million. If the number of pupils, students and retirees are deducted from this number, 44 million active workforces remained. Then, the number of senior top level administration staff should be as 44 million X 1,562% = 686,400. This is the number of staffs that should be working as the top level administration of the state.

But there are still such practical problems as the number of teachers. Turkey's population is very young and there are nearly 30 million students enrolled. Hence, there is a need for 561,600 teachers (80 million X % 1,562 = 1,248,000 then 1,248,000-686,400=561,600). This figure may change according to education policies. A state can get teachers employed in 1/50th or in 1/20th ratio depending on its economic strength. This is entirely depending on education policies of countries. The figure given here is just the ideal based on the model. But education policies change the numbers. For example, many courses may be given through electronic classrooms. Students may only use the schools for experiments. Building large educational complexes would be realised based on the technological structures and networks available. Lectures that do not need any laboratory would be given in classless environments with the help of technology. Thus, the number of staffs will decrease very seriously, and the income of the employees will be relatively higher.

The highest number of staffs is teachers. A solution may be that the government should go beyond the classical familiar order for the education. Instead of doing all the courses in classrooms, it is

possible to do many lectures in their homes through active electronic classes. For this reason, the number of staffs can be further reduced. It depends on the preferences of the educational policies in that country concerned. In many countries around the world, the number of staff and the number of people is used for different purposes. Some of these countries see states as a big employer. Rates of public employment may vary according to countries. A large part of the work of the state and private sector would be undertaken with the help of IT technology infrastructure. If the whole infrastructure is organized according to this situation, it could be possible to further reduce staff to 1/1000 (employee / population) for government and private sector. Many jobs can be done with smart machines.

This layer, 1L, has a staff weight of 1,562%. The ratio of impact is very high from top to bottom. The layer affects the closest layer of security 3, the R&D layer of science and technology 12, and the economic layer 48 fold. The decisions taken affect all layers. If the top administration makes a positive decision, 1 unit of development in the first layer affects security 3 times, R&D 12 times and economy 48 times positively. However, in the case of a negative decision, the wave increases in the same way and even eventually creates chaos in the economy at the bottom. The reason of a chaos at the bottom is due to the bad governance of the top administration. Whatever the case, it affects the economy very much. Measures should be taken accordingly.

Another direction of influence is from bottom to up. A recovery in economic figures affects the above management at only 0.3 multiplier. In other words, favourable developments at the bottom level affect least the top management. It is expected that the top administration will have a great influence on the sub-sectors. On the contrary, state administrators are not expected to be influenced by the bottom layers' developments, especially under normal conditions. If there is an opposite situation, it should not be considered as normal.

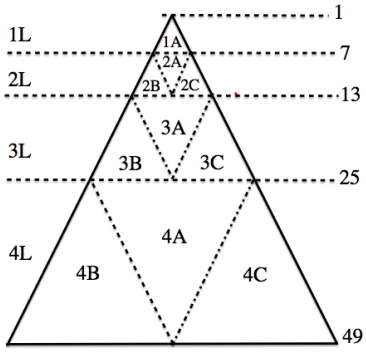

Figure.3: State, administration and staff sizes

To restructure a government, two types of approaches can be used. Firstly, the pyramid can be divided into two equal parts with a line drawn in the middle. In other words, we are proposing to restructure the government model in the form of a (2N + 1) geometric series, in which the President or the Prime Minister (PM) are at the centre. The government structure will be constituted under the prime ministry. According to the (2N + 1) geometric series model, there are seven ministries of which three are executives. These ministries are as follows:

1. Ministry of Security

    a. Domestic security issues

    b. External threats

c. Provincial and local security issues

2. Ministry of Justice

3. Ministry of Finance

4. Ministry of Science, Technology and Education

5. Ministry of Foreign Affairs

6. Ministry of Health and Social Affairs

7. Ministry of Natural resources (Ministry of Agriculture, Food, Livestock and Forestry)

8. Ministry of Economy and Trade

The following ministry numbers are variations of the geometric series. Further arrangements can be achieved by increasing the number of layers, while maintaining the geometric series' structure.

Ministries in Figure 4.a are as follows;

1. Ministry of Security

a. Domestic security issues

b. External threats

c. Provincial and local security issues

2. Ministry of Justice

3. Ministry of Economy and Finance

a. Finance

b. Economy and trade

c. Natural resources; agriculture, food, forestry, animal husbandry and industry

4. Ministry of Science, Technology and Education

5. Ministry of Foreign Affairs

6. Ministry of Health and Social Affairs.

President or Prime Minister centred structure has 7 members in the cabinet including the president/PM.

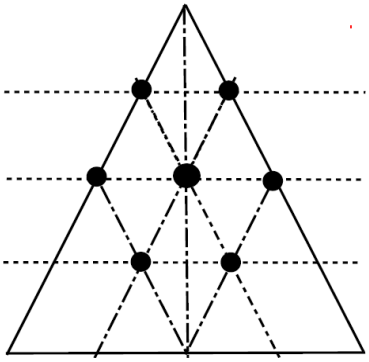

Figure 4.a: President/PM Centred Structure.

Second proposal has nine ministries as is shown in Figure 4.b. These are as follows;

1. Ministry of Security
    a. Domestic security issues
    b. External threats
    c. Provincial and local security issues
2. Ministry of Justice
3. Ministry of Finance
4. Ministry of Science, Technology and Education
5. Ministry of Foreign Affairs
6. Ministry of Health and Social Affairs.
7. Ministry of Economy and Trade
8. Ministry of Natural resources, agriculture, food, forestry, animal husbandry and industry

In this case, president or prime minister centred structure has 9 members in the cabinet including the president/PM.

In this structure, head of the centre is the president or the prime minister. Ministries work only as secretaries. They are bureaucratic structures with non-authorized responsibilities. The advantage of this structure is that it has a very fast decision making mechanism. Major disadvantage is that ministers never take an initiative and responsibility to act on a matter. The system is entirely dependent on the president or prime minister in the centre. It is a restricted form of government with the success of a President or PM.

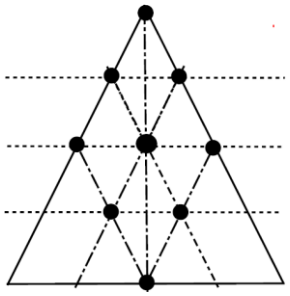

Figure 4.b: President/PM Centred Further Structure.

Ministries in Figure 4.c are as follows:

1. Ministry of Security
    a. Domestic security issues
    b. External threats
    c. Provincial and local security issues
2. Ministry of Justice
3. Ministry of Finance

4. Ministry of Science, Technology and Education

5. Ministry of Foreign Affairs

6. Ministry of Health and Social Affairs.

7. Ministry of Economy and trade

8. Ministry of Natural resources, agriculture, food, forestry, animal husbandry and industry

In this structure, there is only the Ministry of Justice in the centre. Differences from the other structures are, first of all, ministry of justice controls the legality of all activities to be carried out. For this reason, administration of the system works relatively slowly. Because of the rule of law, all ministries take responsibility and take initiative. To make sure that all the decisions to be taken are within the law, things are going a little bit slower. With respect to the other proposals, there is no quick decision making mechanism. The ministries do not work just like a secretary. They use all the authorities and responsibilities in the law. The president or the prime minister relatively in less control of ministers.

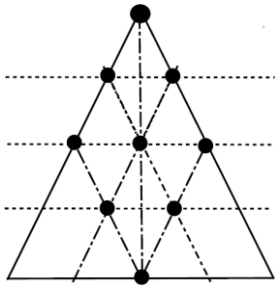

Figure 4.c: Presidency/Prime Ministry at the top, Ministry of Justice at the centre with nine ministers

Thus, the total number of ministries is nine including the prime minister or president. Fewer numbers will affect the ministries to be more effective in their performances. Furthermore, some current problematic areas under different ministries will disappear. The ministry concerned will produce the best integrated solution in its area. Thus, the bureaucracy in administration will be minimised.

In the case of increasing ministries, seven more ministries can be established in the next level. In this case, the names, duties and responsibilities of the ministries are determined by the head of state or the prime minister. Because these ministries will never be active/investor ministers. Only one higher-level ministry's works will be shared. The other feature of these ministries is that they should be superiors of closest sub-layers. In other words, they are the intermediary ministries that will transform the problems from the bottom to the upper level ministries in a more organised way. These ministries also have to be the superiors of their subordinate ministries. All the jobs coming from the bottom will be solved in these ministries or the solution will be found in cooperation with the upper tiers or eventually with the initiative of the prime minister. In this model, the total number of ministries is suggested as 15, including the prime minister. This structure is a geometric structure. Each layer grows geometrically. At the same time, responsibility areas and authorities are divided accordingly. In this model, every kind of growth has to be according to geometric series. Through this way, ministers and workload of the ministries will be optimized. The construction of a very large ministry creates not only an easy solution but also many unrealistic

bureaucratic problems. The initial aim is to decrease the number of ministries to work faster. But on the contrary, decreasing the number of ministries without decreasing the workload will result in problems. Generally, 15 ministry model shown in Figure 3.d is not advised. Sustainable model seems to be the one which has the ministry of justice at the centre and the president or prime minister at the top with nine cabinet members.

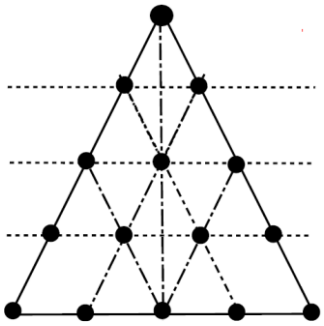

Figure 4.d: Presidency/Prime Ministry at the top, Ministry of justice at the centre with fifteen ministers

The 1L layer shows the institutional structure of the state administration. The multiplier factor in overall size is 1 and the percentage rate is 1,562%. That is, the rate of the state multiplier is 1 and the staff weight ratio is 1,562%. In this case,

a. The weight of the upper layer of the state is 1/9. In this tier, the administrative bureaucracy of the state and the political administration staff should be 1.56/9% or 0.173% of the total number of personnel. But it must be organized efficiently.

b. The multiplier weight in the middle layer of the state is 3/9. The 33.33% of bureaucracy consists of the executive administrators.

c. The total weight of the civil servants is 5/9, which is 55% of the total civil servants.

Thus, the structuring of the state, the establishment of institutions and organizations is optimized.

The overall multiplier factor is 1 and the political administration size is 1,562%. This structure actually has two sides. Political administration should not be expected to affect all levels of the state. If this is the case, this should not be accepted as a normal model.

The first of these two sides is from top to bottom and the second one is from bottom to top structuring and weighting. With the first approach, the effect remains at a very small value. In other words, the state continues its existence as a planner and an organizer.

In other words, roughly consists of institutions that carry out daily affairs of the nation. Political administration that holds the powers and responsibilities of the state has a 1 unit effect as a multiplier of power from top to bottom. Subsequently, it affects 2L-Security layer 3 times, 3L-R&D science and technology layer 12 times and 4L-Economy layer 48 times better. For this reason, downward impacts are strong enough to create enormous effects on the production level. This power comes from the laws and the legislation of the state.

An example of Turkey for this layer is as follows:

Active workforce in Turkey: 44,000,000

Total number of employees for the 1L layer: 686,000 (1/117 employees)

Total number of employees for the 2L layer: 1,975,1182

Total number of employees working for layer 3L: 7,647,693

Total number of employees working for layer 4L: 33,650,000

All of these represent manpower planning in a state. These are all employees of the state and private sector.

In the next century, security workers will be three times more than other employees. This is actually more realistic, although it does seem very outwardly in appearance.

For large companies, the management model is that the president is on the top and the law department is at the centre. Two deputies of the president are seemed to be suitable. For smaller companies, the structure is better only where the president is at the centre of the model. In this form of administration, the president delegates many powers to his sub-units. So, the president only decides on top of the company. Many other day-to-day operations within the company are interested in the subordinate units and solutions are produced by them.

LAYER-2L

2A, 2B, 2C: Security

The multiplier coefficient of this layer is 3 and the weight is 4.56%. Security is to be one of the areas in which states are most responsible and focused. Defence is not only including military and police but also all kinds of technical threats that science and technology have brought to the fore. New security units that are not even mentioned in these areas will be installed in the future. Security consists of three basic segments. These are as follows;

2A: Military Security : (1/4.56)

2B: Police Security : (1/4.56)

2C: Other Security Issues : (1/4.56)

Existing security units must be restructured by the division of tasks. In other words, soldiers, policemen and others must be separated into professional branches. All units should be managed in a single security context.

Among them, highly specialized staff in police, military and other defence areas should protect their place in the future structure. Those that are missing would be constructed. For example, followings are the things that comes to mind such as GMO-modified seeds, various bacteria and microbes, and biological pests that would lead to extremely dangerous epidemic deaths. The first thing that comes to mind is establishment of a virtual warrior unit like hackers, single soldier flying warriors who attack with special aircrafts, the establishment of robot warriors' units, flying robot troops, submarine robot troops, units to fight drones, units for air, land and sea vehicles.

In the next century, functions of the security departments will change drastically in order not to be overwhelmed, especially against threats and attacks of the developed enemies. Future structures of

the security will be made up of functional structures that can make more dynamic and quick decisions.

The types of warfare in the years to come will be power, asymmetry, hybrid, cyber, food and biological battles rather than classical warfare. Nations will be exposed to attack by GMOs for a long time to cause people to become sterile and to destroy extinction or by a major epidemic in a shorter period of time living beings will be destroyed. Therefore, the state will have more security and defence costs and will have to employ more staff for security. For today's security, while the number of direct personnel is less than 1/100, it will be much more in the next century.

With the development of technology, people will be more employed in security and R&D fields. One can make robots defend country to a certain level and use them throughout the production process. But in the R&D process, robots cannot easily be used in the education and training of people, religion and moral values. Especially robots cannot be used to experience moral values. Over the next century employees will have new functions and new business areas. In short, we can call it employment shift.

Today's security model consists of soldiers in the centre, police in the residential areas, private security personnel in various institutions. In addition, new security units have to be established. For example, the virtual attack on an electricity distribution system of a country makes the electricity system inoperable. There is a need to establish a new unit for these and similar attacks. Another example is the supervision and regulation of the vehicles that are capable of moving both at land, sea and air to secure their travel safely.

At present, there is no institution responsible for the legislation as a whole. For this reason, apart from airplanes, it is necessary to create a new legislation and to create laws by creating basic legal sub-structure according to this legislation, to regulate building architecture in cities, to organize especially roads of city planning and then to implement other regulations. Many new units like this should be built and assembled under one administration. The advantage is that all security is managed from one hand. It can be structurally very humble and big. But this problem can easily be solved by partitioning the main sections in itself.

An important feature of this layer is that the state is built on this layer. Another feature is that it ensures all the security of the next levels. In fact, this unit provides the security of the nation and the state. At the top of this layer is the state itself. In other words, the state also secured by this layer. The provision of state authority also depends on the success of this unit. For this reason, although the multiplier ratio to the upward is 0.33, the downward multiplier ratio is 60. As can be seen, the downward effect is much bigger.

For example, considering the active labour force of Turkey, 1.9 million people must be employed in security in the private and public sectors. The number of people working for these areas is already approaching to the identified number. But in the public sector, the number of these personnel has not been reached to the target. In the future, requirements will be even more. This layer could be recommended to be the layer to deal with safety, security, quality, reliability, durability, availability, supportability and maintainability operations.

LAYER-3L

3A, 3B, 3C: R&D Science and Technology

R & D science and technology is actually one of the largest elite human stocks cultivated and owned by a country. The effects of people working in this layer affect the domestic politics, foreign policy, economic development, defence strength and prosperity of the country. Especially in foreign politics it acts as soft power and when necessary it is also deterrent as hard power. Today, having nuclear weapon technology is effective both in hard power and soft power in world politics. The presence and quality of the people of this layer are directly affecting the economy and all other layers of that country. People see it as an increase in income, and an increase in the reputation of the state in foreign policy. The merchant easily recognizes that the unit value of the merchandise it sells is high, that it is competitive, and that it conserves legal rights in other countries. Security forces are superior to other peers with superiority of the technological weapons they use. Governments especially the foreign policy influences, are distinguished by their soft power among the other countries in the world [22, 23].

Results and effects of the existence of R&D science and technology layer in a country are;

1. Trade marks,

2. Technological superiority of the brands they possess,

3. Competitiveness of brands, competition coefficients,

4. The contribution they have made to the S&T,

5. Issuing patents,

6. The technological superiority of patents,

7. Contribution of art, literature and culture,

8. Media and film brands

9. Fairness, justice and the rule of law.

This layer has also binding effect for governors, the legal system and the political regime in the country. This effect occurs indirectly, not directly.

The upward effect of this layer is 1/3 whereas the economic effect is four folds. That is, the growth in one unit of science and technology has a positive effect on the economy 4 times. The other implication is that there is no direct political pressure on the directors of the state. The effect on the institutions of the state is restructuring of the institutions and the speeding up of the communication between the institutions. But the economy is affected four times positively.

This layer is the most important layer of the country as R&D science and technology layer. The multiplier coefficient of this layer is 12 and the weight percentage is 18.75%. The benefit of this layer is that it greatly affects the layers below and above itself. This layer has not yet been institutionalized in any country. The organization of these institutions in the coming years has to be for the security of all states.

R&D Departments at this layer;

3A: IT, Electronics, Defence

3B: Agriculture, Food, Forestry, Animal Husbandry and related Industries

3C: represents other sectors.

The research layer here consists of three main parts. One of these is not a substitute for the other. The geographical area of a country may be very small, the land area for agriculture may not be appropriate. Agricultural production may be impossible wherever it is. But this does not preclude the research for agriculture in accordance with geography.

LAYER- 4L

4A, 4B, 4C: Economy - Production

The coefficient of this layer in the economy is 48 and the weight ratio is 75%. This layer is the department where the goods and services are produced entirely. It is the sector where 75% of the real active workforce operates and the goods and services are produced in real terms. Particularly unqualified workforce where the problem of unemployment resides is accommodated in this layer.

The economic size represents the largest circulation of money in the market. In short, it is the most important segment for a country. There is no alternative to this layer. That is, the economy is where the wheels turn, and production is made.

This layer consists of;

4A: IT, Electronic-Defence

4B: Agriculture, Food, Forestry, Animal Husbandry and associated industries

4C: Other Sectors.

Economy is an infrastructure to the model. Everything depends on the size of this infrastructure. This layer means that if works and things are going well then, the economy works well on each layer. If everything is going bad, it affects everything in other sectors. Because the force multiplier has a great effect. The active presence of this sector has some basic criteria.

These are:

1. Size of exports,

2. Kg / $ value of Exports

3. Product range

4. Brands

5. Competitiveness

These are representing the technological capabilities of the country concerned.

ANALYSIS OF 3L AND 4L SECTORS

3A, 4A: IT- Electronics-Defence (IT-DEF)

Information-Technology (IT) generally includes computing technology. It includes all kinds of small and large computer systems and calculators. Particularly their priorities should be the development of computational systems with organic materials and bio-computation. Leaders of today's calculators: microprocessors, microcontrollers, computers of all sizes, small chips, and computing systems. Today, these technologies are used in every part of the industry.

These embedded systems constitute the core of the production technology called the Industry_4.0. In other words, Cyber Physical Systems (CPS) are shortly called Industry_4.0. There is a part of these computational systems in all kinds of products. In short, it includes mathematical computational technology. On the other hand, rapid communication and operation of these systems are among the demands of the industry. The most prominent example is that the electronic components used in communication systems are very important for these areas because of the high operating frequencies of the chips, the high number of packets for digital communication and the packet sizes reaching 10^{24} bytes.

The other technology group is analogue electronic technology. Analog technology is introduced into every part of our everyday lives, small and large. In the future there is not yet a technology that can be used in place of semiconducting sensors and other sensors. The real-life model bio-sensor research will come to the fore. It will be more important to develop medical systems, to produce organic artificial organs, and to shorten the response times of systems. As a calculation technique, the working model of the human brain will be the ultimate target technology.

The communication section of electronic technology works by using the substructure of today's internet, wired and wireless communication systems. The infrastructure of these systems is fibre optic systems. In the future, visible light communication in the visible light region within the limited volume for wireless communication will come to the forefront.

But there are communication systems that will revolutionize the future. These are;

1. Free space light communication,

2. Laser free scattering communication

3. Hadron scattering communication

For this reason, future technologies will be used in all areas of the industry for a wide range of purposes.

More important for the future is the design of Hadron systems operating at 10^{24}Hz. Their operating frequencies can be up to 10^{42} Hz if the Planck time constant is taken into account. According to our work, there are theoretically working particles up to 10^{94} Hz. The other important area is systems working (response) at $1x10^{-12}$ s and very low frequency of $1x10^{-12}$ Hz. [16]

Another technology group is defence technology. Defence technologies are not simply pure technology. It consists of complex and complex industrial products containing many areas. For example, gasoline. Gasoline is actually a simple organic hydrocarbon origin. You can use it as a fuel for vehicles, for fire in battle or as an explosive device. You can still use poisons as medicines in treatment of patients, you can use them as weapons in battlefields.

One more example is bread. Breads are simply produced daily commercially and commercially consumed in the industrial society. But to produce defensive bread, it is produced to last for a year instead of daily bread production. In this case, the bread that is seen as a simple nutritional food vehicle becomes a very strategic industrial product. In this case it serves the defence area completely. For this reason, this sector indirectly affects every part of the industry either directly or indirectly

In history and today, many industries have entered our everyday lives while developing for defensive purposes. It is not easy to count them all. For example, ax is simply produced as a defence weapon in history. But nowadays most of the time it does not utilised except cutting wood and

trees. Moves, seem to be very irrelevant but have been used for entertainment purposes. For example, psychological warfare, advertising, scientific, public engineering purposes etc. can be considered. Innovations in defence products are also commercialized as an economic product for the society. Thus R&D expenses are also included in the area.

This part is the core of what is called high tech. Many other machines, instrumentation and production machines used in other industries are developed with the technology produced here. For example, many capabilities of nuclear physics technology are used in the field of imaging, magnetic resonance and in the operating rooms.

Some of these researchers should be slightly different from the others. Researchers working in this department should be well equipped to understand the problems of agriculture, defence and other sectors as well. Every new product developed here should be made available for other segments.

As can be seen in Figure 5, there are interferences between layers. Number of simple and pure layers is very small. Some areas in some layers may develop as contributions from other areas. This means that it should be considered as R&D products that work in the field of technology that has not yet been identified.

3A IT, electronics-defence R&D division conducts 25% of its direct researches for 4C. Section 4C also has abilities to use any kind of research results in section 3A. Section 3A is a department that is in the center. For this reason, other sectors benefit from the results of the R&D studies done here.

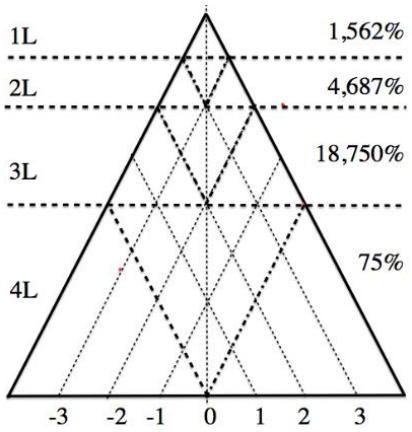

Figure.5: Sectoral interferences of the layers

25% of the section 3A is doing direct researches for the other section 4B. It uses technologies produced here directly. 50% of the section 3A R&D division has to research continuously to produce new technologies as a core regardless of other sectors. The division has a capacity to produce high technology as core. It is not so wrong to call it the most important for this reason.

IT, electronics and defence are 25% economic size. But it is at the center of the economy. This economic sector meets all kinds of technological needs of agriculture and food and also meets the needs of other economic requirements.

50% of 3A services to agriculture and other sectors. The other 50% should be independently producing continuous technology. Technologies produced here are shared with every other segments. Although it has a size of 25% in total, it affects the other 75%. In another view, 75% of the country is in need of this part.

3A's core competence is to research and develop technology and products for all sectors outside of itself. It is to search for new products that are not continuous in itself and to commercialize products in 4A by commercialising research results for 4A section.

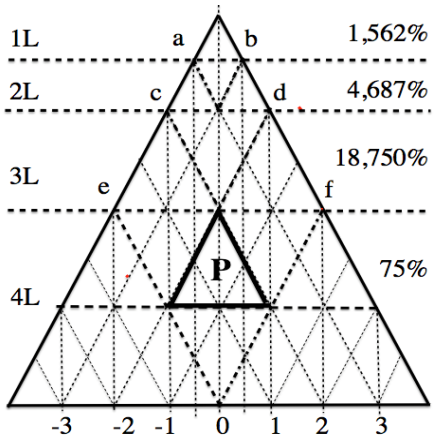

Figure.6: Sectional clustering and the location of money (P)

Figure 6 may represent clustering of sections in Layer 4L. It represents all finance sectors in the Layer 4L. The size is 1/12 of the 4L layer. This magnitude represents the size of the total economy. According to the model, the amount of money in circulation may be at least 6.25% and at most 12.5% of the total economic value. It is here assumed that all financial activities are related to the real production of goods and services.

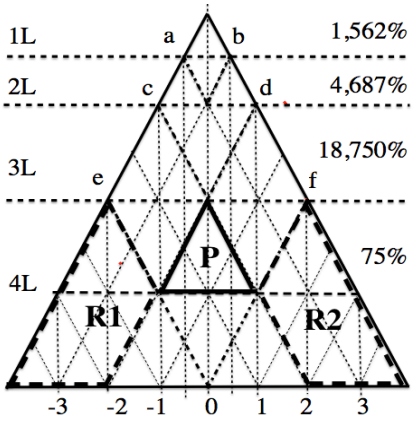

Figure.7: Basic sections in the Layer 4L

The R1 and R2 clusters shown in Figure 7 are basic sections in the layer 4L. These are basic clusters that produce goods and services in the other intersections. The magnitude in the economic size is 50%. The remaining excluding P is 41.6%.

3B, 4B: Agriculture, Food, Forestry, Animal Husbandry and Associated Industries

The purpose of 3D R&D section is to provide all kinds of researches for production in Section 4B. That is, it is responsible for resolving production problems in 4B segment, conducting research that will improve yields, and doing all kinds of R&Ds to produce new products in Section 4B.

This industry is vital for the survival of all living beings in a country. The main objective should be to produce all kinds of agricultural products needed in a country safely and adequately. For this reason, it is necessary to take all kinds of precautions to ensure life safety of all living beings. Among these are to proper use of agricultural land and to protect soil from being contaminated by all kinds of chemical substances. Thus, keeping the sustainable agricultural areas clean and protecting the existing ones are main objectives. It is not hard to understand no land no life criteria.

An important issue is food safety. Most of foods originate from agricultural products. Some foods have been consumed immediately after being harvested. Fruits and vegetables are the first to come to mind. There are also products manufactured as industrial products. These include all kinds of biscuits, pastries, pasta, different types of durable breads, canned varieties and all kinds of marmalades on market shelves. It is not possible to put a limit on the numbers of these things. Because people in every geography have different products according to their tastes. It is a very important issue to provide safety and reliability for these products.

Another area is forests and forest products. Forests encompass many associated areas. Trees and wild plants are main elements. But there are also many forest products depending on them. For example, wild animals' and even pets' natural nutritional areas are forests and forest products. Forests are also habitat of all wildlife. They live and survive thanks to forests. All kinds of birds, insects, butterflies and bees are also inhabitants of forests. It is necessary to protect habitats of wild plants. The presence of these creatures makes people live. People owe their lives to them.

Environmental pollution is another issue to be careful about. In particular, air pollution. Thanks to forests, the oxygen needed to live in the air is produced. It also makes a great contribution to regular rainfall by softening the climate. It prevents destruction of agricultural lands. Forests have similar environmental effects. It is a very important natural phenomena for living beings.

Animal breeding is a basic source of food. There is still not any technology to substitute animals. As examples, meat, milk, yogurt and related industrial products can be given. Animals are in fact conversion plants that turn grass into milk, meat and other products. Thanks to these conversions, people can live on. It's not only the pets but also wild animals that sustain the life. This is a holistic cycle. No one is trivial than the other.

The main objective of this section is to investigate, safely develop and improve all kinds of agricultural products not mentioned above. It is also to solve all of known problems of agricultural sector and present new products. This section has to be constantly innovative. Raising safe seeds for agriculture throughout R&D, theoretically producing harmless drugs for plant diseases, increasing productivity of animals and producing drugs against animal diseases are primary targets. On the other hand, it is to produce industrial healthy products and to produce technologies that provide safety.

Industrial plants are also grown in agricultural fields and especially in forests. For example, chemicals produced from opium, sugar, vegetable oils. Many of these are used as medicines in a controlled manner. For this reason, the presence of wild plants must also be protected. All of these products are among products of the agricultural industry.

As a whole, agriculture, food, forestry, animal husbandry and associated industries has 25% of the weight including the private sector. While this sector constitutes 25% of the workforce in a country, unqualified ones are employed in a wider range than others. It is therefore a major contribution to the problem of unskilled unemployment. For this reason, this sector has a wide effect within economic activities. The weight of this section should not exceed 25% of total production.

In a country, the entire food chain, all restaurants, bakery, grocery stores, food factories, transportation and associated sectors occupy a great place in the real economy. In another point of view, countries without high-tech capabilities can survive thanks to this agricultural sector.

The 4B triangle represents the size of unskilled workers of business. This segment consists of segments that are blue-collar and completely dependent on the human work power. It contributes greatly to the utilization of the active human power in the economy. This section has lower fees and incomes from other sections. In particular, businesses with low economic values are owned by their owners. These small entrepreneurs may also find a seasonal job in case their profitability is very low. Other family businesses also profitable with respect to the technology they are using and the closeness of their products to markets.

Within the 4B area, 25% of employees must be absolutely qualified with respect to remaining 75%.

The effect on the overall economic scale of agriculture, food, forestry, animal husbandry and industry are 37.5%. It takes 12.5% service from IT-electronics defence and R&D. This means that in order to keep agriculture in operation, 50% of agricultural workers must be qualified. However, in this case, only 25% of the agricultural workforce, will have 37.5% effect in the overall economy. It is unlikely that the agricultural sector will be successful in other cases.

In the 4B sector, unskilled workers are over 50%. Nonetheless, those who are secretly experts but do not perform R&D constitutes the remaining 50%. One can say that they are invisible agricultural experts. If at least 50% of the employees are not made up of well-trained farmers, it is not possible to produce goods in economic size and efficiency. In such a situation, it means that a production does not have a competitive economic value.

Although there are more unskilled workers in the forestry area, specialists are needed in the field of food production. These specialists do not necessarily have to be educated. This problem is solved if traditionally well-trained personnel are used. This is a priority because the products produced will ultimately appeal to the taste of countries and nations.

The top of 4B section consists also of experts. In this area, 50% of them are unskilled, while 50% are skilled workers. This segment has more strategic areas as follows:

- Seeds
- Breeding of domestic animals,
- Increasing the productivity,
- Increasing the yield and diversity of fruit and vegetables,
- Increasing the quality,
- Detection of GMO products,
- Hybrid seeds,
- Diversification of forest products,

- Protection and enrichment of fauna of wild plants

- Development of organic pesticides.

This includes R&D 2/20 employees and 1/20 employees from IT, electronics and defence production employees. In other words, 3/20 high level experts of the economy must work for this sector. In this way, the total number of its employees reaches to 7/20.

Turkish figures can be given as an example. Turkey's current population is calculated as 80 million, 82% of this population lives in big cities. In this case, 65.5 million people remained out of agriculture, food, forestry and livestock sector. The remaining is 14.5 million people. This population should be 50% active workforce. That makes 7.25 million employees with at least 50% of experts. The active working population is 44 million and 4/20 of agriculture, forestry, food and animal husbandry with associated industries can only cover 20% of workforce requirement. In this case; 44 million X 0.2 = 8.8 million people should be working for this sector. However, the current number is 7.25 million people. From this computation, we realise that there is 1.55 million expert shortages for the section.

Number of staffs in the layers are;

Total number of employees for the 1L layer: 687,000 (1/117workers)

Total number of employees for the 2L layer: 2,062 Million

Total number of employees for the 3L layer: 8,250 Million

Total number of employees for the 4L layer: 33,000 Million

The distribution in the 4L layer is;

4A = 11 Million

4B = 11 Million

4C = 11 Million, workers are needed.

The active workforce in 4B of Turkey is 7.25 million but the need is 11 million. There are clearly 3.75 million shortage. With the other R&D segments, there is 6,50 million active workforce shortage. If 3B (2.75 million) is included, totally (3B + 4B) = 13,75 million active manpowers are needed. This represents the whole of 4B sector in total. In Turkey, the total population besides the big cities is 14.5 million. Since this active work force is not balanced among 4B, and because of the shortages in the number of experts, the country is in a state of difficulty. This can also explain the need of importation of agricultural products.

Problems arise when experts and R&D personnel are added to these numbers. Agriculture, food, forestry, animal husbandry and associated industry workers should contain 50% experts of the time. This means that with 5.5 million specialist farmers, 3.2 million industrialists and 2.3 million R&D employees at the production level, this sector will then suffice. Turkey, as an agricultural and self-sufficient country, has failed because of lack of planning.

In today's developed countries, 4B service sectors are growing disproportionately. In the undeveloped countries, 4B is as large as disproportionate. Neither of these should be acceptable. The service sector is presented as off the agriculture sector. But in reality, agriculture also has an industry. For example, many sectors can be added, such as food factories, ready-meal factories,

restaurants, bakery factories, markets, many shops, agricultural machinery factories working for the agricultural industry.

According to our assessment, the size of the agricultural tracts in production in the 4B area must be at a reasonable level. In other words, the state must absolutely prevent the agricultural companies from both being very small and unprofitable and from being very large and inefficient corporations. Small organizations operate unprofitably with low productivity, but they cannot produce technology that would harm the public. Bigger ones and cartels can even use their products as weapons to make more and more money. Moreover, they hinder the development of other agricultural sectors in the country. For this reason, the states need to be careful about this 4B area.

3C, 4C: OTHER SECTORS (OS)

These layers encompass all manufacturing and service sectors which have economic values and are active in other sectors in the country. Furthermore, any production or service which have economic value of trade is considered in this sector. Financial sector is also a part of this group.

Other production and service sectors include aviation, marine, automotive, chemical, energy, medical, pharmaceutical, construction, machinery, materials, mining, metallurgy, service, insurance, accommodation, transportation, technology, educational institutions and many other large-to-small sectors. In fact, these sub-sectors can be very independent in the sector with critical values.

The duty of research groups at this level is;

1. To solve problems in production rapidly

2. To introduce new products to the production. It is a duty of this layer that enables new innovations to be added as a product in the fastest way possible for the economy and the market.

Layer 3C is highly intersected and is commercial layer to the economy. Every product and service produced can participate as a new item to the economy and exports. Goods produced in this layer do not have a great deal of security. It means products in this layer do not bear strategic importance. They are usual products that can always be substituted. But if this layer do not work as required then after a while there would not be a manufacturing sector. Size of the manufacturing sector is a matter of today's academic discussions.

Trade, defence, economies and competitive brands of countries emerge from Layers 3C and 4C. Creation of new brands come naturally. Main problems of developing countries are that they can not form this layer properly. Alternatively, they do not prevent this layer from being formed differently by other countries.

In countries where there is no third layer, there is a remedy for unemployment by increasing the number public workers and security forces. Less employees work at the 4L level. Consequently, it results in;

- Low productivity,

- Low wages,

- Low GDP,

- High unemployment,

- No branding,

- No sufficient export ($/Kg is less then the world average),

- Closed economy.

In other words, science and technology are not produced in these countries, and only a certain part of the economy is left to private sectors. It means that other parts are being controlled by the state directly. This means that those who are working in security are also carrying out economic activities as second business. For example, a soldier does both trade and military services. An example can be Egypt. 75% of the economy is managed by the army who govern the state in different names and forms.

Layers 3C and 4C weighs 25% of the overall economy. This is where all economic activities that do not considered in other two sectors are laying.

VERTICAL LAYERS

5A, 5B, 5C, 6A, 7A: Sectors' Interference

Vertical interference areas occur between layers and sectors as shown in Figure.2. This means that sectors sometimes become intersected, and the contributions of more than one sector represent the resulting sectors. Passenger planes, war ships and automobiles can be given as examples of this. There are dozens of different types of computers in passenger aircrafts, hundreds of different electronic systems, GPS, radar, hydraulic and mechanical systems etc.

Interference layers are as follows:

- 5A: Interference constituted of $\overset{\text{D}}{hmp}$ triangle
- 5A-1: Interference constituted of $hknl$ rectangle
- 5B: Interference constituted of $fbmg$ rectangle
- 5C: Interference constituted of $fpcg$ rectangle
- 6A: Interference constituted of $afhg$ rectangle
- 7A: Interference constituted of $adne$ rectangle

As can be seen in Figure 2, sectors can sometimes not be separated from each other at precise intervals, and it may be unclear what sector is involved. This is prevalent in economic activities and production.

5A

The 5A region is a new high-tech segment consisting of 4A, 4B and 4C in the centre. The industrial sectors that are formed in this region are those produce hi-tech products of agriculture, food, forestry, livestock and associate industries. In another approach, 25% of 4B production is produced for 4A. In this sense, it is a very important segment. 4C sector in the 4A sector is producing high value added products that meet very basic needs.

5A-1

This region is the sector which is in the centre of the 4A region and produces 50% of 4A independently from other sectors. In a way, high value-added products formed here are production of self-sufficient sector. This is the core sector of 4A. The 5A and 5A-1 regions are completely independent of any sector, and 50% of the IT, electronics and defence industries, including new researches. In other words, it does not need any other sector outside for its production. This region should be regarded as a strategic core research and production area. It is actually chosen to produce exactly the desired products for the 21st Century. Thus, everything developed and produced in this region will bring about the use of other fields and the export will become more competitive. Everyone working in this area has to be an expert. There are no blue collar workers here. All of the employees are white collared and are producing products that add the value and increase exports.

5B

The outer part of the 5B region is the first layer of the agricultural, food, forestry, livestock and industrial sectors. This sector is composed of 50% of 4B, 1/16 of 4A and 75% of 3B R&D segment. In this area, simple problems are existing. The industry has solved its problems using production and ¾ R&D of 3D, and 1/16 R&D of 3A. This layer is composed of 50% of high value added agricultural products and other products of 4B. However, 50% of the workers here are expert farmers. These experts can also take their problems directly to Ministries'. Decisions of the ministry of this segment are also transmitted to the lower sections without intermediaries. This way is the direct link between the bottom and the top of state administration.

The second layer of 5B, which is adjacent to 5A, is the segment that receives ¾ R&D of 3A and supports ¼ R&D of 3C. This layer also produces products that use high technology in the previous layer and produce agricultural products which have strategic importance. In other words, products that contribute 75% in the 3A sector are produced. That is, the 4B sector receives 66% of R&D support. In this case, the agricultural sector means producing more qualified products. The use of technology in agriculture is more prominent. For this, R&D is being used for this sector, with newly developed organic biological drugs using bio-technologies, GMOs in 4B.

The first quarter of 3A is used for the product R&D from the production of agriculture. Area 3A uses both products from 4B and all products from 4C. On the other hand, they provide 100% R&D support. It also offers the opportunity to benefit from every product produced.

5C

Under the name of other manufacturing sectors, critical products are existing. These are mainly from banking, energy, pharmaceutical and aviation sectors. They have priority and strategic features. Other areas in this segment are associated industrial sectors. But these are strategic territories because of defence of a country and high technology it has.

Accommodation and tourism industry have less strategic importance. It is composed of only activities for the economy when the world and country are peaceful. There is no vital feature of the sector for defence industries. Many similar sectors are in this segment. Most of goods and services of this segment can be provided by developing countries. These goods do also not have high technological features. In fact, kg unit prices for imports are below than 1Kg / 1.5$ rate.

From the other segments, IT, electronics and defence sector provide 1/4 contribution. In other words, ¼ of IT, electronics and defence production directly contribute to this sector. If R&D is

included, other R&D and IT contribute 50% of total sector contribution i.e. together with electronics and defence R&D. Thus, the total economic effect of this sector is 30%. Again, 50% of this sector constitutes a strategic area within itself. Employees are 50% blue collar employees. However, this number is changing according to various sectors. In this sector, the staff structure must be 50% or more R&D experts.

In the R&D segment, the 50% staff is fully self-sufficient and has the ability to make independent research. So, they can search for a product that is not in the market or they can improve a product with more functional and more efficient features.

There are two ways in which decisions reach to the top of governments, as shown in Fig.2. The first one is the outer 5C zone and the other is the 5A neighbouring zone. The problems of these sectors can be communicated to governments without any intermediaries. On the second road, demands from the sector and the institutions' decisions cannot be directly communicated to governments. Views of all the sectors in the relevant area are firstly taken, matured and then communicated to governments i.e. to the related ministry.

6A

The 6A segment is actually located on the area fed by the IT, electronics and defence sectors. In other words, security is fully supported by electronics and defence R&D. Alternatively, security is in need of full support of this section. Thus, any kind of technological support that occurs in the field of security is obtained from this segment. The government is also in the segment.

It is the responsibility of this sector to produce the national technology within the E-government and all other automation systems of the State. As a result, people will use secure IT infrastructure. There are two different intervention sectors, 7A-centered and 6A-adjacent. The prominence of these is the 3B R&D segment and ¼ of the 4A segment are working together. With another assessment, 3B R&D, 4A R&D and the areas used by 3D are in co-production.

On the other hand, another segment is a common area of 4C, 3C R&D, and ¼ of 4A. 3C R&D is based on products produced in ¼ of 4A area. In other words, products in the 4C region are high value added products as a result of joint research. Another meaning is that it represents sectors where strategic products are developed and produced.

7A

Layer 7A represents a reduced state model. In this model, it is necessary to find out things that a state can abandon. If a state is forced to shrink, it represents institutions and industry that should never be abandoned.

These segments are;

a. Security

b. 3A, 3B, 3C R&D

c. 4A.

These three areas consist of indispensable areas for a state and its nation's existence. If 4A is destroyed, 3A, 3B, 3C also disappear. As a result, the security layer 2A, which ensures the existence of the state, will be ineffective and the state will eventually be destroyed and gone. For this reason, it is the core segment. It's a matter of existence or not. This core structure must be preserved in a

large and small way. It must be taken into consideration when states are established. Particular attention should be given to the fact that employees in this segment should be well trained personnel. There is no place for blue-collars in this segment. It is imperative that all of employees are experts. It also represents the elected core staff of the state. The smallest state would be represented within 1L and 2A layers. In other words, the presence of 1L depends on the presence of 2A on where the state is based. It includes the minimum security system 2A, which will protect the state from external and internal conflicts.

Establishment, growth and downsizing the state must also be within certain rules. When a state is established, for the continuation of it, a military power should also be established. In other words, states are sitting on military powers. If there is no state, there is no military power and vise versa. For this reason, these two core structures constitute a state. All other constructions are based on this. The most important function of the other structures is to increase the effect of the state's security and to increase the scope of the people's well-being. The state is established, that is, the 1L layer is formed and then the 2L layer 2A should be formed. Later on, when the state grows, 2B and 2C should be established accordingly. One of these layers is the police security system, and the other is made up of safety experts to protect the health of the people. The term commonly used for this is auditing experts from different institutions.

If the expansion is continued, then 3A, 3B and 3C should be established in layer 3L. If conditions are suitable, it is ideal to install 3A, 3B and 3C concurrently. The superstructure of the state is actually built on this layer. In other words, the state will be completed with the responsibility of the whole organization including R&D supervision. Later, Layer 4L is established, which is the business areas where people will work and earn their life expenses. This category consists of sectors that produce goods and services in free market conditions. The priority area in this section is the area 4A. Having established this area, foundation of the state is considered to be completed. The goods and services produced by this segment are produced by the public who will earn their income on the basis of it. The state will also have taxes in different names to regulate and to cover its expenses. This is one of her financial resources. The healthier this sector is, the stronger the budget is for the state. For this reason, this sector has financially very important functions.

If the state is required to shrink, then the processes of growth should be implemented in the reverse order. Otherwise, the system will crash. Especially the central institutions and organizations are the ones that will be closed last. Priority should start from the peripherals.

Figure. 8a. shows optimum number of personnel that can be in an N = 24 layer system. This could be a company, an organization, or a state structure. These ratios were calculated to maintain the geometric structure so that load and work distribution and staff distribution would be equal.

Here, the total number of personnel or the ratio for N = 24 is calculated as 579. Taking this ratio into consideration, when the number of layers is less, this total number of ratios will decrease to small values. It is enough to work in 1640 active production in shifts. A maximum of 35,357% of the total employees in the institution can be constituted of unskilled employees. Other employees are well-trained specialists. A significant number (about 83%) of the employees in production must have accumulation that can be considered as well-trained experts. But in reality, it is composed of 17,678% of blue-collar workers. They must be graduated from a high school at least.

The other employees consist of 58,54% of well-educated and highly skilled staff. Among them, 20,725% of them must be PhD, R & D experts.

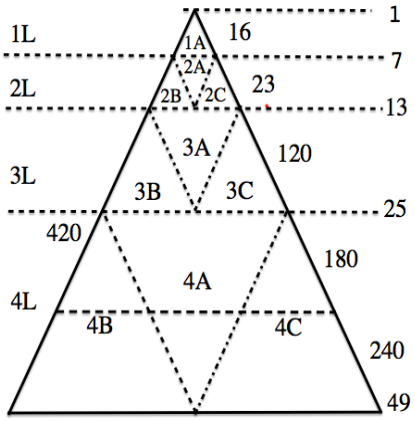

Figure 8.a: Symbolic Employee Numbers for N = 24 (Total: 579)

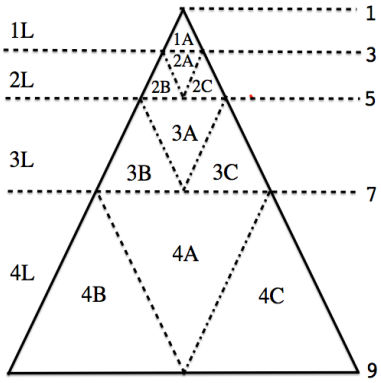

Figure 8.b: Minimum Structure with 25 Employees

For a minimum level N = 4 in the case of no-shift working, a total of 25 employees work. Top management consists of four personnel; a top manager, a secretary, a person responsible from marketing and purchasing, and another person responsible from administration, quality and safety.

In the case of shift working, the same management is sufficient up to 64 active workers in production. Increasing the number of employees in production does not affect management up to a certain number.

84% of staff are involved in direct production. If the number of personnel is limited to 100 then a top manager and a secretary are enough for the management. This structure is not recommended for institutions with less than 25 employees. They are very small family businesses. A senior manager and a secretary are enough for them.

Figure 9 shows vertical sectors that a state will be laid down. These vertical sectors are the ones in the centre of the state. In other words, they represent very important sectors for a state from the left and right of the centre.

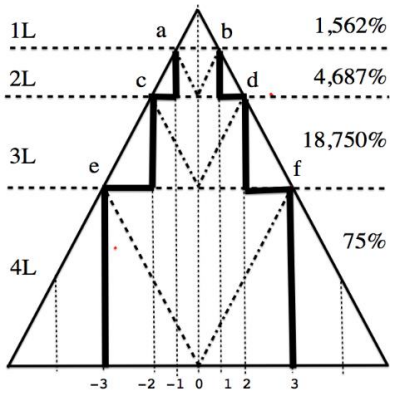

Figure.8: Vertical Sectors in a state (thick lines)

These sectors should always be in the centre. Proportional sizes of these sectors are calculated as 1, 4, 16 from top to bottom. Among the most notable sectors of these areas are 2/3 of 2L, 2/3 of 3L and 2/3 of 4L. This is showing us that if need be, a state and other sector can be shrunk by 1/3 ratio. Final limit of shrinking is the Layer 2L. Further shrinking in state structure would make security issues increase.

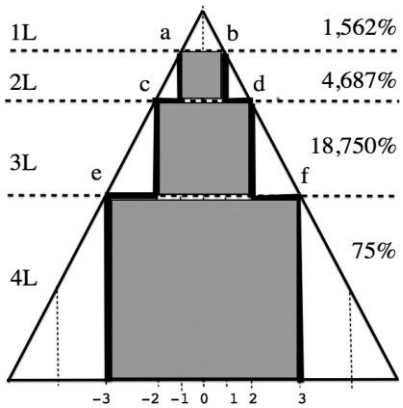

Figure.10: Shaded Area Represents Minimum State Structure

Figure 10 shows the minimum state structure if it needs to shrink. In case of such downsizing, 65% of the state and 35% overall are reduced. The shrinking value is critical. Further shrinkage endangers existence of the state. The downsizing should be done proportionally from 1L, 2L, 3L and 4L layers. Depending on the downsizing, tax revenues and number of personnel would also decrease. In the event of a war, a state needs both money and production of food and defence materials. For this reason, sectors should be well selected by carefully analyzing this contrast.

The downsizing should begin with the sectors in Layer 4L beyond the shaded area. If this shrinkage is not sufficient then the unshaded sections of the Layer 3L would be processed. Then, it should continue to shrink from the unshaded sections of the Layer 2L. Conversely, the same path should be followed in growing. In order to shrink it should go from bottom to the top. On the contrary, to grow, it should go from top to the bottom. Because first the upper legislative structure should be established and then the downstream users should use those legislations.

RESULTS AND DISCUSSIONS

A model for restructuring of future states, for large corporations and for institutions has been proposed. The restructuring of future states is considered as a basic target. However, this model can be used for restructuring a certain number of institutions or companies. These are institutions with at least 25 employees.

The most interesting result obtained is the existence of unqualified personnel that is 17.68%. These personnel are unprofessional and poorly educated in active workforce of a country. In a way, this reality validates the model.

Another important result is that 18% of the employees in R&D sectors are very well-trained PhDs and specialists. This is an inevitable reality in the last quarter of the century and beyond [18].

Approximately 82% of the active workforce in the model should be well-trained professionals. They must be proficient enough to know their profession theoretically and practically to adapt to changing conditions. Blue-collar workers also need to have at least high school graduation. These will work in man-power required jobs where automation is not available nor economical. The blue collars will not be able to work for regular and continuous works because of automation systems.

Power of the states will be based on their economic size, science and technology, and then on the safety of their security systems. Any other circumstance will be a destructive deficiency.

Safety is supported by 2L, 3L science and technology and 4L economic layers. Security of these layers is proportional to their size. Real power will be seen in the capabilities of production in science and technology. Powers beyond this are virtual powers.

Three basic sectors have been selected for the restructuring of states. These sectors can be identified according to relative superiorities of countries and are vital for their nations. But there are such sectors that cannot be substituted as security, agriculture, food, animal husbandry, forestry and industry. They are necessary for the life of all states and all living beings. For instance, if natural environment is not liveable, there is not much to do.

Another vital sector consists of IT, electronics and defence. It is represented by contemporary high-tech, defence industry and security. Safety cannot be substituted by any other sector. As long as states prevail, there will always be security issues.

Importance of 4B sector i.e. agriculture, food, livestock, forestry and associated industries will be even greater in the future. Today, effects of the 4B sector are to be analysed separately. A large part of service sectors is made up of the 4B sector. As a result, the size of employment in the service sector is increasing. Increments can be seen in USA that has reached to 50%, in Switzerland and Germany that have reached to 65% more [17]. There may be an employment shift within the 4B sector. But it must be realised in such a way as it does not distort the overall size. If employment growth under the service sector continues in this trend, the size of production sector in the next century may fall below 10%. In such a case, 90% of the other sectors will be in the service sector at 85% rate. This is in fact due to the shift in employment in sectors 4B and 4C. In short, 4B, as technology and science evolve, is growing in size within macroeconomics. It may be dangerous. All countries have to take precautions about employment shifts. For this reason, macroeconomic position of this sector is reduced in the model. The three selected sectors in the model should have equal macroeconomic values and equal distribution of work force. There may be employment shifts within these sectors. This looks also like a normal shift [19,20,21].

The other sectors, 4C, are contemporary sectors of the time. Every sector here can change. Maybe not even half of today's sectors in the next century would exists. There will be many new sectors.

The sectors that are the most flexible and the most commercial are active here. If high technology is used in industrialization, 4C will shrink and sectors under service sector will grow. Many measures should be taken to ensure that this 4C does not shrink.

The service sector must be defined differently from the current definition. Some "service sectors" are adjacent to the production phase. For example, many sectors such as food factories, bakeries, biscuit factories, canned food factories, grocery stores, cafes, food wholesalers, restaurants and coffee houses etc. are included in macroeconomic service sectors and some are excluded from the 4B. Sectors whose primary source of production is agricultural products are out of 4B. As the service sector, we refer to similar sectors that are not directly related to production such as educational institutions, schools, accommodation, hotels, shuttle services, taxis, insurance etc. These are not a part of production supply chain. These sectors have no direct relationship with food production. Once they are considered as service sector, countries' 4B and 4C are growing. These sectors should be prevented from growing disproportionately. This is the real basic danger for future economies.

For the next century, countries with more educated human resources and knowledge will survive and be better off. The concept of 'great state' will no longer be meaningful with respect to geographical concept. In fact, the cost of protecting large geographical lands will be larger than the gain. So that geographies without efficient economic values will be deprived.

Countries that have qualified human resources for the next century will be the leading centres of science and technology and will be grate states. They will be centres of attraction and others will be peripheral states of them.

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