SOCIAL INFLUENCES OF THE TURBULENCE CONCEPT

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ABSTRACT

This text offers the reader a view over the historical development of turbulence and its metaphorical use in social terms. The theory of vortices can be useful in examining the impact of future events, and the effects of the various obstacles that are in the path of the organization.

Keywords : *Turbulence, metaphor, company.*

INTRODUCTION

There is no intention here to review the literature, but the interested reader can consult the review works of MEDEIROS [9] (2005), MOURA[10] (2007) and DA SILVA[3] (2008). Scholars see evidence of drainage patterns in Leonardo da Vinci's drawings dating back to 1490, which studied the vortex phenomenon by analyzing the effect of flowing water on the pillars of a bridge, and provoking a series of different vortices.

According to GAD-EL[5] (2000), such drawings constitute the first qualitative contribution to the experimental fluid mechanics. As mentioned by LAVINAS [8] (2010), HELMHOLZ[8] (1858) and THOMPSON[8] (1869) pioneered the mathematical formulation of vortex study, followed by STROUDHAL (1878), HIEMENZ (1911) AND VON KÁRMÁN (1912). very important contributions of RALEIGH and KELVIN. According to SILVA FREIRE[14] (2009), BOUSSINESQ, in his quest for the causes of turbulence, observed on the free surface of a river the presence of "fluid balls" that move in the direction of the flow forming small swirls. Additionally, he finds that the swirling structures reach the bottom and return. The origin of the turbulence, therefore, must be sought in the walls that limit the flows. According to their subsequent experiences, the importance of turbulence varies strongly with local velocity, with the hydraulic radius as an index of fluid delimitation with respect to the wall and with the roughness of the pipe (SILVA FREIRE [14], 2009). In 1868, BOUSSINESQ, based on the experiments of BAZIN [1] (1865), recognizes the origin of the formation of swirls by the action of viscosity. In order to describe mathematically the turbulence, Boussinesq elaborates the concept of deviations, average magnitudes and their influences in the flow, postulating that the sum of the fluctuations over a certain time interval is null by definition. In 1904, LUDWIG PRANDTL appears with the description of the boundary layer. The contribution of Prandtl was to observe that, over a wide region of the flow, the classical theory of potential flow could be applied normally. Only in a very narrow region adjacent to the wall should viscous effects be considered. To this region, Prandtl called the boundary layer. However, as explained by LAVINAS [8] (2010), the masterly research on the nature of vortex emission in the runoff behind a robust body was made by THEODORE VON KARMAN [8], in 1911, who enunciated and grounded the "vortices of von Karman ". This would lead, years later, to the idea of coherent structures in turbulent flows. It can be said, then, that VON KARMANN was one of the pioneers of vortex theory. His contribution to the calculation of drag on bodies in supersonic outflows was at least 20 years ahead of his time. However, his genius was expressed in his extensive and significant contribution to the statistical theory of turbulence. In the flow of a fluid around a cylinder, he noticed that internal flow part moves much more slowly than the outer portion that is in contact with the free flow. This difference between the velocities of the two adjacent portions allows the layers of fluid to fold over one another and turn into spiraled vortices. The set spreads in

the space next to the cylinder, forming a trail of vortices, causing an intrinsic uncertainty to the flow itself (TELMA [(15)]), 2006). The phenomenon of vortices is known only from the statistical point of view, whose fluctuations generate perturbations that make difficult the predictions on the determination of the position and the speed of a particle. So we can say that the vortex tracks are responsible for the flow turbulence. On the other hand, from a social and economic point of view, the changes in rules, the great amount of information, and the unpredictability of events become increasingly clear. Then, it is possible to perceive the metaphorical use of vortex track theory when, for example, DRUKER (Apud RODRIGUES [(13)] 2005) says that "the normal state of things has never been anything other than turbulence; exception". Throughout history, many examples have shown us human progress as a result of crisis, turbulence and instability, whether of any nature. In this sense we can establish parallels between the theories about phenomena of nature and the behavior of humans and organizations. The observation of current events suggests that certain events in process depend on the initial conditions in which they were formed, since small causes can generate great effects, especially in a regime of turbulence.

METAPHORS, ANALOGIES AND CORRELATIONS

From what has been discussed, it is possible to associate some concepts of hydrodynamics, especially on turbulence and vortices, with business and organizations [(7)], including in school planning and classroom administration. Note that: "The greater the turbulence of a fluid system, the greater the disorder and the greater its entropy and the lower the availability of energy." Can we conclude that in a very chaotic system there may be an order within the chaos, as Ilya Prigogine)? That is to say, societies with all the diversities of thoughts manage to organize and be more productive? Such considerations could well be applied, as a metaphor, to disturbances caused by economic variables, government policies, social variables, world monetary decisions, or competitive movements in relation to an organization. According to ETZIONI [(4)] (2011), due to constant technological innovations, it is difficult to find stable organizational environments. Even so, they do exist. The author says that there can be innovation in product, market, legislation or technology. However, trends are likely to be visible and predictable, and organizations adjust to the new conditions. Organizations generally operate in a changing environment, especially when competitors launch new products unexpectedly, when laws are passed without warning. So when technological advances revolutionize product designs or production methods, the organization is in a turbulent environment, usually only temporary until they adjust. KOSCHECK[(7)] (2011) admits that it is possible to establish an association of ideas about the interaction regime with the environment found in physical systems, especially fluid hydrodynamics, with the behavior of the environmental dynamics of organizations. From this association it is possible to graduate and indicate what would be the most appropriate organizational structure for the developmental stages or regimes of the productive organizations, seeking the point of equilibrium. A preliminary analysis of organizational phenomena can be made from the theory of turbulence. Organizations and economic systems are affected by interconnected phenomena, their behavior being modified or influenced by the effects of turbulent environments. Thus, this theory can be used for the formulation of scenarios, projections and forecasts, given the unpredictability of organizational events. Organizational turbulences arise when there are factors, obstacles or resistances along a flow, whether of fluids, air, or information that cause a disturbance, which in turn causes subsequent pressures (TELMA[(15)] 2006). In the real world, one is not faced with a simple set of vortices, but with a complex set of multiple vortices, caused by resistances, internal frictions, lack of adherence, inflexibilities that can often produce catastrophic results. It may be that planning includes vortex theory to aid and predict the behavior and impact of environmental variables that influence it. Vortex Theory can be useful in examining the impact of future events and the effects of the different obstacles that will be in the way of the organization. The instability of a continuous flow does not immediately turn into a turbulence, which is a non-linear and chaotic stage characterized by a huge mixture of environmental variables. Under these considerations an organization may find itself in a state of transition for a longer period of time, and it is important to recognize this state and to identify the moment it is in its trajectory so that it can make appropriate managerial decisions. More details can be found in CIRNE LIMA [(2)] (2003).

THE ORDER CAN COME FROM CHAOS AND VICE VERSA

The order is not per se positive and chaos is not per se negative. It seems that there is mutual dependence between the two. Chaos can be needed in unstructured space. This is possible because even space is not a place, but the possibility of all places. Chaos differentiates itself from nothing, since it has no antithesis about being, existence. Chaos [(6)] is a specific state of being, not in an objective but dynamic form, opening to all possibilities. Order, on the other hand, defines places and shows clear alternatives to the changes of position. In the aesthetic form, the contradiction between order and chaos is dissolved in favor of order. The postulate of order and disorder [(11)] preaches that order creates nothing and disorder maintains nothing. That throughout the universe, states of order and disorder alternate to generate the

evolution of all things, as occurred in the initial explosion, a time of sheer disorder, followed by a long period of ordering of the galaxies with their stars and planets . It is believed that a period of order will follow a new disorder that will bring about a rearrangement of all things, and therefore a new evolution. And this process, they believe, is repeated on all levels and in all things, from the universe level to the atomic level. In the history of mankind such a postulate also occurs. It was in the moments [(6)] of greatest disorder, such as wars, revolutions, catastrophes, or intellectual boiling, that we observe the greatest evolutions. Chaos mobilizes, propels, vivifies, but nevertheless, nothing can maintain. Only a later period marked by accommodation, by calm, by regulation, can consolidate the gains of the previous disturbance. That said, we must understand that it is possible to admit within the organizations a certain degree of "disorder". The challenge for organizations[(7)] is to create mechanisms that allow developments to occur in such a way that the need for order does not immobilize initiatives and the need for disorder does not endanger the integrity of what is intended to evolve. It is worth remembering that turbulence is associated with the Chaos phenomenon. There is an order within Chaos. According to AGOSTINHO [(1)], even if societies are somehow associated with turbulent phenomena, they would also present an intrinsic order.

FINAL CONSIDERATIONS

For RIBEIRO [(12)] (2010), Adam Smith drew on Newton's "Principia" by writing in 1776 his classic "On the Wealth of Nations" where he used ideas of causal forces. Then, in 1835, Adolphe Quételet published the book entitled "A study in social physics" in which he sought to establish the laws of society analogous to those of Newton. Alfred Marshall at the beginning of the last century used physical ideas of thermodynamic equilibrium to develop a theory according to which an economic system reaches equilibrium in a manner analogous to the Maxwell and Boltzmann gases. But the first economist and sociologist to use mathematical models along with statistical evidence was Vilfredo Pareto, who enunciated the "Pareto law" of income distribution. Louis Bachelier, under the guidance of Henri Poincaré, defended in 1900 his Ph.D. on the theme "Theory of Speculation," when he used physical concepts of diffusion theory and applied ideas of the Brownian movement to explain the formation of stock market prices. Therefore it is possible to establish an association of the ideas about the interaction regime with the environment found in the physical systems with the behavior of the environmental dynamics of the organizations. Such an association can be made by observing the characteristics of each approach and comparing their similarities, by analogy, to the correlated processes. Some authors consider that a company maintains itself as living beings, because it is made up of people, and then, for them, quantum vision can be useful for as companies. NOBREGA[(16)] (1996), using simple language and direct and colloquial style, shows how businessmen can draw on metaphors and analogies with the world of science to achieve results in the complex and plural world in which we live. The essence of this chaotic universe has been studied by the rigor of the calculations of the scientists, which can be translated to the laity through metaphors. The metaphorical artifice extends to many areas of knowledge from human behavior to the unstable environment of organizations and their market fluctuations (NICOLAU [(11)], 2006). From what has been discussed, it is possible to associate some concepts of hydrodynamics, especially about turbulence and vortices, with business and organizations, including school planning and classroom administration.

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