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الذكاء المنظومي ووظائف المخ

"دراسة تحليله للمفاهيم والتطبيقات"

دكتور / عبدا لوهاب محمد كامل

أستاذ علم النفس الفسيولوجي

كلية التربية – جامعة طنطا

مقدمة : ترجع أصول مفهوم الذكاء المنظومي systemic Intelligence(SI) إلى العديد من الأعمال العلمية الجادة في مختلف فروع العلم والمعرفة : بيترسينج Peter Senge (١٩٩٠،١٩٩٤،١٩٩٩) فاروق فهمي Farouk Fahmy&لاجاوسكي lagawsky (١٩٩٩،٢٠٠٢،٢٠٠٤) عيسي سارينين Esa Sarrinen & ريمو هامالينين Raimo Hamalainen (٢٠٠٢،٢٠٠٤) , ويرجع اليهما الفضل فى تقديم مفهوم الذكاء المنظومي .

مفهوم الذكاء المنظومي : من التحليل والدراسة يمكننا تعريف الذكاء المنظومي (SI) على أنه منظومة الأداء للأنظمة المركبة Complicated systems مثل : المخ البشري , الأقسام العلمية كمنظومات متشابكة ومركبة , بناء وتنظيم العمل كفريق ٠٠٠ الخ , ومن ثم فإن الذكاء المنظومي يتضمن التفاعلات المتبادلة والتغذية المرتدة بين العناصر المكونة للنظام من جانب والبيئة الخارجية من جانب أخر , إذن هو المحصلة النهائية للعلاقات المتبادلة بين وظائف المخ الانفعالية والمعرفية والنفس – حركية (عبد الوهاب كامل,١٩٩٣)

تتناول الدراسة الحالة : عرضا للجوانب الآتية :

١– خصائص الذكاء المنظومي مقارنة بالذكاء الخطي

٢– علاقة الذكاء المنظومي بنظام عمل المخ البشري

٣– الذكاء المنظومي والتعلم القائم على نظام عمل المخ Brain – Based Learning

٤– المعادلة العامة لتكوين الذكاء المنظومي .

٥– عرض مختصر لأهم التطبيقات العملية لتفعيل الذكاء المنظومي من أجل التنمية البشرية

٦– بناء الذكاء المنظومي: ويتم على ضرورة توفير المتطلبات الموضوعية الأتيه :

- منظومة مصادر واستقبال المعلومات. ● التقويم المنظومي للمدخلات والمخرجات

- الرؤية الرقابية المنظومية للأداء Systemic Monitoring .

- التدعيم المنظومي (من خلال التغذية المرتدة متعددة المصادر) .

٧- تتناول الدراسة الحالية عرضا مختصرا للمبادئ الاساسية التي أوضحها كل من كين & كين caine & caine(١٩٩٤) حول التعلم القائم على نظام عمل المخ Brain – Based Learning وتتضمن اثني عشر مبدأ حول خصائص عمل المخ كمنظومة معقده :

١- المخ نظام تكيفي معقد ٢- المخ اجتماعي ٣- البحث عن المعني تلقائي ٤- الإنفعالات أساسيه لتشكيل عمل المخ ٥- المخ يقوم تلقائيا بادراك وتخليق الجزئيات والكليات ٦- البحث عن المعني يحدث من خلال الخبرة ٧- المخ الذي يتعلم يتضمن تركيز الانتباه من جانب والانتباه الحسي (الطرفي) من جانب أخر ٨- يقوم المخ في ذاته بتنظيم طرق التذكر ٩- يتعلم المخ من خلال العمليات الواعيه الإراديه وأيضا الارادية الاشعورية ١٠- التعلم نمائي بطبيعته ١١- المخ كنظام للتعلم المعقد ينشط بالتحدي ويحبط بالتهديد ١٢- كل مخ إنساني يعتبر حالة متفردة بذاتها تنظيميا .

Systemic Intelligence and Brain Functions.

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Abstract:

The paper discusses the relationship between systemic intelligence and the learning, working, and creating human brain, with view to present the concept of the brain-based systemic intelligence(SI), consequently, the real challenge that encounters multidisciplinary efforts would be selecting compatible-integrated brains to establish: SI(team, group, organizations). The article also examines the general principles of building systemic intelligence, a long with the applications of SI being outlined

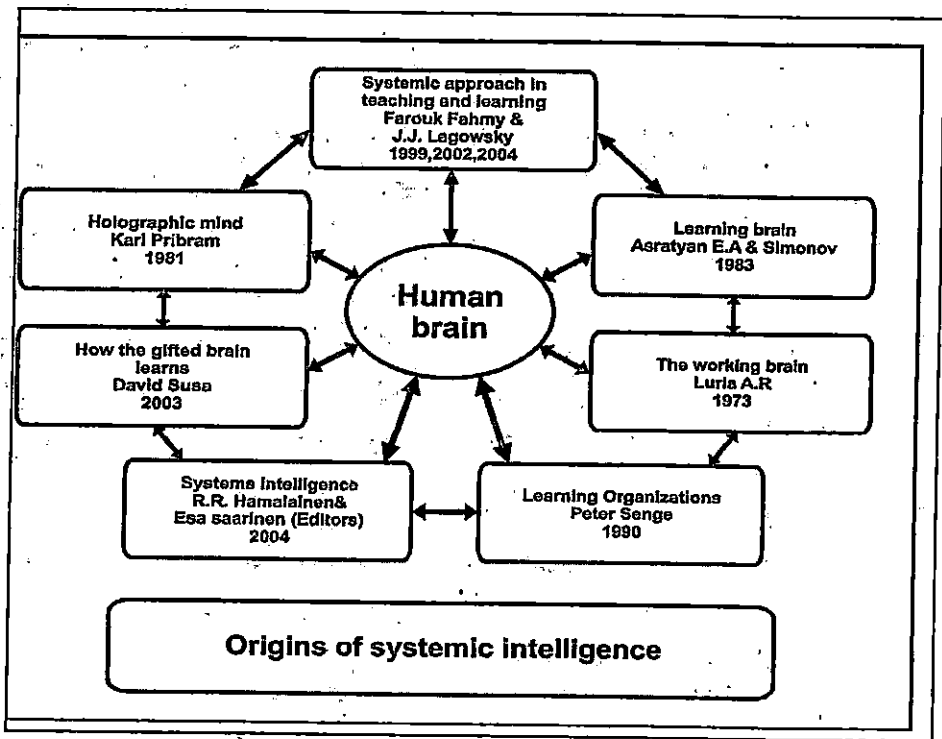## The Human Brain and Systemic Intelligence:

Much about the human learning and working brain is still a puzzle. But several scientific researches acclaimed in the Nobel Prize awards in 1981- have absolutely proven, beyond all doubt, that the human brain is the most fascinating, amazing system on our planet. (A. Berkley Book 1984). Every success, every intervention, every thought, hope, act, change and bodily function of our waking and sleeping lives- is controlled by the learning, working and creating brain and its Wide Web network of nerves and synapses: Brain Wide web- the utmost complicated, astonishing system in existence.

Systemic Intelligence (SI) is the higher final product of brain structures (systems) that includes mutual, dynamic, holistic interaction and feedback-within the system and with the environment or other systems. It is well-known that systemic Intelligence(SI) concept refers to a variety of multidiscipline and scientific schools of thought, e.g. (Peter Senge 1990, 1994. 1999), (Farouk Fahmy and Lagowsky 1999, 2002, 2004), (Esa Saarinen& Raimo Hamalainen 2002, 2004).

Saarinen and Hamalainen (2004) consider that systemic intelligence succeeds systems thinking in setting out from the primacy of the whole, from acknowledging interconnectivity, interdependence and systemic feedback as the key parameters.

Luria (1973), Karl Pribram (1981), and Astratyan& Simanov (1983) proved according to authentic results that human brain learns and works holistically, systemically and integratively through feedback mechanism.(see figure-1)

Consequently, systemic intelligence can be defined according to the holistic model of brain functions (Kamel, 1993): SI is a complex product of emotional, cognitive, and psychomotor functions of the learning, working and creating human brain. Therefore, our ultimate goal is to promote any system by reinforcing conscious interconnectivity among system elements, using the powerful tools of learning and training.

(Figure-1) Origins of systemic intelligence

Many problems can be resolved and many applications can be achieved by simulating the human, learning, working, and creating brain. (Asratyan 1983, Luria 1973 and David Susa 2003). The brain is the organ of the mind, said Pythagoras (6th century BC). Since the brain learns, works, and creates, it is not only a biological product but also a highly organized socio-cultural

complex system. The main function of the brain is to alter reality and to change itself in the course of alteration process.

Systemic intelligence is a modern concept that is greatly useful for comprehending human behaviour in complicated interactive settings to change reality: the educational system, political system, industrial system, socio-cultural system, etc. When we know exactly how the brain learns, works, and creates, we will devote our efforts to reconstruct and develop the educational system, on the basis of systemic intelligence- to enable that system to become more dynamic, interactive and holistic, with a view to survive and grow.

Saarinen and Hamalainen (2004) reported that systemic intelligence hybridizes engineering thinking with human sensitivity. They summarize key ideas of systemic intelligence as follows: 1) whole is more important than parts. 2) Human agents can influence the entire systems. 3) Part and whole are relatively abstractions that are always subject to potential redefinition by changing perspective. 4) System approach starts when you perceive the world through the eyes of another person. 5) Structures produce behaviour.

In addition to the above, systemic intelligence is based on four essential conditions:

1) To interact dynamically.

2) To take into consideration the mutual interactions between elements, both holistically and simultaneously.

3) The system should be able to develop and correct itself through feedback loops.

4) It is very important to supply the system with its language to achieve an effective communication between its elements.

Towards a General Equation of Systemic Intelligence

The above analysis proves the importance of building or rebuilding our brain, organizations and systems: educational, economic, industrial...etc, so that such systems will be able to learn, work, and create what will always make them productive. In simple words, systemic intelligence should become an integral part of the person or organization. To accomplish this smart goal real, we should bear in mind three major interactive systems:

1) Good material substrate: Biological brain or "bio-ware" BW, or the material base of organizations, keeping in mind that human agent can influence the entire system. Therefore, one can safely say that human

biological fitness (BW) plays a crucial role for the establishment of systemic intelligence (SI).

2) The second system. The source of information or environmental information (EI), is recognized as the control variables: a) Kinds or quality of the information. b) Quantity or magnitude of information. c) Level or structure of information.

3) Learning and training time (LTT), which are the most effective system behind the major differences among individuals, societies and nations. Personal mastery depends mainly on the ability of the system to learn, to train, and to modify the functional relationships between inputs and outputs. Learning is a very powerful tool to build all psychological structures of emotional, cognitive and psychomotor skills. (See figure-2)
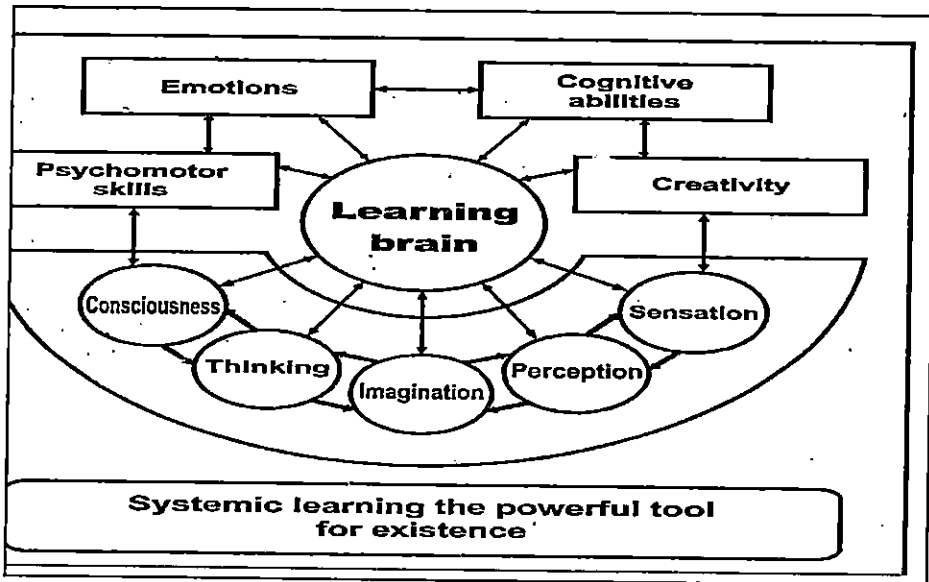

Figure-2 : systemic learning the powerful tool for existence

Learning is any change in performance of the system under the condition of practice, so it is the only tool for programming the learnable systems. Training surely comes after learning to keep the system performance always up to the desired optimum degree. It is, by all means, the backbone of development and changing. Our effort should be dedicated to train the system, any system, to achieve systemic intelligence. The three formed systems can well be summarized and expressed through the following equation:
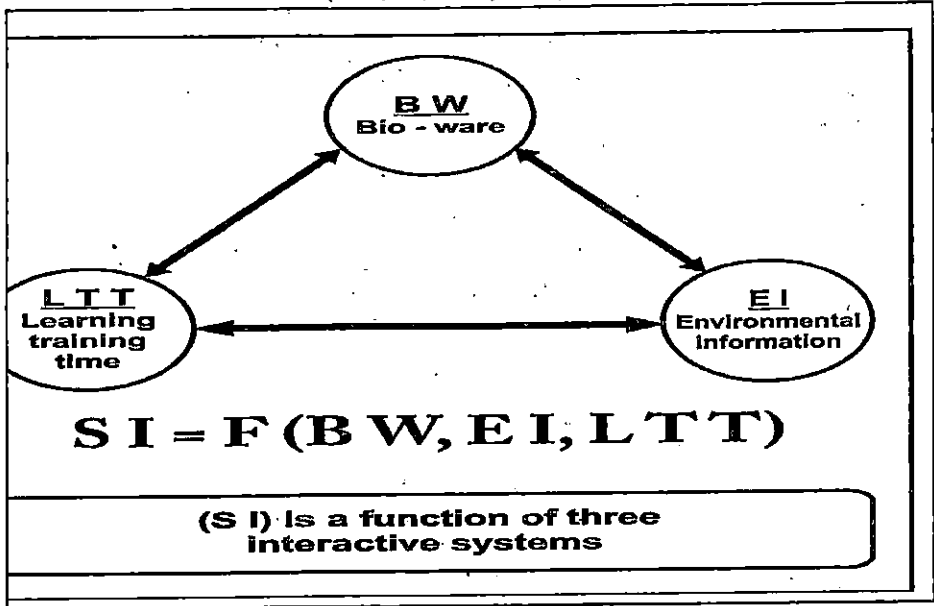
$$SI = F (BW, EI, LTT)$$ (see figure-3)

Figure-3 : (SI) is a function of three interactive systems

Brain-Based Systemic Intelligence:

The previous analysis denotes that systemic brain-based learning is a very vital demand for both human and organizational development. Therefore, human SI structure and functions can be explained in the light of *the holistic model of brain function:See Figure-4* (Kamel, 1993).

This model deals with complex behaviour in the context of different fields and situations of life, according to four systemic dimensions:

1) The circumferential dimension: which is penetrative and exists everywhere in all zones and areas of the nervous system. This dimension refers to the efficiency of the synaptic interconnectivity that is formed and programmed by learning and training in the course of life situations.The researcher prefers to call it Brain Wide Web (BWW).

2) Cortical-sub cortical dimension (vertical): This conveys on its levels the relationship between phylogeny and ontogeny. It represents the cortical (thinking cap, consciousness, voluntary and rational) dominance versus sub- cortical (automatic, unconsciousness and involuntary) dominance of emotional arousal.

3) The left and right hemispheres of the brain dimension (horizontal): although the two hemispheres are anatomically just the same, they deal

with information processing in quite a different manner. The right hemisphere tends to be:˙ non-verbal, holistic, synthetic, visio-spatial, intuitive, timeless, and simultaneous. On the other hand, the left hemisphere is predisposed to be: verbal, analytic, reductive into parts, sequential, rational, and time-oriented. According to systemic intelligence, the two hemispheres are working integrativly.
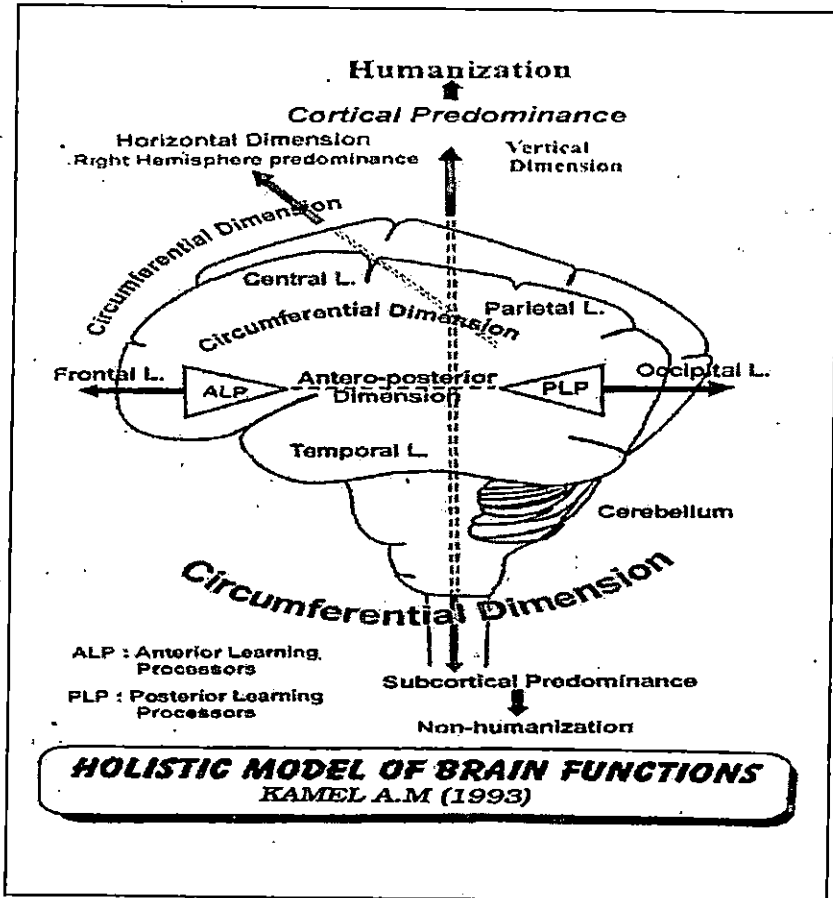

Figure-4 Holistic Model of Brain Functions (Kamel,A.M) (1993)

4) The dimension of the learning anterior- posterior processor. (The anterior processor (ALP) is formed up of frontal, anterior temporal, and central areas of the cortex. The ALP. is responsible for assimilation and processing of cognitive, abstractive, and higher thinking activities. Alp is continually growing up as a function of time (age) and it has a spatial stereotyped nature, it also has a mutual interconnected relationship with

the posterior learning processor (PLP). The PLP exists in both hemispheres and lies in the intersected function of the posterior-middle temporal, occipital and parietal. The PLP assimilates and processes visio-spatial and audio-spatial information, it converts abstractive ideas and conceptual frames into concrete percept objects, it works interactively with ALP.

Systemic intelligence, then, is an optimization of the brain functions in order to systemize the incoming information (inputs), problems or principles to achieve radical change and change management. Thus, we can generate and assume the survival potential of a system.

The above analysis shows that there are essential aspects of systemic intelligence.

Table (1) presents some differences between systemic and non-systemic intelligence.

Table (1)
Systemic and Non-Systemic Intelligence

Systemic	Non- systemic
Not a static sum of individuals intelligence.	Individual differences in partitioned mental abilities.
Depends on interaction and feedback with other systems.	Depends on individual development of special abilities.
Works as orchestral symphony.	Plays solo.
Deals with complex systems.	Deals with subsystems.
Perceives self as an interdependent part of a whole.	Perceives self as an interdependent individual case.
Depends on multiple perspectives.	Concentrates on separated points of view.
Organized team work.	Organized individual activity.
We think as a whole.	The person thinks as an individual.
Feeling and sensing each other consciously to promote system.	The parts do not sense and assist the influence of the whole.
Survival potential of the system.	Look for elements.
Simultaneous-concurrency	Sequential.

Building Systemic Intelligence - Experimental results

The main challenge encountering scientists and researchers in system intelligence issue is how to build it. Is it possible to construct or to make a "group-brain"; one working dynamic brain from interactive synergic and

compatible integrated members (individuals)? Can we select compatible integrated brains to establish a group or a team according to systemic intelligence criteria? There is a general consensus opinion about the essential characteristics of systemic intelligence, and consequently, we can depend on multidiscipline measures to select compatible integrated members (brains) in order to construct or reconstruct groups or organizations according to what we call: *Brain-Based Systemic Intelligence*.

A hypothesis about Brain Based Classified Pairs of subjects (BBCP), according to the holistic model of brain functions (kamel A.M 1993); **are** significantly distinguished in solving none steriotype problems than **non classified random pairs(NCRP).**

Using a performance battery test for brain functions assessment, (Kamel A.M& Yousef M. Shalaby (2005) proved a hypothesis of forming dyadic distinguished groups, based on "the holistic model of brain functions" (Kamel,1993). 19 pairs-dyadic and distinguished groups-were selected on the basis of the brain dimensions mentioned above, and 18 undistinguished pairs, were randomly selected. **The results denotes that, compared to the undistinguished, randomly selected groups(NCRP), the performance of the compatible integrated dyadic groups according to brain functions (BBCP), were better and statistically significant.**The most effecient pairs were those who working holisticly, dynamically,interactively and practicising multiple feedback.

Recommendations for application of Systemic Intelligence:

There are five essential interacting processes should be considered to buld functioning systemic intelligence at different levels: individual, systems and organizations eg.(quality control management) :

First, to depend on different related sources of information as systemic sensors in order to receive it as a whole.

Second: Booting the parts, elements or members of the system to promote mutual sensitivity in overall system. The booting mechanism is the process by which the brain centers sense each other reciprocally (kamel, 1999, p.412-413).

Third: to learn how to practice self-systemic evaluation according to

objective findings, for both inputs and outputs. Systemic evaluation is a cooperative process that depends on group or team evaluation to make a comparison between the current state and the desired one according to standardized norms or rules.

Fourth: self systemic monitoring, which is a self observation to determine exactly where in why the system is in a good state-productive and effective. Systemic monitoring requires panoramic vision of all positive and negative signs in order to promote the system to all optimum level.

Fifth: Self-systemic reinforcement, which is the increasing of the internal power of the system in order to resist the external negative stresses. Therefore, systemic reinforcement occurs when each element (member) supports consciously the whole system to back up each other for the sake of the system existence. (see figure 5).
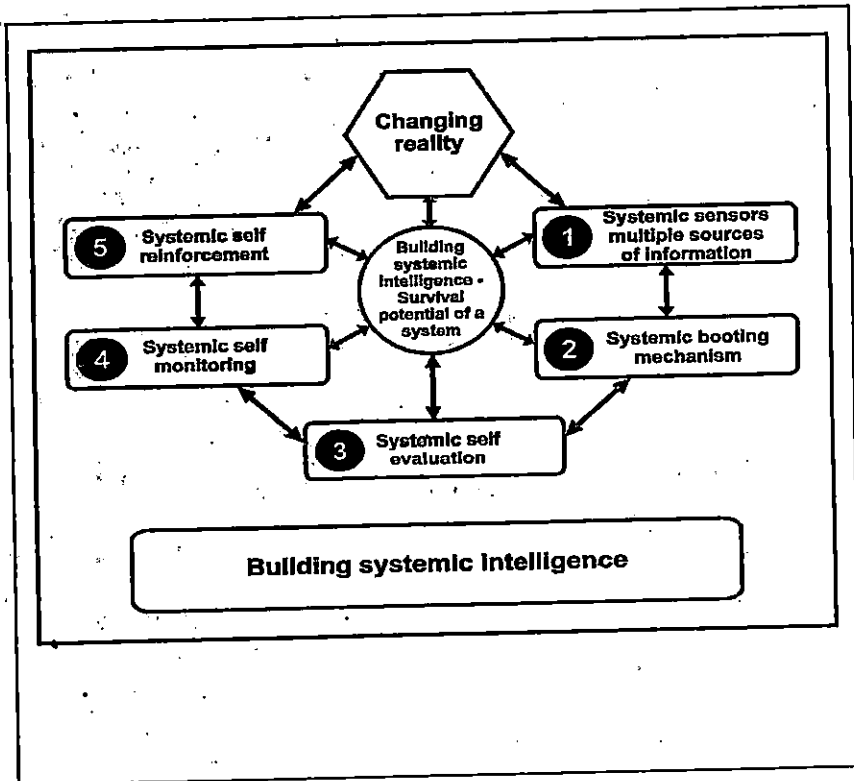

Figure-5 : Building Systemic Intelligence-Survival Potential of a System

The great success of systemic approach and systemic thinking preceded the applications of SI in many fields and organizations. Although there is no general theory of systemic intelligence, many successful applications have been the concern of different field and organizations in the society. Hamalainen and Saarinen (Eds: 2004) presented many applications of systemic intelligence related to: 1) Supervision as a specific development for both individual and organizational level (Jari Salonen).2) Business organizations (Mera Fisher). 3) Expert interaction. 4) Internet security (Kamillo Sars). 5) Preventing organizational crisis (Isoti Norkivi). 6) Multiple Intelligences in performing (Henry Penttinen).

The applicable dimension of SI must include the five interactive systems the paper referred to: systemic sensors, booting, evaluation, monitoring, and reinforcement. Therefore, the author suggests some applications in addition:

1)Systemic intelligence and reconstructing ourselves:

In order to construct or to reconstruct yourself, you should keep in mind all the four following interactive systems: :(See figure-6)

1-The basic system: such contains three interactive subsystems: A) Feeding well your genes to fix your bio-ware. B) To intentionally develop your mental and cognitive skills.C) To support your spiritual and ethical principles.

2-The development system: such is based on three interactive subsystems:

A) Learning or education. B) Make a daily, weekly, monthly…etc plan. C) To exercise self management skills.

3-The atmosphere of the development system: such is also composed of three interactive subsystems: A) To learn how to appreciate peace and to accept the others. B) To back up and live for freedom and democracy in everyday life situations. C) To think systemically.

4-Enjoyment system: such is the final product of the above dimensions (systems), and consists of three subsystems: A) Performing physical exercises (sports). B) To have an attitude in life and to enjoy free readings. C) To be concerning with arts.
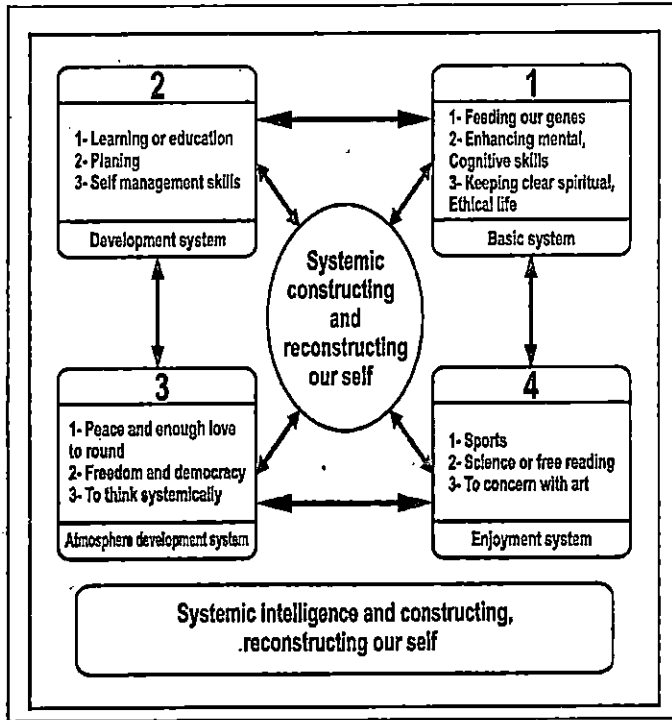
Figure-6 : Systemic intelligence and constructing, reconstructing ourselves

2)Systemic intelligence is a powerful tool for developing cognitive psychology and Computer sciences.

Connecting emotional, cognitive, and psychomotor functions of the brain requires a very unique interface issue which can sense, evaluate, monitor, and feedback the systemic relationship between inputs and outputs, and thus, nano-technology will have a crucial role to build a systemic human-computer interface.

3) Systemic intelligence and psychological fitness:

Psychological system is a valuable goal for every person and every athletic sport team, such fitness can be achieved by designing psycho-exercise halls that shall include the following systemic training activities(see figure-7)

1-Focusing on attention training.

2-Enhancing activation of different types of memory.

3-Booting brain centers through different forms of biofeedback mechanism: EEG biofeedback, EMG biofeedback, blood pressure biofeedback...Etc. Training shall last for 15 minutes successively.

4-Situational stress shooting skills.

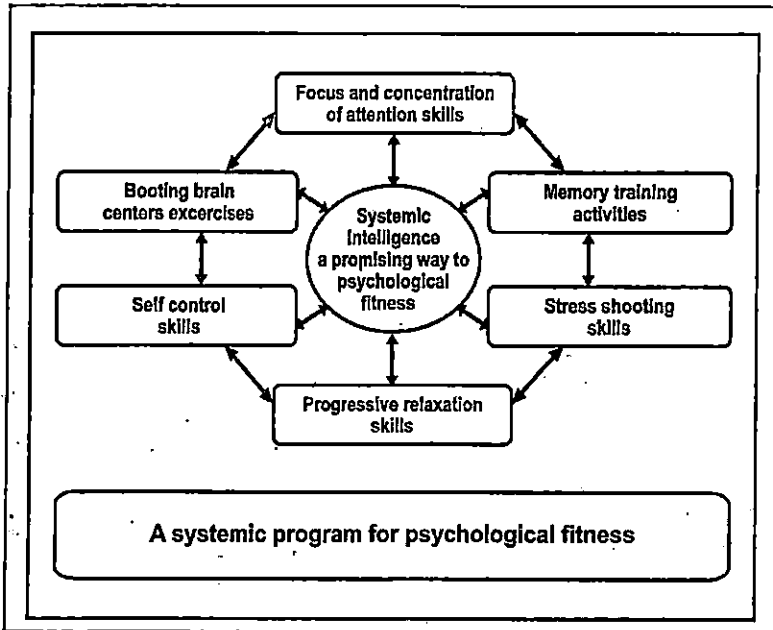5-Self control and energy control skills.

6-Progressive relaxation skills

Figure-7 : A systemic program for psychological fitness

4) Systemic intelligence is the highway of innovation and invention

Invention in the past depended on serial sequential events or discovers, but SI demands simultaneous and parallel activities of highly selected team ,according to the will known five(p)s :problem finders team, scientific research paper team , patent group, prototype and production groups.

Is it possible to lead organizations to establish four compatible integrated teams :

1- Building problem finders ,problem opposers and problem solvers groups.

2- Building a team to   systematize results of scientific research papers.

3- Building a team to transfer systematized papers to a systemic patents

4-Creating a systemic prototype.

5-building a team for systemic marketing and production.

5)Systemic intelligence a powerful tool fore total quality management:

Systemic intelligence frame work is about human intellect in action, so we have to simulate our working ,learning and creative brains in quality management organizations. Consequently , our efforts should be directed to the learning , working , creative organization through interconnectivity . (booting all sub systems together), multiple feedback and dynamicalyt to sense, evaluate .monitor ,and reinforce all activities of the organization.

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Systemic Intelligence and Brain Functions

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Abstract

Theoretical Background

The concept of Systemic Intelligence (SI) refers to a variety of disciplines and scientific school of thought : Peter Senge(1990,1994,1999), Farouk Fahmy & Lagowsky(1999,2002,2004), Esa Saarinen & Raimo Hamalainen who are the founder of SI in the Laboratory of Systems analysis in Helsinki University of technology (2002,2004) and others.

SI is the behaviour in complicated systems that include mutual interaction and feedback, both within the system and with the environment. SI then is a complex product of : emotional, cognitive, and psychomotor functions of the human brain(Kamel A. M ,1993).

The general Equation of Systemic Intelligence :

Genesis and formation of SI is expressed by the following equation :

$$SI= F(BW, EI, LTT)$$

Where BW stands for fitness of biological systems (bio-ware), EI stands for environment information systems ,LTT stands for learning and training time.

SI structure and functions can be explained on the light of the holistic model of brain functions (Kamel A. M,1993).

The model describe the emotional , cognitive and psychomotor functions through four dimensions or subsystems : 1- cortical versus subcortical 2- anterior learning processor (ALP) versus posterior learning processor (PLP) 3-Right versus Left hemisphere dominance. 4- Circumferential – forming new synapses as a result of learning and training. The human brain is always interacting and feeding back within itself and with external systems.

Building Systems Intelligence

In order to reconstruct our systems of life in all human activities, we have to take in consideration the following interactive systems : 1- Systemic sensors(sources of information). 2- systemic evaluation of inputs and outputs. 3-systemic monitoring. 4- systemic feedback and reinforcement.

Application of Systemic Intelligence

Twenty two scientific researchers in Helsinki university of technology (2004) devoted themselves to present many applications in different fields for example : 1-expert interaction 2-in business 3-internet security 4-preventing crisis 5-decision making 6-learning and teaching. 7-multiple intelligence in performing.8-Brain-based learning.9-Brain-based teaching.10-Brain-baased curriculum designe.11-Brain-based team building.