SYSTEMS MODELING OF SCALAR VARIABLES: A PROPOSAL

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Abstract: When the personal computer appeared in 1970's, all scientists imagined they will do huge calculus, and once for all help to solve the "formula of everything", a lot of computational theories and methodologies were developed. Those computers didn't handle the job and forced the scientists to develop new approaches and some adaptations to their theories and methodologies in the following years. This research is a new approach to "state-matrix-equations" understanding that intends to be a rescue of some of those methodologies and an opportunity to develop and register some basic modeling structures, that could be used in adaptive management.

Key words: Modeling, Scalar Variables, Adaptive Management, Engineering, Technological Education.

1 Introduction

In the 70's, the Modern Control Theory [3], used the format shown in Figure 1 to represent a mechanic translational system (MTS), however hiding some of the very known physical formulas, in that case, $F = m*a$. That's why a new representation was made, as shown in Figure 2. The new representation intends to allow any professional to establish what are variables and elements they work with, based on a Generic System (GS) structure. Both models just give scalar values, they could not represent fields or vectors models, but it can represent a scalar value in a referred space, as a coordinated point (x, y, z), using three different basic models for each coordinate, then establishing the couplers elements.

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At the same time, the Adaptive Management (AM) took its first steps with Holling's book "Adaptive Environmental Assessment and Management" [2]. The Adaptive Management (AM), or Scientific-Based Management is the management methodology recommended for processes with a high degree of uncertainty, in which the chosen technique for modeling of complex systems due to the need for continuous improvement of management and constant changes of ambience, it is imperative and indispensable constant monitoring (data collection) of the key information concerning the activity performed [7].

Nowadays, get the great volume of information and build a database is extremely easier, but build a reliable model to give a fair prognostic still a problem. Some activities like sales, political campaigns or even commerce still struggling to embrace the AM because they cannot realize how useful is this methodology.

This article will transmit some thoughts about systems that their "state-equations" could be identified, and how to built empirical models of scale variables (SV).

2 Formula-Based Physical SV Models

Basic time-dependent models are the tiniest part a complex system, although this affirmative doesn't make them less complicated to define, basically they are formed by absolute state-variables, relative variables, and physical elements, and they could be linked to other systems by coupler elements.

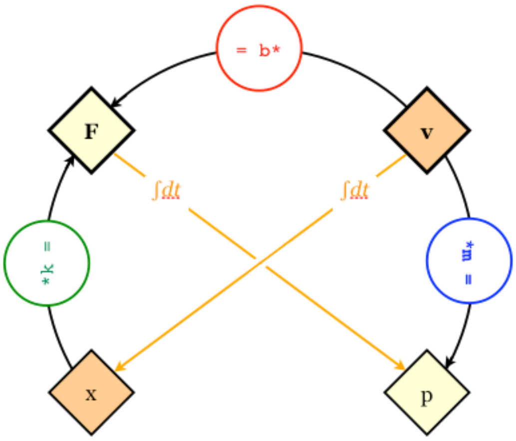
In the 1970's the basic SV model was represented as shown in Figure 1, but as anyone can notice, one of the principal formulas of physics wasn't represented ($F = m * a$), that's why the representation must be developed to have all known formulas in it (Figure 2), and be used as a blueprint for a possible Generic System (GS).

Could be up to three absolute state-variables, all with differential relationships, that variables have the same scalar value no matter where the observer is. They contain some kind of flux, or flow, characteristic. Examples of principal absolute state-variables are:

- force [N];

- torque [N.m];
- current [A];
- volumetric flow [$m^3.s^{-1}$]; and
- thermal flow [W].

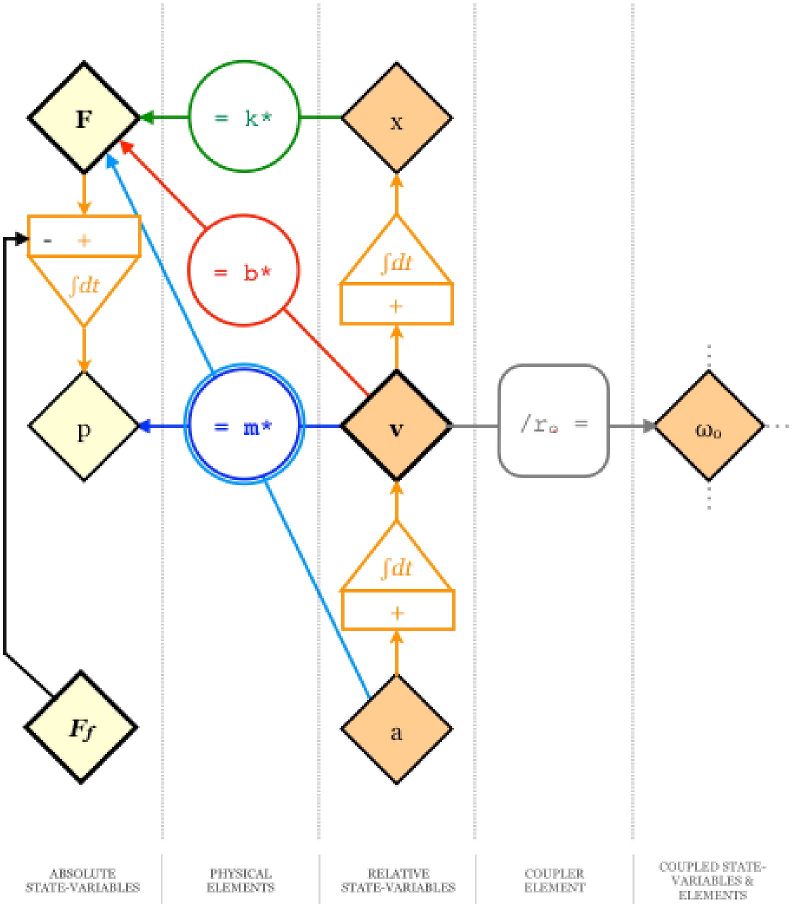
Figure 1: Old Representation of a Translational Mechanical System (MTS) (Source: Author)



The relative state-variables could appear up into three different ways, too, all with differential relationships and their scalar values could be different depending the observatory position or reference. Examples of principal relative state-variables are:

- speed [$m.s^{-1}$];
- angular speed [$rd.s^{-1}$];
- voltage [V];
- pressure [Pa or $N.m^{-3}$]; and
- temperature [K].

Figure 2: New Representation of a Translational Mechanical System (MTS) (Source: Author)



Absolute states: $F = k.x = b.v = m.a =$ force [N] $p = \int F\,\mathrm{dt} = m.v =$ linear momentum [N.s]	**Relative states:** $x = \int v\,\mathrm{dt} =$ distance [m] $v = \int a\,\mathrm{dt} =$ speed [m.s^{-1}] $a =$ acceleration [m.s^{-2}]
Elements: $k =$ spring coefficient [N.m^{-1}] $b =$ damper coefficient [N.m^{-1}.s] $m =$ mass [N.m^{-1}.s^2] = [kg]	**Gain/loss states:** $F_f =$ friction [N]
Couplers: $r_o =$ orbital ray [m]	**Coupled states:** $\omega_o =$ angular orbital speed [rd.s^{-1}]
Potential Energy: $U_t = \frac{F.x}{2}$ [J], $h.F_g$ could be added	**Kinetic Energy:** $K_t = \frac{p.v}{2}$ [J]
Power: $\mathscr{P}_t = F.v$ [W]	

The elements are physical proprieties of the system, they could be a fixed value or behave as a variable. When the fixed value is used, most of the times, they represent an average, to it be possible implies that when it behavior as a variable it has little cyclic variations, most like a tendency. All systems, in a mathematical approach, have all the elements and variables, but when the system begin to look like a field one (thermal or chemical dispersion), may not exist all of them.

An unorthodoxy definition of inertance (or inductance, or spring) coefficient is that it express the capacity of the system to "retain" (or "store") some quantity of absolute state-variable to "try compensate" a relative state-variable variation; and the capacitance (or mass, or inertia) coefficient is that it express the capacity of the system to "retain" (or "store") some quantity of relative state-variable to "try to compensate" an absolute state-variable variation; both coefficients are the system effort to maintain its existence, however, the resistance (or damper) coefficient try to stop the system and reports the internal losses that naturally occur.

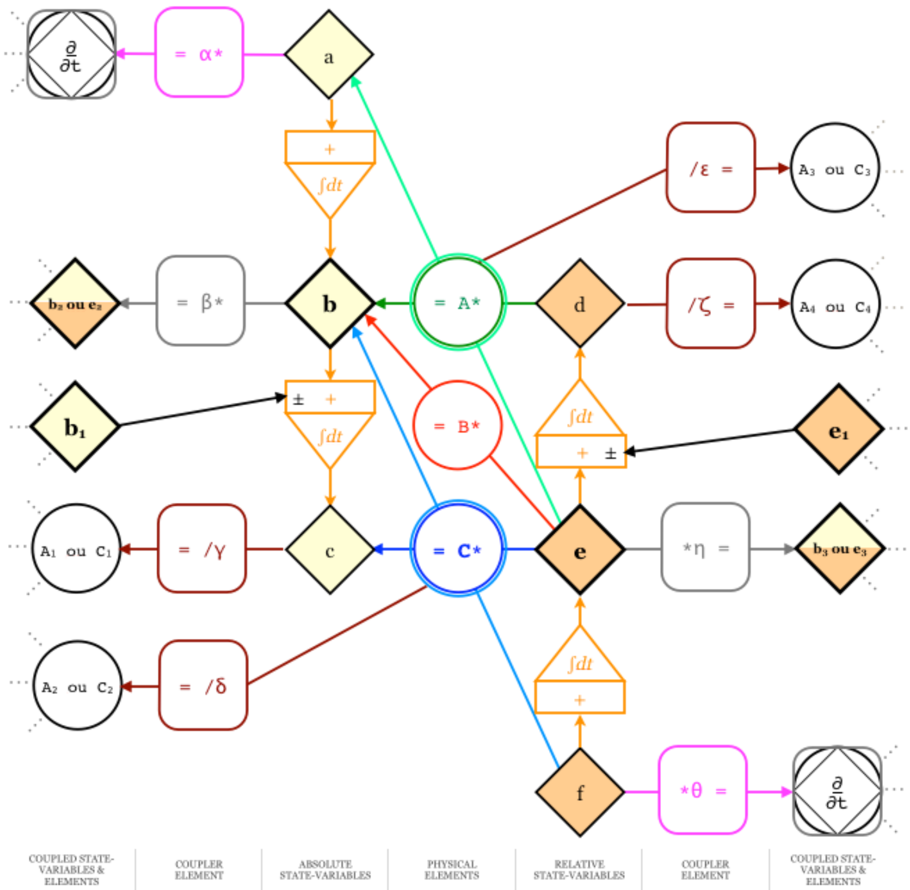
The use of the scalar concept in this research tries to express a one-dimensional quantity, that can be represented by a real number with a unit (in the IS), but also try to express the disregard of the spatial differentials. Spatial variables could be part of another line of this research when it would attempt to develop an "Everything Is The Same" (EITS) basic model for that.

Insights are given by Gordon [1] and Schaefer [4], create the first bond between biological systems and economic (management) systems, and that bond can be easily stretched to others complex systems too, as environmental systems or even political campaign systems.

Complex systems are, no more no less, that an amalgamated of basic systems, in which the modeler try to represent only the most important variables and elements to establish a reasonable size "state-matrix" that could be used.

To develop a "feeling" about absolute and relative variables, the Section 2.1 of this article will show some well know physical models, but most of the students never realize how they could be expressed in the modeling EITS theory. However, first, will be presented the proposed representation of a Generic System (GS) where all systems fit in, including biological and management systems.

Figure 3: Proposed Representation of a Generic System (GS) (Source: Author)



- **Absolute states:** a, b & c
- **Relative states:** d, e & f
- **Elements:** A, B & C
- **Couplers:** α, β, γ, δ, ε, ζ, η & θ
- **Coupled states:** A_{1-4}, C_{1-4}, b_{2-3}, e_{2-3} & others
- **Gain/loss states:** b_1 & e_1
- **Potential Energy:** $U_{gen} = \frac{b.d}{2}$
- **Kinetic Energy:** $K_{gen} = \frac{c.e}{2}$
- **Power:** $\mathscr{P}_{gen} = b.e$

For those who have disgust for differential calculus, just think that the "$\int$" symbol means an accumulated total of variables and the "∂t" means their rate of growth, because this is they really are; as an example, Administrators and Accouters deal with annual revenue and interest taxes, but most all times don't relate their math with calculus, or a fisherman may not see his catch activity as part of a biological system, neither part of a fish business system.

Theoretical models do not assume the existence of the "gain/loss states", forcing the energy sum to be constant and guaranteeing the perpetuation of the systems, however, the proposed GS model (Figure 3) use it, trying to be more accurate to the real need of a real system, than its differential state-equation formula is:

$$\dot{s} = M.s + g \tag{1}$$

where s is the state-vector, and g is the gain/loss vector, that equation also can be expressed as:

$$\begin{bmatrix} \dot{a} \\ \dot{b} \\ \dot{c} \\ \dot{d} \\ \dot{e} \\ \dot{f} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 & \dot{A} & A \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{C} & -\frac{\dot{A}}{A} & 0 & 0 \\ 0 & 0 & 0 & \frac{A^2}{B^2} & -\frac{\dot{B}}{B} & 0 \\ 0 & 0 & 0 & 0 & \frac{A}{C} & -\frac{\dot{C}}{C} \end{bmatrix} \cdot \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ b_1 \\ e_1 \\ 0 \\ 0 \end{bmatrix} \tag{2}$$

, and its results can be applied in the linear differential state-equation:

$$s_{(t+\Delta t)} = s_{(t)} + \dot{s}_{(t)} * \Delta t \tag{3}$$

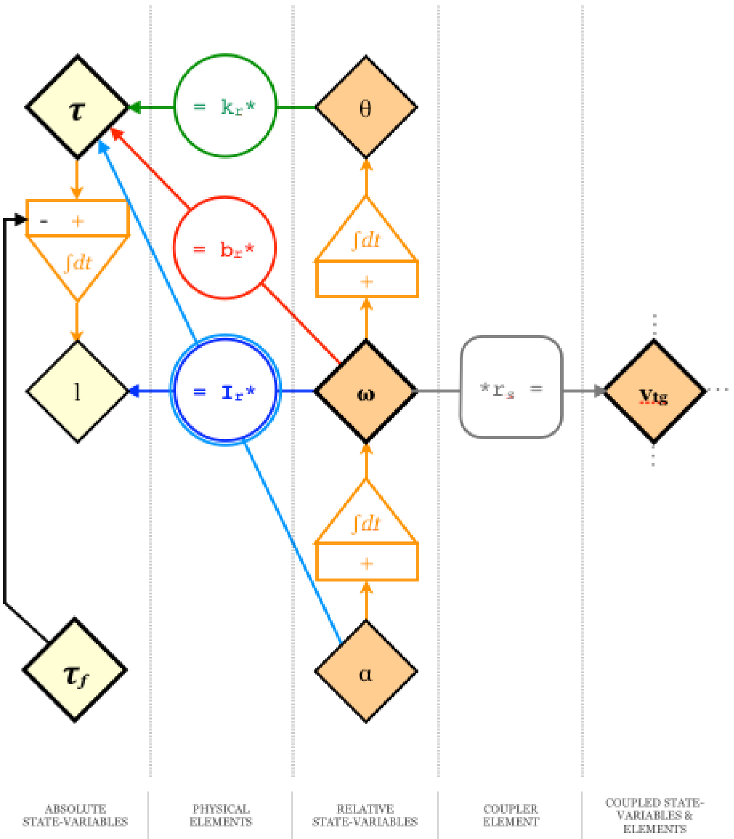
where $s_{(0)}$ are the initial conditions of the system, and $\dot{s}_{(0)}$ is 0 by definition.

The $\dot{s}_{(0)}$ value be equal 0 maybe isn't real but is the best assumption to be used, this will generate in the system model a period called "transient state" in which the system may present some high oscillations in a short period of time before get into its "permanent state". Similar variations appears when one variable get an abrupt change (pulse-step)[1] its values, like a lightning striking a power line.

[1] Take management actions during the transient state sometimes make it more intense and elongated, therefore is preferred use the system prediction to rely on the decisions.

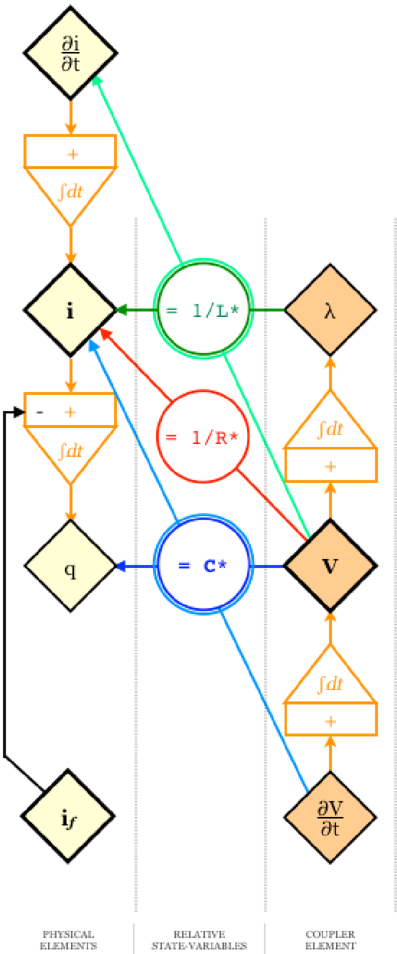
2.1 Well Known Physical Models

Figure 4: Representation of a Rotational Mechanical System (RMS) (Source: Author)



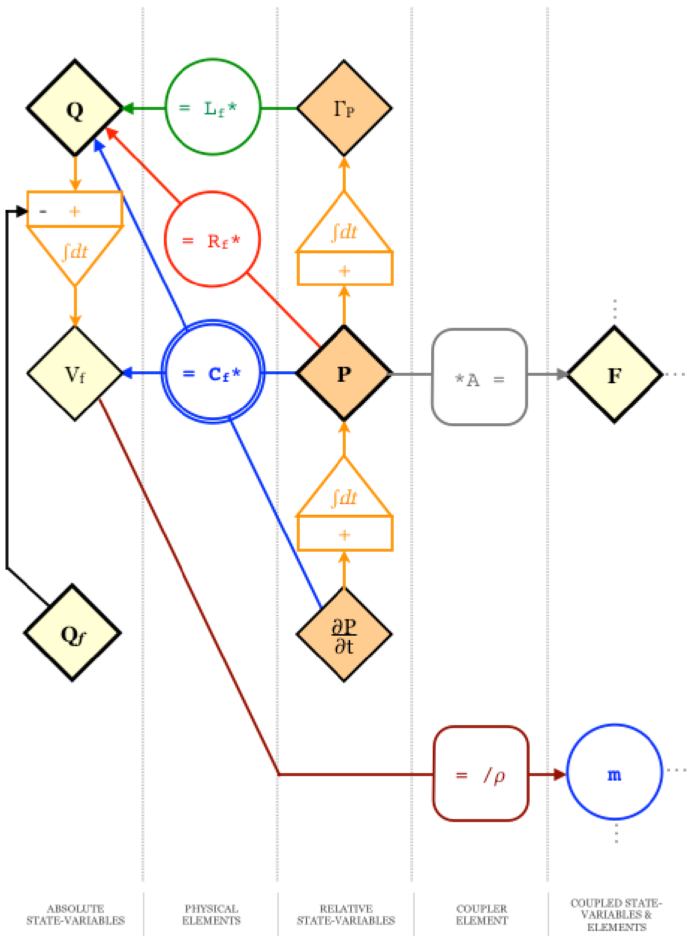
Absolute states: $\tau = k_r.\theta = b_r.\omega = I.\alpha =$ torque [N.m] $l = \int \tau \, \mathrm{dt} = I.\omega =$ angular momentum [N.m.s]	**Relative states:** $\theta = \int v \, \mathrm{dt} =$ angle [rd] $\omega = \int a \, \mathrm{dt} =$ angular speed [rd.s^{-1}] $\alpha =$ angular acceleration [rd.s^{-2}]
Elements: $k_r =$ rotational spring coefficient [N.m.s^{-2}] $b_r =$ rotational damper coefficient [N.m.s^{-1}] $I =$ inertia [N.m] = [kg.m^2]	**Gain/loss states:** $\tau_f =$ rotational friction [N.m]
Couplers: $r_s =$ self ray [m]	**Coupled states:** $v_{tg} =$ tangential speed [m.s^{-1}]
Potential Energy: $U_r = \frac{\tau.\theta}{2}$ [J]	**Kinetic Energy:** $K_r = \frac{l.\omega}{2}$ [J]
Power: $\mathscr{P}_r = \tau.\omega$ [W]	

Figure 5: Representation of a Electrical System (ES) (Source: Author)



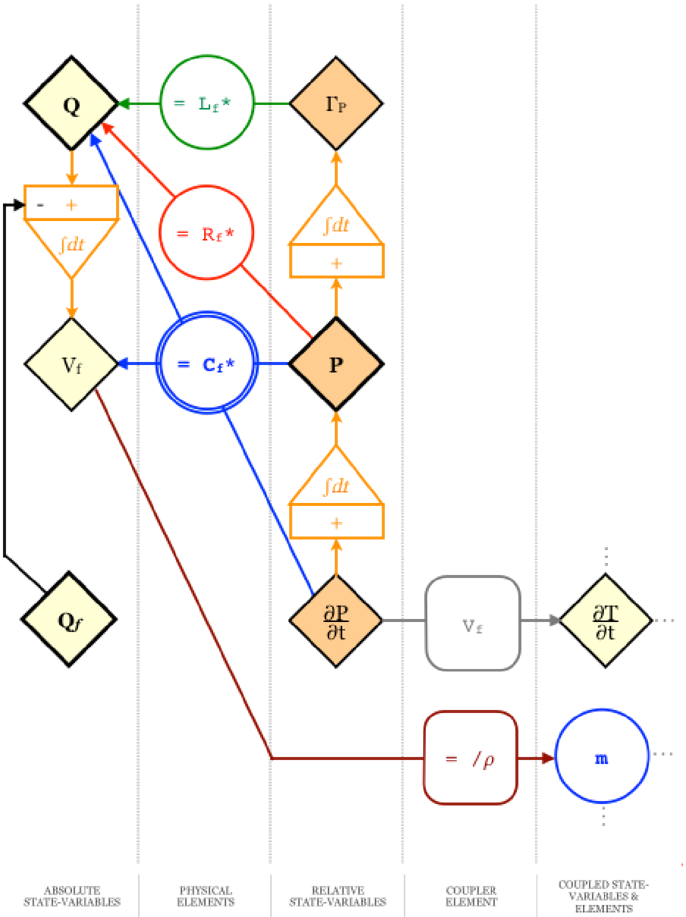
Absolute states: $\frac{\partial i}{\partial t} = \frac{V}{L}$ = current rate [A.s^{-1}] $i = \frac{\lambda}{L} = \frac{V}{R} = C.\frac{\partial V}{\partial t}$ = current [A] $q = \int i\,dt = C.V$ = electric charge [A.s]	**Relative states:** $\lambda = \int V\,dt$ = electrical flux [V.s] V = voltage [V] $\frac{\partial V}{\partial t}$ = voltage rate [V.s^{-1}]
Elements: L = electrical indutance [Ω.s] = [H] R = electrical resistance [Ω] C = electrical capacitance [Ω.s^{-1}] = [F]	**Gain/loss states:** i_f = current fault [A]
Couplers:	**Coupled states:**
Potential Energy: $U_e = \frac{i.\lambda}{2}$ [J]	**Kinetic Energy:** $K_e = \frac{q.V}{2}$ [J]
Power: $\mathscr{P}_e = i.V$ [W]	

Figure 6: Representation of a 2D Fluid System (2FS) (Source: Author)



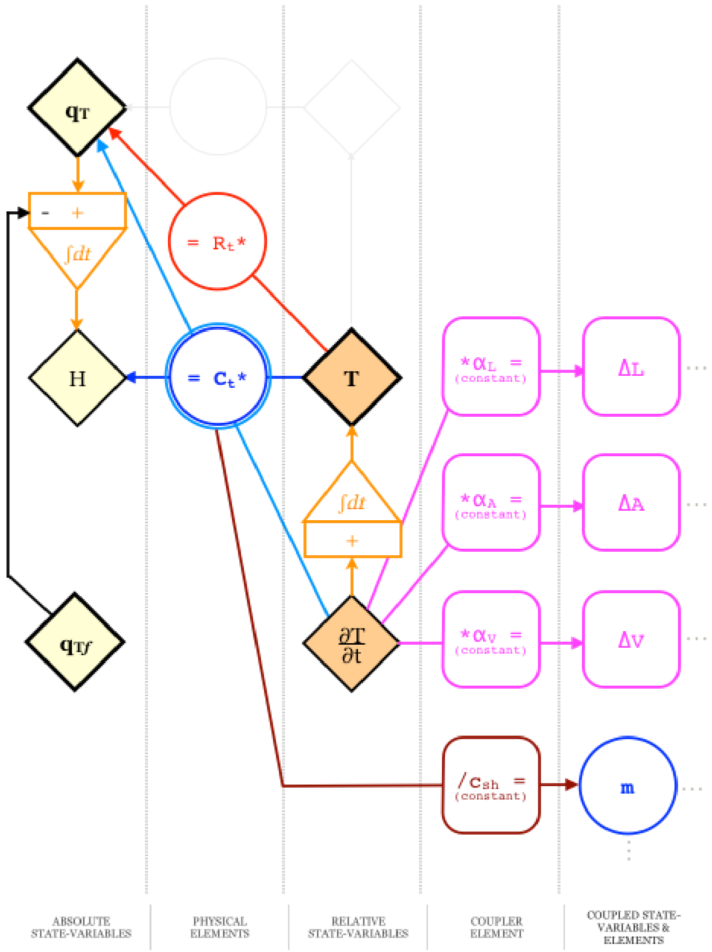
Absolute states: $Q = \Gamma_p.L_{2f} = P.R_{2f} = C_{2f}.\frac{\partial P}{\partial t}$ = volumetric flow [m^3.s^{-1}] $V_f = \int Q\,\mathrm{d}t = C_{2f}.P$ = volume [m^3]	**Relative states:** $\Gamma_P = \int P\,\mathrm{d}t$ = fluid momentum [Pa.s] P = pressure [Pa] $\frac{\partial P}{\partial t}$ = pressure rate [Pa.s^{-1}]
Elements: L_{2f} = 2D fluid indutance coefficient [Pa.m^3.s^{-2}] R_{2f} = 2D fluid resistance coefficient [Pa.m^3.s^{-1}] C_{2f} = 2D fluid capacitance coefficient [Pa.m^3]	**Gain/loss states:** Q_f = volumetric flow fault [m^3.s^{-1}]
Couplers: A = area [m^2] ρ = density [kg.m^{-3}]	**Coupled states/elements:** F = Force [N] m = mass [kg]
Potential Energy: $U_f = \frac{q.\Gamma_P}{2}$ [J]	**Kinetic Energy:** $K_f = \frac{V_f.P}{2}$ [J]
Power: $\mathscr{P}_f = Q.P$ [W]	

Figure 7: Representation of a 3D Fluid System (3FS) (Source: Author)



Absolute states: $Q = \Gamma_p.L_{3f} = P.R_{3f} = C_{3f}.\frac{\partial P}{\partial t}$ = volumetric flow [m^3.s^{-1}] $V_f = \int Q\,\mathrm{dt} = C_{3f}.P$ = volume [m^3]	**Relative states:** $\Gamma_P = \int P\,\mathrm{dt}$ = fluid momentum [N.m^{-3}.s] P = pressure [N.m^{-3}] $\frac{\partial P}{\partial t}$ = pressure rate [N.m^{-3}.s^{-1}]
Elements: L_{3f} = 3D fluid indutance coefficient [N^{-1}.m^6.s^{-2}] R_{3f} = 3D fluid resistance coefficient [N^{-1}.m^6.s^{-1}] C_{3f} = 3D fluid capacitance coefficient [N^{-1}.m^6]	**Gain/loss states:** Q_f = volumetric flow fault [m^3.s^{-1}]
Couplers: V = volume [m^3] ρ = density [kg.m^{-3}]	**Coupled elements:** m = mass [kg]
Potential Energy: $U_f = \frac{q.\Gamma_P}{2}$ [J]	**Kinetic Energy:** $K_f = \frac{V_f.P}{2}$ [J]
Power: $\mathscr{P}_f = Q.P$ [W]	

Figure 8: Representation of a Thermal System (TS) (Source: Author)



Absolute states: $q_T = C_t.\frac{\partial T}{\partial t} = R_t.T$ = thermal flow [W] $H = \int q_T \, \mathrm{d}t = C_t.T$ = heat capacity [W.s] = [J]	**Relative states:** T = temperature [K] $\frac{\partial T}{\partial t}$ = temperature rate [K.s^{-1}]
Elements: R_T = thermal resistance coefficient [W.K^{-1}] C_T = thermal capacitance coefficient [W.K^{-1}.s]	**Gain/loss states:** q_{Tf} = thermal flow fault [W]
Couplers: α_L = 1D thermal expansion coefficients [m.K^{-1}.s] α_A = 2D thermal expansion coefficients [m^2.K^{-1}.s] α_V = 3D thermal expansion coefficients [m^3.K^{-1}.s] c_{sh} = specific heat capacity [W.K^{-1}.s.kg^{-1}]	**Coupled elements:** ΔL = length expansion [m] ΔA = area expansion [m^2] ΔV = volume expansion [m^3] m = mass [kg]
Potential Energy: $U_T = \nexists$	**Kinetic Energy:** $K_T = H$ [J]
Power: $\mathscr{P}_t = q_T$ [W]	

In all systems presented before, is used the time partial derivative ∂t, and not just dt, the motive for that is to give room for all the variables and elements could be space-dependent too. The central idea there is show the by which foundations the EITS theory was build, and give the reader examples of each variable and element type represent.

2.2 Formula-Based Non-Physical SV Models

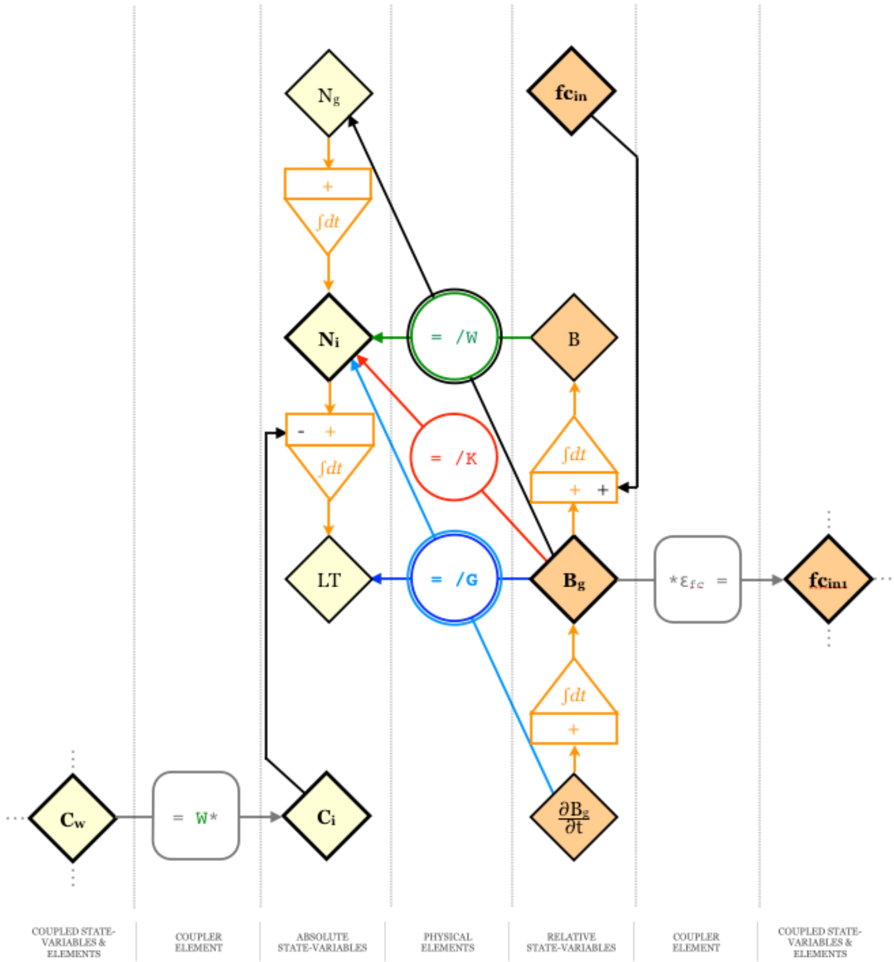
Maybe now, the readers can start to construct their own basic model, and to do that the first movement is to make a list of all information they work with (variables and elements) and precisely define the units used and the time interval unit (second, month, day, hour,...), and the period used for determine the accumulated total (infinite, 12 moths, 30 days, 24 hours,...). The next step would extract some differential relations and identify the existing formulas, and then maybe realize that they need to build more than one basic model.

As a non-physical model will be shown the drafts of the models for Fish, Fish Vessel, and Fish Business based in the Generic System presented before. These models were made with specialist aids in each area, and were construct using the units as a guide and trying to identify which information are could be variables or elements.

The variable "catch" is an important example how flexible have to be our thinking to do such kind of real model, it appears in all models but with three different units (kg, un & m^3), as well the "average lifetime" that represent an average of the lifetime of each individual have to be expressed in [un.y], and not just in [y] as we normally would do.

On the perspective of a fish farm, will be notice that farm has a lot of kinetic energy, because there a big number of individuals, but little potential energy, because the lifetime period is too short, those characteristic make the farm unsustainable without a continuous food income to provide the biomass growth, mandatorily associated to the permanent arriving of new young individuals. Therefore, it makes clear that the fish active continuously maintain the catch of newer and smaller individuals each year, the system eventually will collapse.

Figure 9: Draft of the Representation of a Fish System (FS) (Source: Author)



Absolute states: N_g = cohort growth^2 [un.y^{-1}] N_i = number of individuals [un] LT = average life time [un.y]	**Relative states:** B = biomass [kg] B_g = biomass growth [kg.y^{-1}] $\frac{\partial B_g}{\partial t}$ = biomass growth rate [kg.y^{-2}]
Elements: W = average individual weight [kg.un^{-1}] K = individual weight growth [kg.un.y^{-1}] G = youth tendency [kg.un.y^{-2}]	**Gain/loss states:** fc_{in} = food income rate [kg.y^{-1}] ξ_{vf} = Bycatch fault [m^3]
Couplers: ε_{fc} = food chain contribution [%] W = average individual weight [kg.un^{-1}]	**Coupled states:** fc_{in1} = food income rate to other species [kg.y^{-1}] C_w = catch [kg]
Potential Energy: $U_f = \frac{B_g.LT}{2}$ [un.kg]	**Kinetic Energy:** $K_f = \frac{B.N_i}{2}$ [un.kg]
Power: $\mathscr{P}_f = B_g.N_i$ [un.kg.y^{-1}]	

The Fish System is one kind of biological system, these systems have as power unit [un.kg.y^{-1}], that ultimately indicates the capacity of the system to react and maintain itself running. Basically, the FS model could be used for any animal of vegetable to give a prognosis of its states-variables, and a group of them could be used to represent an ecosystem.

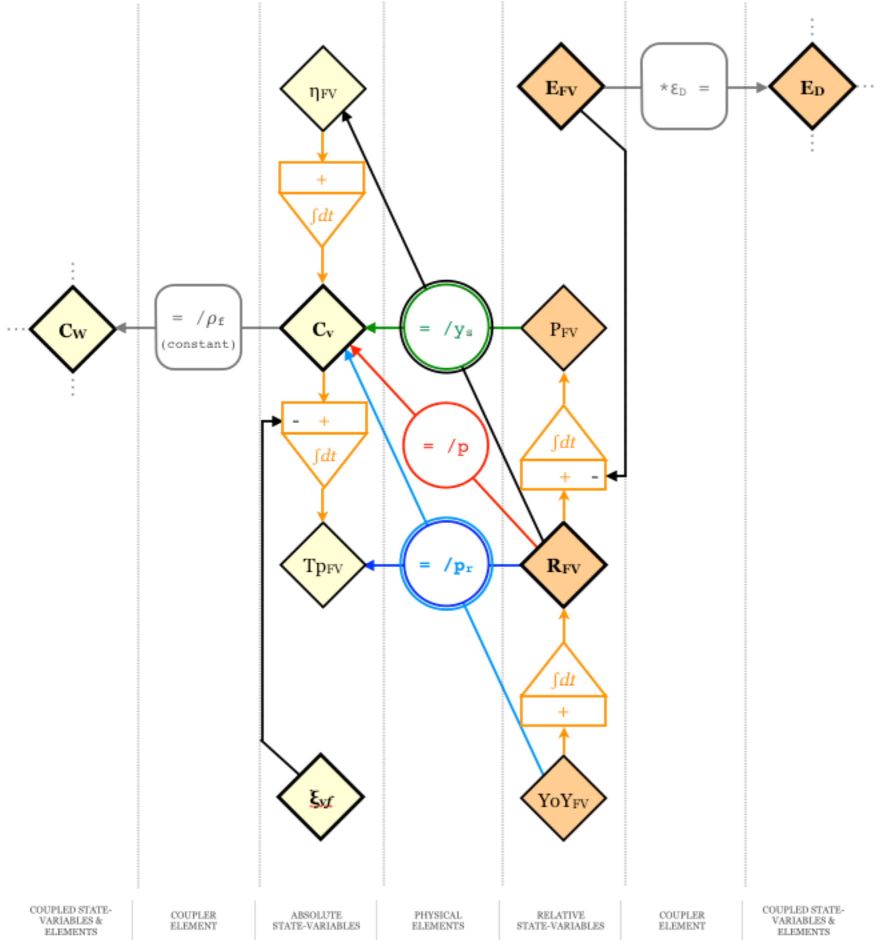
As said before, this is a draft, and more study is required to make a definitive model. One conceptual trick could be the definition of LT; each individual of N_i has a lifetime, and LT is the sum of these lifetimes and is also the multiplication of the average lifetime by the total of individuals; another aspect is G that represents the inverse of the species capability to have elder (mature) individuals; because I may have a regular B_g but with a big G the lifetime will be small.

The Fishing Vessel System and the Fishing Business System are two examples of an economic extractive system, in which the power unit is [un.$], [kg.$], or [m^3.$], depending on the unit used to measure the catch/collect. They are very similar but the time interval sampling makes all the difference, the Fish Vessel system show to us that isn't a necessity to use a conventional time interval if the model is based on a specific cycle that defines our process.

Again, as a draft, the profit variables (P_{FV} & P_{FB}) maybe could have other denomination, however, they are the sum of revenues minus the sum expenses (E_{FV} & E_{FB}), the denomination appears to be appropriate. The by catch faults ξ_{*f} are interesting state-variables, because they have a direct relation with the price rate and is an indicator of efficiency (or inefficiency), if they are big is a catastrophe for the ecosystem but generate a price rise.

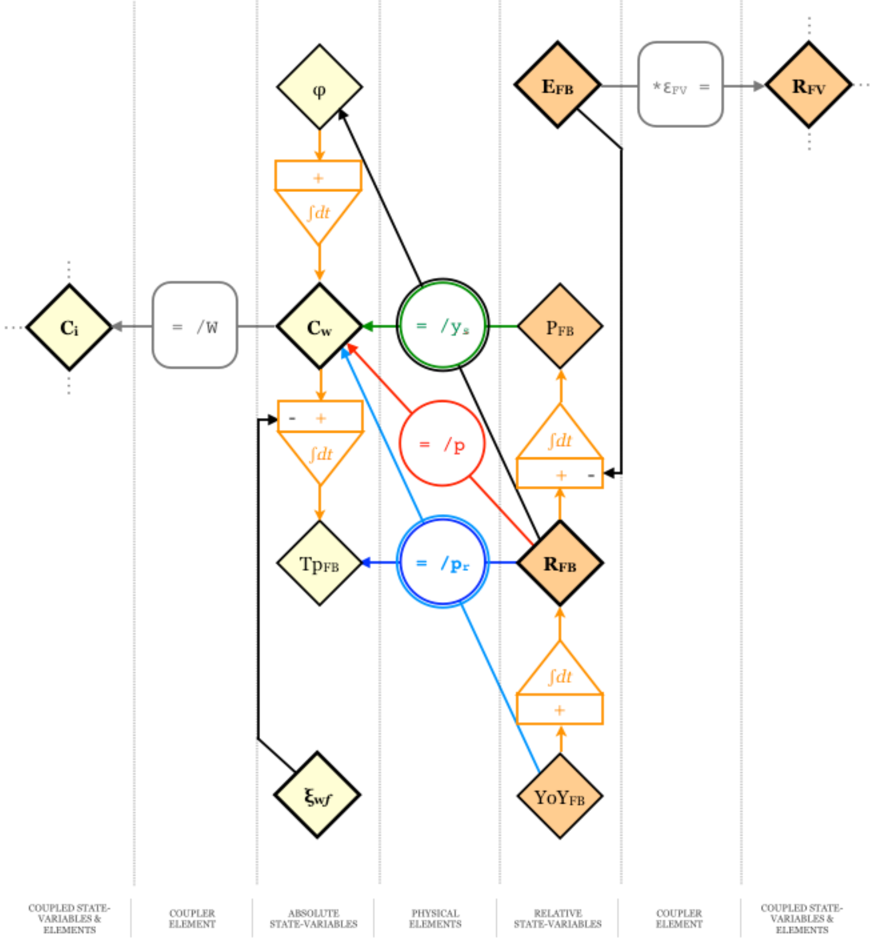
These three models are drafts because they're no tested, just the coherence of the state-variables units do not guarantee the relation among them, it is appropriate to point out that the modeler and the area specialist must understand perfectly the difference between correlation and causation, maybe the behavior of two state-variables are very similar, however, they could not have any relation, as an example, the behavior of numbers of white stork and childbirth at Alsace, Germany, during the World War II have the correlation near 1, but they didn't have a causation between them unless you believe the babies are given to their mothers by storks, in this case, war is the confounding factor.

Figure 10: Draft of the Representation of a Fishery Vessel System (FVS) (Source: Author)



Absolute states: η_{FV} = fish volume catchable [m^3.trip^{-1}] C_v = catch [m^3] Tp_{FV} = fish throughput [m^3.trip]	**Relative states:** P_{FV} = fish vessel trip profit [\$.trip] R_{FV} = fish vessel revenue [\$] YoY_{FV} = fish vessel revenue rate [\$.trip^{-1}]
Elements: y_s = fish vessel species yield rate [\$.m^{-3}.trip] p = average selling price [\$.m^{-3}] p_r = price selling rate [\$.m^{-3}.trip^{-1}]	**Gain/loss states:** E_{FV} = fish vessel expenses [\$] ξ_{vf} = Bycatch fault [m^3]
Couplers: ε_D = diesel vessel contribution [%] ρ = average fish density [kg.m^{-3}]	**Coupled states:** E_D = diesel expenses [\$] C_w = catch [kg]
Potential Energy: $U_{FV} = \frac{C_v.P_{FV}}{2}$ [m^3.\$.trip]	**Kinetic Energy:** $K_{FV} = \frac{Tp_{FV}.R_{FV}}{2}$ [m^3.\$.trip]
Power: $\mathscr{P}_{FV} = C_v.R_{FV}$ [m^3.\$]	

Figure 11: Draft of the Representation of a Fish Business System (FBS) (Source: Author)



Absolute states: φ = fish catchability [kg.y^{-1}] C_w = catch [kg] Tp_{FB} = fish throughput [kg.y]	**Relative states:** P_{FB} = fish business annual profit [\$.y] R_{FB} = fish business revenue [\$] YoY_{FB} = fish business revenue rate [\$.y^{-1}]
Elements: y_s = fish business species yield rate [\$.kg^{-1}.y] p = average selling price [\$.kg^{-1}] p_r = price selling rate [\$.kg^{-1}.y^{-1}]	**Gain/loss states:** E_{FB} = fish business expenses [\$] ξ_{wf} = Bycatch fault [kg]
Couplers: ε_{FB} = fish vessel contribution [%] W = average individual weight [kg.un^{-1}]	**Coupled states:** R_{FV} = fish vessel revenue [\$] C_i = catch [un]
Potential Energy: $U_{FB} = \frac{C_w.P_{FB}}{2}$ [kg.\$.y]	**Kinetic Energy:** $K_{FB} = \frac{Tp_{FB}.R_{FB}}{2}$ [kg.\$.y]
Power: $\mathscr{P}_{FB} = C_w.R_{FB}$ [kg.\$]	

3 Empirical Systems Modeling

The physical and non-physical models are very mechanistic-descriptive, and both could be used to make predictions, otherwise the empirical models are more inferential-causal, most because however the variables have some known level of causation but the "formulas" of this relation are unknown.

An empirical model has the capability somehow to express relationships of qualitative variables (mood, expectative, approbation, intention) and quantitative variables (revenues, votes, sells). Starting with a group of time series of some chosen variables is possible to built a state-matrix, most of the times a fully populated one that differs of the sparse created by physical and non-physical model, and with this state-matrix is possible to rebuilt the behavior os the variables and give a good prediction, that depends essentially on the original time series data.

Some mathematicians maybe have felt from their chairs with the last statement, because is mathematically impossible get a specific state-matrix by using just state-equations (time series), but using the MATLAB® is possible to get one specific state-matrix using a group of time series.

But to use these time series is essential that the high-frequency components, those are near a noise, be removed from the raw data, this procedure will remove some uncertainness and generate a higher differences with the original time series, however, will give chance to built a more sparse state-matrix. To evaluate the effect of this procedure is recommendable use two, or more, different cleaning approaches, with different intensities, to remove the noise of the time series.

With n number of time series is possible to generate $n!$ combinations, and to select the most probable one, some statistical concepts could be used to support the decision, as mean squared error and standard deviation, to point the most reliable state-matrix(es). After that we have to try to identify some correlations among one variable and the derivatives of the other ones, and correlations among the variables. These last procedures are done with the intention to discover some time series relationships with the expectative to mount the EITS SV model shown before.

Even any correlation coefficient is bigger than 0.95, the state-matrix will be able to reproduce the original series, without the high-frequency components, and give a good prediction. This kind of model maker has a particularity, give better results with short time series, as an example for a group of six time series must be used no more than three hundred values, and more time series you have better will be the results.

The method is similar to a polynomial regression [5], another 70's abandoned methodology, of what you could extract the state-equation of each variable, and it will be an n^{th} degree equation, with the additional benefits of making all variables interdependent. Now is that more variables you have more precise will be the prediction, however the processing time rise exponentially; to avoid problems is not recommended to use state-matrix (in one standard personal computer) with more than twelve variables for a daily output, or six variables to a "real-time" application with one minute data refresh, to solve this limitation must be used concatenated matrixes.

To an n state-variables system be stable, all eigenvalues of the state-matrix have to have a negative real part. At this time is worthwhile to remember that stability is a very rare condition in systems, most them are unstable with one, or more, of their variables tending to infinite (or minus infinite).

A theoretical example is a model to predict the result of one candidate in an election, the best approach is to obtain an optimist and pessimist forecast using least two different data sets: the "positive" and the "negative" indicators. The "positive" and the "negative" indicators are temporal series built using data mining, in the social media and search machines/sites traffic statistics, with the absolute number of hits, and in the optimist and pessimist scenarios could be modeled by:

Optimist Scenario	**Pessimist Scenario**
number of searches in search machines or sites (google, yahoo, wikipedia,...)	number of negative mentions and hashtags in social media (posts, twitts,...)
number of followers in social media (Facebook, Twitter, YouTube, Instagram, ...)	number of negative headlines in printed or tv media (newspapers, news programs, ...)
number of positive mentions and hashtags in social media (posts, twitts,...)	number of negative actions in social media (likes, shares, retwitts and visualizations in negative mentions)
number of positive actions in social media (likes, shares, retwitts and visualizations in positive mentions)	percentile of rejection (using all pools)
percentile of vote intention (using all pools)	percentile of vote intention (using all pools)

These two matrixes are the basic model, that could improved using matrixes with all sort of economic, social, or ideological indicators, generated from specific area models, trying to associate each subject with the voter intentions related to one specific candidate. This basic model also minimizes the influence of "internet-activism" because brings to the predictions the benefit of the vote intention pools as a guide.

To do that, you have to define if the words, or expressions, are of positive and negative for a specific candidate, regarding a word like "welfare" could indicate a positive mention to a liberal candidate and a negative one to a conservative candidate, while "integrity" is a positive mention for both. This basic model uses just five variables to guarantee a fast processing and allow the user to detect variations when using specific area models.

Another theoretical examples could be a model to define a price of a ticket, in an event or transport service or a model to identify sales problems by customer feelings big data.

4 Time Quality Modeling

Is a comparative statistical (non-predicting) model used for complex flow operations like cargo exportation, or crop transportation; the entire operation is segmented in small processes with very well defined characteristics and the time spent in each process is one variable. It is one of the many components of the Total Quality Management (TQM), and could be used to start a quality analysis or intervention [6].

The start is collect some physical or technical information as available time, usability index and productivity capacity, that could be used to calculate the production, assuming that all process run in a continuos way, and with exact inputs and outputs, in other words, receiving and delivering the exact amount of product in all steps of the operations of all segments could execute their functions without any delay or paralyzation.

Now, the barriers (operation delay or paralyzation) time of each segment is put in a table, as columns, and each row must be related to business with an identical process, and identical objectives. The trick part is to obtain data of your competitors, that's why this kind of model is recommended just for holding companies with a number of subsidiaries in the same activities, like a brand with their stores, or a logistic company with their trucks and store compounds.

With this information will be able to calculate the average and the minimum of each process segment, and work to improve the productivity (reduce the time) where barriers are identified, and with the amount above of the minimum, or benchmark selected, for each segment, is possible estimate the impact growth in the final cost.

5 Conclusion

These scalar variables (SV) models aren't the only way to establish a model to be used in an adaptive management (AM), there are others like "time quality models" and a "cost quality models", but they the most tangible way to understand some process, and gave hints to improve it.

The generic model proposed in Figure 3 must be tested and refined, however, is a good start for all researchers who want to develop a mechanist model in their area of knowledge.

5.1 Invitation

If someone want to discuss a specific model or have made a different physical or non-physical model please send us an e-mail with your article or work, I will be very grateful. If you have a set of time series that you want to test in an empirical model, please contact us too.

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