Theory of Constraints Revisited – Leveraging Teamwork by Systems Intelligence

October 28, 2004

Helsinki University of Technology
Department of Engineering Physics and Mathematics
Systems Analysis Laboratory

Martin C. Westerlund
47073M
Table of Contents

Abstract................................................................................................................................2

Introduction......................................................................................................................2

Theory of Constraints Revisited .....................................................................................4

The Five Steps of TOC......................................................................................................5

The Process of Ongoing Improvement................................................................................9

The Team Viewed as a System.........................................................................................9

TOC and Systems Intelligence..........................................................................................11

Leveraging Teamwork with Systems Intelligent TOC.......................................................13

Team Learning..................................................................................................................17

The Final Steps ................................................................................................................20

Identifying Constraints through Systems Intelligence......................................................23

Conclusions......................................................................................................................25

References.......................................................................................................................26

Internet Sites....................................................................................................................29

Acknowledgements.........................................................................................................29

Author.............................................................................................................................29
Abstract

This article presents the Theory of Constraints in the context of teamwork with strategic enhancements through Systems Intelligence. The Theory of Constraints is introduced and put into practice on a theoretical level from the point of view of teamwork. With the Theory of Constraints providing the analytical roadmap to elevate teamwork, Systems Intelligence offers the complementing systemic behavioral approach, the final touch, which enables the realization of significant teamwork leverage.

Introduction

“I came through the gate this morning at 7:30 and I can see it from across the lot: the crimson Mercedes. It’s parked beside the plant, next to the offices. And it’s in my space. Who else would do that except Bill Peach? Never mind that the whole lot is practically empty at that hour. Never mind that there are spaces marked ‘Visitor’. No, Bill’s got to park in the space with my title on it. Bill likes to make subtle statements. So, okay, he’s the division vice-president, and I’m just a mere plant manager. I guess he can park his damn Mercedes wherever he wants.” (Goldratt 1992, p. 1)

Conceived originally in the 1970s as a scheduling algorithm, the Theory of Constraints – also referred to with the acronym TOC – has during the last decades been developed primarily by Dr. Goldratt into a strong and versatile management theory. As it exists today, TOC comprises a suite of management related theoretical frames, methodologies, techniques and tools (Mabin and Balderstone 2003, pp. 569-570). In the words of Mabin and Balderstone (2003, p. 570), TOC is “…a systemic problem-structuring and problem-solving methodology which can be used to develop solutions with both intuitive power and analytical rigour in any environment”. Goldratt himself refers to TOC as a generic management theory for running an entire organization (Goldratt 1988, p. 453).

The management concept delivered by the Theory of Constraints may be summarized by means of the following two fundamental principles (Rahman 1998, p. 337).

- Every system is equipped with at least one constraint.
- The systemic constraints represent opportunities for improvement.

Systems Intelligence is introduced by Saarinen and Hämäläinen (2004) in their Systems Intelligence: Connecting Engineering Thinking with Human Sensitivity, where Systems Intelligence is proposed as a key form of behavioral intelligence. However, readers should note that the ideas and concepts of Systems Intelligence that I will discuss herein are based on the working draft by Saarinen et al. (2003), Systems Intelligence: A Programmatic Outline\(^1\). In this programmatic outline Saarinen et al. (2003) define Systems Intelligence as intelligent behavior that incorporates a holistic view of the complex system one belongs to. Refer to Saarinen et al. (2003) for the complete outline and see Saarinen and Hämäläinen (2004) for the updated version.

The primary objective of this article is to present the Theory of Constraints and its analytical roadmap in the context of teamwork, and to seek further teamwork leverage through Systems Intelligence.

---

\(^1\) http://www.sal.hut.fi/Publications/pdf-files/msaa.pdf
“The bottom line of systems thinking is leverage – seeing where actions and changes in structures can lead to significant, enduring improvements.”
(Senge 1990, p. 114)

Theory of Constraints Revisited

Goldratt (1997, p. 84) presents the Theory of Constraints as a new management philosophy. In this sense, TOC is comparable to such eminent management concepts as Total Quality Management (TQM), Just-In-Time (JIT) and the Learning Organization. But notwithstanding the fact that Goldratt (1997, p. 85) considers these philosophies to be complementary rather than contradictory, there is still an imperative distinction between them as far as their theoretical foundations are concerned. Both TQM and JIT are firmly rooted in the notion that any improvement realized anywhere in the organization produces a global improvement in the organization (Umble and Spoede 1991, p. 27). As shall be discussed in the subsequent paragraph, TOC represents a dramatic departure from this concept. Still, the aspect of complementariness is well illuminated by Ronen and Pass (1994, p. 10) as they state that TOC may enable managers to implement TQM in a more effective manner. Being able to determine the loci where organizational performance is impeded the most using TOC tools automatically results in a significantly improved implementation record of TQM.

In order to clarify the characteristics of TOC, Goldratt (1997, pp. 88-89) defines two fundamental frames of reference, the “cost world” and the “throughput world”. The essence of this approach lies in the fact that controlling cost and protecting throughput imply different modes of management, rendering any proposed compromise between the two frames unacceptable. In accordance with the managerial theory of the cost world, any local improvement automatically results in an improvement of the organization. In light of this statement, achieving global organizational improvement calls for inducing many local improvements (Goldratt 1997, p. 88). The managerial mode of the throughput world, on the other hand, proclaims the opposite – most local improvements do not automatically translate into a global improvement (Goldratt 1997, p. 90). This is due to the fact that not only the entities subject to the local improvements influence the total throughput but also
their linkages. To elucidate this scenario more explicitly, Goldratt (1997, p. 89) parallels the performance of a company to the strength of a physical chain. The analogy convincingly demonstrates that the performance is not only determined by the links in the chain but also by the interaction between them, i.e. all linkages. Elaborating on this equivalence, it is also evident that ultimately the weakest link of the chain determines the overall strength (Goldratt 1997, p. 89).

“Companies are so immersed in the mentality of saving money that they forget that the whole intention of a project is not to save money but to make money.” (Goldratt, 1997)

To distinguish the managerial approach of protecting throughput from controlling costs even further, Goldratt (1997, pp. 91-92) clarifies the applicability of the Pareto principle - that is, the concept of focusing - in both cases. According to Goldratt statistical rules prove that focusing on solving twenty percent of the relevant problem issues yields an eighty percent realization of the potential benefits. However, this theory is only applicable to systems involving independent variables. In consequence, the 20% - 80% rule can be successfully employed only in situations where the entities or links are managed on an individual basis as in the case of controlling costs. As for the throughput world the influential linkages result in the Pareto principle being inapplicable.

**The Five Steps of TOC**

This section outlines a workable procedure for TOC by presenting the process of focusing in five highly intuitive steps. In fact, Goldratt (1990, pp. 3-4) vigorously accentuates the importance and the potential of human intuition. But in order to realize to intrinsic innovative power of the human intuition, one must put strong emphasis on continuously verbalizing the intuition in a convincing and depictive manner. “If we don’t bother to verbalize our intuition, we ourselves will do the opposite of what we believe in.” (Goldratt 1990, p. 3)
Before unveiling the TOC working model, two axioms need to be introduced. First, every system is built for a particular purpose (Goldratt 1990, p. 4). Thus, the mere existence of a system does not automatically translate into self-justification. In accordance with this purpose driven or pragmatic systems approach Goldratt (1990, p. 4) states that any action taken by any organ in the organization is to be judged by its overall impact with respect to the global objective. This, on the other hand, implies that targeting the global objective of a system is prerequisite to being able to carry out improvements or successful change strategies in for example any section of an organization. Second, in reality any system is influenced by very few constraints and, complementarily, any system must be influenced by at least one constraint (Goldratt 1990, p. 4). This postulate is discussed and proved in detail by means of the Boy-Scout analogy in Goldratt’s The Goal (1992). As the name Theory of Constraints suggests, the TOC management philosophy recognizes a system’s constraints as the key elements in seeking ways to leverage the system. Goldratt (1990, p. 4) defines a constraint of a system as follows - once again stressing his faith in the exertive power of intuitive behavior and perception.

“A system’s constraint is nothing more than what we feel to be expressed by these words: anything that limits a system from achieving higher performance versus its goal.” (Goldratt 1988, p. 453, 1990, p. 4)

Having brought forward the foundation of TOC in the previous paragraph, it is now appropriate to introduce the five steps of focusing. The five steps of focusing as presented by Goldratt (1990, pp. 5-6) are depicted in Figure 1. The circular motion used to illustrate this workable procedure is intended to accentuate the correlation between the five steps of focusing and the process of ongoing improvement – the process of continuous improvement is discussed in the next section.
Obviously, identifying the system’s constraints implies the process of locating the limiting factors of the system. In addition, identifying the constraints implicitly proposes that the constraints be prioritized according to their individual impacts on the global objective (Goldratt 1990, p. 5). In this step two different cases of constraints may be encountered (Goldratt 1997, pp. 92-93). The first and more intuitive one is the case concerning a physical constraint, e.g. a bottleneck or, yet in other words, a lack of some critical resource or a shortcoming in capacity. The second case concerns encountering an erroneous policy.

In light of the two cases depicted above the decision regarding the exploitation of the system’s constraints may likewise face two scenarios (Goldratt 1997, pp. 92-93). As for the
scenario involving a physical constraint the proper measure would be strengthening the weakest link, i.e. improving the efficiency or capacity of the bottleneck. An erroneous policy, on the other hand, requires replacing the policy as opposed to strengthening.

Recalling the integral linkages of the throughput world, it is self-evident that any decision made as part of the second step is likely to have ramifications reaching beyond the particular link initially targeted. Analyzing the situation from the holistic perspective of protecting throughput, Goldratt (1990, p. 5) concludes that the exploitation of all unconstrained resources should be adjusted to the maximum level of performance of the weakest link. This stems from the fact that the overall performance of the system is sealed as dictated by the constraints. By subordinating all other operations to the solution agreed upon in step two, the possibility of redundant or futile effort is eliminated.

The fourth step, elevating the system’s constraints, simply addresses the issue of reducing the limiting impact of the identified constraints even further (Goldratt 1990, p. 5). The desired result being enhanced global throughput, targeted measures have to be taken in order to ensure the leverage of the inhibiting factors.

Not paying sufficient attention to questioning the validity of instituted policies may result in policy constraints being the greatest limiting factors of the system. Not paying sufficient attention to questioning the validity of instituted policies may result in policy constraints being the greatest limiting factors of the system. To sum up, due emphasis must be placed on not allowing inertia to bring about a system constraint.
The Process of Ongoing Improvement

The workable procedure consisting of the five steps of focusing laid out in the previous also corresponds to the process of ongoing improvement (Goldratt 1997, p. 95). The process of ongoing improvement essentially means being able to achieve continuing success without experiencing the loss of momentum following even a dramatic growth. The consequent stagnation combined with misguided management policies may in a worst case scenario cause the demise of the business (Sheridan 1991, p. 44). In point of fact, a major problem with companies pursuing ongoing improvement is the lack of an adequate definition of the concept. Sheridan (1991, p. 46) quotes Eliyahu Goldratt for a meticulous definition: ‘Anything that improves the bottom line is an improvement. Anything else is an ego trip.’ By nature, a successful implementation of the process of ongoing improvement requires a leap to the throughput world (Sheridan 1991, p. 46). However, making the leap partially as far as the organizational functions and levels are concerned does not suffice. Without a comprehensive across-the-enterprise transformation the improvement chain will ultimately be blocked.

The Team Viewed as a System

Since the introduction of TOC in the The Goal (1992), Eliyahu Goldratt has successfully applied the theory in a number of different contexts. In It’s Not Luck (Goldratt 1994) TOC is put into operation for sales and marketing, whereas in Critical Chain (Goldratt 1997) the power of TOC is harnessed in the environment of project management. Indeed, according to Umble and Spoede (1991, p. 27) TOC is a generic management philosophy for all levels, departments and functional areas in the business organization. Taking this argument one step further, Umble and Spoede (1991, p. 27) propose that TOC as an overall management philosophy can be viewed as an umbrella for reinforcing the effectiveness of other management methodologies. In what follows, with reference to its generic nature, TOC is analyzed from the point of view of teamwork and Systems Intelligence. Being inherently sensitive to systemic interventions, teamwork qualifies as an ample candidate for systems intelligent TOC leverage.
For the purpose of this article the team concept is defined as any group of individuals faced with an arbitrary task characterized by encompassing a desired state or output. Intuitively it is apparent that a team represents a human system. However, vis-à-vis the system concept portrayed by Saarinen et al. (2003) in their programmatic outline of Systems Intelligence the team concept defined above possesses an intriguing dissimilarity. Before advancing on this subject the five key features distinguished by Saarinen et al. (2003) to delineate a system are summarized in the following enumeration.

1. A system is defined by the following variables: elements, interconnections and reciprocities.

2. A system amounts to more than the mathematical sum of its entities. Saarinen et al. (2003) refer to this quality of the system as emergent.

3. Minor changes imposed on the system may have significant consequences.

4. A system must be defined in accordance with the chosen perspective of analysis.

5. As far as the input and decision variables are concerned, the control of a system is by nature imperfect.

The characteristics outlined by Saarinen et al. (2003) do not take the possible output or state of the system into account. However, the authors do reflect upon the subject as they turn their attention to the link between systems and game theory. In that context the output of a system is defined as the variables that can be observed directly. The state in turn comprises the state variables constituting the elements of a system. Also the concepts of controlling as well as observing a system are put forth.

I believe that the state or output of the system is an essential factor worth considering in detail as an additional feature defining a system. By state I mean the level of operation, i.e. the current operational status, of the system. Output, on the other hand, pertains to the yield or productive result of the system. In either case, the logic is applicable to any scenario
involving a system as defined by Saarinen et al. (2003). Therefore, a system may for instance maintain peace of mind or produce happiness as well as quality footwear and forklifts. As implied by the fourth statement of Saarinen et al. (2003), a system needs to be defined with respect to the observer’s point of view. As for the system state or output, I would employ the same reasoning and recommend that the state or output be defined specifically in accordance with the perspective of analysis.

In light of the foregone discussion a team may represent any of the following human systems: a board of directors, a project team, an orchestra, a family, a football team, etc. Hence, the arguments presented herein are not to be taken solely from a business perspective, albeit they have far-reaching managerial implications.

**TOC and Systems Intelligence**

Successfully employing TOC in the context of teamwork requires adopting the approach of protecting throughput in contrast to controlling costs. In essence, protecting throughput translates into managing and understanding the team holistically, accentuating the team performance as the core measure of achievement—not the individual performances of the team members. As for this holistic approach towards problem solving, TOC has a close relationship with Systems Intelligence. Saarinen et al. (2003) de facto elaborate on the notion of wholeness and holism and present several conforming ideas constituting the foundation of Systems Intelligence. To begin with, the authors assert that the whole is more important than the constituents. Moreover, it is proposed that in many cases people would change their behavior if they were given the chance to objectively comprehend the system settings imposing or dictating that behavior. It is also argued that most subjects taking part in a system do not understand the cumulative overall effects their individual reactions may have on the system. The key ideas stressed by Saarinen et al.
(2003) are also reflected upon in Checkland’s Systems Thinking, Systems Practice (1999). Checkland (1999, p. 3) describes the central characteristics of the system as the properties of the whole – not properties of the component parts. Checkland (1999, p. 5) continues to define the “systems approach” as a means of approaching a problem utilizing a broad view, i.e. attempting to take all aspects into account and concentrating on interactions between the constituents of the problem. In conclusion, it all comes down to Systems Thinking – defined in the following words by Peter Senge (1990).

“Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static ‘snapshots’. ... And systems thinking is sensibility – for the subtle interconnectedness that gives living systems their unique character.” (Senge 1990, pp. 68-69)

Systems Thinking has been studied and applied as a means of problem solving by numerous authors (e.g. Churchman 1979, Flood 1999, Gharajedaghi 1999). The relationship between TOC and Systems Thinking and, consequently, Systems Intelligence is interestingly put into perspective by Mabin and Balderstone (2003).

“The TOC approach epitomises systems thinking: a philosophy that recognises that the whole is much more than the sum of its parts, and that a complex web of interrelationships exist within the system.” (Mabin and Balderstone 2003, p. 570)

As pointed out in the course of the discussion relating to the elements characterizing a system, the concept of system state or output is not referred to by Saarinen et al. (2003) as a fundamental systemic feature. However, as for the systems intelligent adoption of TOC in the case of teamwork I suggest that this characteristic be addressed properly. Saarinen et al. (2003) do contend that structure produces behavior, but the possible state or output of the system is not targeted with the exception of the game theory topic. In order to be able to efficiently implement TOC in teamwork, I insist that the main operative focus be placed on the throughput of the system as a whole. Furthermore, I propose the emphasis on throughput also be included as a fundamental element in Systems Intelligence. I believe
that a system is metaphysically defined, at least partially, by its outcome or state in the sense that a system without exception either produces or maintains a result or a status, respectively. Since systems intelligent behavior according to my perception leans towards a certain level of pragmatism I would consider the embodiment of throughput in Systems Intelligence a powerful complementary asset. As a matter of fact, Saarinen et al. (2003) provide an illustrative example of the emergent potential of a system in their programmatic outline. Using an example of a project team, the authors describe the substantial possibilities of system leverage as a result of positively reinforcing human interaction. Additionally, the subject is touched upon as the authors make an effort to clearly distinguish Systems Intelligence from Systems Thinking.

“Systems Intelligence reaches beyond Systems Thinking in its pragmatic and active, personal and existential emphasis.” (Saarinen et al. 2003)

The following section initiates an attempt to present suggestions for harnessing that emergent potential in a human system, and more specifically in teamwork.

**Leveraging Teamwork with Systems Intelligent TOC**

This section addresses the issue of applying the five steps of TOC in the context of teamwork.

As discussed earlier, the first step of the process is to identify the system’s constraints. In the generic case two scenarios were introduced, the physical constraint and the erroneous policy. As argued in the previous section, the systems intelligent TOC approach is based on the concept of overall team performance. In The Fifth Discipline, the landmark contribution to the concept of the Learning Organization, Peter Senge (1990) explains the poor performance of a team in terms of alignment and wasted energy.

“The fundamental characteristic of the relatively unaligned team is wasted energy.” (Senge 1990, p. 234)
According to Senge (1990) the kernel of this statement lies in that fact that the potentially extraordinary hard work of the team members does not translate into a united or common effort, i.e. a team effort. By contrast, Senge associates the aligned team with a commonality of direction and harmonization of the individuals’ energies. Senge parallels this phenomenon to the development of resonance or synergy as well as the coherent light of a laser. I believe that this proposal by Senge lays the foundation for the identification of a team’s constraints – that is, the unalignment of a team could generally be considered the primary constraint in teamwork.

Contemplate the following scenario. A team is formed by a group of experts to be responsible for an operation of paramount importance. The outcome of the operation is directly proportional to the overall performance of the team, i.e. the combined performance of the team members including synergy as well as rivalry. Acting blindly in accordance with the cost world introduced by Goldratt (1997) results in each team member striving to optimize his or her performance without paying any attention to the interactions inside the team affecting overall performance. Using project management terminology, the team members attempt to create local optima instead of a global optimum. In my experience a major driver for this single-minded quest for localized optimization may be the misconception among team members that individual excellence is more appreciated or valued than the total accomplishments of the team. That having been said, one must stress that this quest is often well-founded due to poor or misleading management – or total lack thereof – which in some cases even enforces localized optimization. The major reasons and solutions for unalignment will be addressed in more detail as part of the second step of the TOC routine. All the same, it should be clear from this example that the unalignment of a team may in a worst case scenario be substantial and, thus, a serious constraint of the system.

The second step suggests that the system’s constraints be analyzed for exploitation. In the case of teamwork this refers to replacing an erroneous policy. There are several feasible
reasons for a possible distortion towards unalignment in teamwork. In my opinion, especially the following underlying causes are worth putting forward for consideration.

- A weak commonality of purpose.

- Distorted measurement of success.

- Team pessimism.

Within the scope of this article only the first aspect, a weak commonality of purpose, will be examined thoroughly. Nevertheless, the other two allegedly major causes of unalignment – distorted measurement of success and team pessimism – represent interesting targets for future research and should under no circumstances be undervalued. For example, the aforementioned misconception regarding the question about individual performance versus team performance is without doubt strongly associated with distorted measurement systems. By these I mean team performance indicators which do not optimally enhance overall team performance. In fact, I believe that distorted measurement systems may in the least favorable case even weaken overall team performance. In other cases they just strengthen each team member’s effort to optimize his or her individual performance, frequently leaving much room for improvement with regard to the global accomplishments of the team. In developing team performance measurement frameworks it is imperative not to lose focus of something I am inclined to call the teamwork axiom: the team is superior to any single team member due to the fact that one team member’s weakness can be compensated for through the strengths of others (Rushmer 1997). Rushmer (1996) also refers to this powerful trait as “harnessed diversity”. The importance of measuring team success in a constructive manner is emphasized in teamwork culture guides as well. In building highly effective teams even a

In building highly effective teams even a team member with an excellent personal record of performance should be valued less than the team member capable of achieving results with others.
team member with an excellent personal record of performance should be valued less than the team member capable of achieving results with others.

By team pessimism I mean a general pessimistic attitude among team members which spreads and grows inside the team as an epidemic outbreak, preventing the team from performing to the best of its ability and potential. In his revolutionary guide to learned optimism, Martin Seligman (1998, p. 156) presents the following predictions for athletes and team sports. First – assuming that all other factors affecting performance are equal – the athlete with a more optimistic attitude will succeed or win because he will try harder especially under pressure, e.g. after a frustrating defeat. Second, in conformity with the optimistic athlete – again assuming equal talent – a team with a higher level of optimism will win. And following as a result from the two previous predictions, Seligman hypothesizes that once an athlete changes his attitude from pessimism to optimism, he should in fact succeed better or win more, again particularly under pressure. Thus, the optimistic and pessimistic attitude of the whole team may produce either victory or defeat, respectively. Seligman goes on to explain the role of optimism in an organization or organizational team. According to Seligman talent is not always enough – especially in ‘high-defeat’, ‘high-stress’ occupations requiring persistence and initiative, dynamic optimism is a real virtue (1998, p. 256). Seligman asserts that an optimistic employee produces more, and that even an extraordinary talent may amount to nothing unless a firm belief in one’s chances to succeed is present. However, Seligman is convinced that optimism can be taught – on a personal as well as a team level (1998, pp. 258-280). In conclusion, team pessimism may be a severe inhibitor of team alignment. In order for the team to be ready to recuperate as a united whole when adversity strikes, team pessimism is to be addressed properly and a change of attitude towards what Seligman calls the “optimistic organization” should be fulfilled.
Team Learning

A weak commonality of purpose indicates that the team members do not have a clear vision of their consolidated goal. That being the case, the team ineluctably suffers from reduced determination, motivation, passion, resolution, etc. and in the wake of these undermined productivity, efficiency and stamina. According to Senge (1990, pp. 234-235) a commonality of purpose is equivalent to the notion of having a shared team vision as well as understanding how to complement other team members’ efforts. As stated in Senge’s The Fifth Discipline, the means to confront a weak commonality of purpose is found in team learning.

“Team learning is the process of aligning and developing the capacity of a team to create the results its members truly desire.” (Senge 1990, p. 236)

Senge presents some interesting dimensions of team learning, the most important of which are discussed in this context. First, Senge (1990, p. 236) proposes the need to think insightfully about complex issues. By this statement Senge refers to the ability to take advantage of the synergy in the team, i.e. the cooperative interaction which allows for a combined effect to be greater than the sum of the individual effects. This idea was also discussed briefly in the previous section, where the team synergy was referred to as the emergent potential of a system. Saarinen et al. (2003) propose three different reasons for the absence of team synergy. First, people view themselves as individual agents affected and, above all, limited by others and the interaction patterns of the environment. This translates into internal team competition as opposed to cooperation. As a second argument the authors suggest skepticism towards the possibilities of remarkable positive change in the other people as well as the system. And third, skepticism towards a remarkable positive change in oneself is proposed. These possible inhibitors of team synergy are presented as contrasts to the virtues of Systems Intelligence. Indeed, Saarinen et al. (2003) assert that Systems Intelligence is based upon the assumption that human interaction intrinsically is a system exhibiting a massive potential of leverage.

The second dimension of team learning is the need for innovative and coordinated action, i.e. action that is spontaneous yet structured and systematic (Senge 1990, p. 236). Senge
introduces the concept of ‘operational trust’ – a form of enhanced relationship utilized effectively in outstanding organizational teams. Senge describes the operational trust as a way of interaction, where each team member is actively conscious of other team members and, thus, acts in a manner that complements the actions of the others. The concept of operational trust is strongly linked to the ideas that Saarinen et al. (2003) bring forward as part of their discussion regarding a person’s perspective inside a system. The authors convey that the perspective or behavior of a person demonstrating systems intelligent qualities is characterized in the following two ways.

– The person perceives himself as part of a system environment and adopts a holistic perspective as opposed to a limited self-centered perspective.

– The person perceives himself and his environment from the perspective of the system and is consequently able to act intelligently – that is, in harmony – with the system.

Saarinen et al. (2003) refer to these characteristics with the general concept ”seeing oneself as part of a system”, the perhaps most important consequence of which is the ability to influence systemic interactions. In the same context the authors contend that in particular self-centeredness is a personal trait that Systems Intelligence attempts to challenge. Saarinen et al. (2003) insist that “self-centeredness is a prominent feature of the human apparatus and of our mode of thinking”. To manifest a clear distinction between this limited perspective and the holistic perspective that Systems Intelligence offers, I trust an additional note on this issue is in order. Systems Intelligence convincingly displays the power of extending one’s perspective to cover, on the one hand, the system one is part of, and, on the second hand, the interactions the system entails. Extending one’s perspective implies moving from a limited vision to an enlightened vision, disclosing a frame of reference previously unknown to the person experiencing this revelation.

Saarinen et al. (2003) mention several aspects connected to the aforementioned ability to see oneself as an actor inside a system. The most fascinating aspect in the context of team learning is expressed as follows.
“The impact of one’s behaviours and possible changes in interaction patterns upon the behaviours and possible interaction patterns of other agents in the system.” (Saarinen et al. 2003)

The concept of operational trust and the ability to see oneself as part of system both have crucial implications as far as the interactions inside a system are concerned. Especially from the point of view of Systems Intelligence the capability to affect or manipulate those interactions consciously is of paramount importance. In the case of human systems such as teams this type of skill is also discussed in Howard Gardner’s Frames of Mind, the groundbreaking contribution to cognitive psychology introducing the theory of multiple intelligences (see also Gardner 1993b and Gardner 1999). Gardner (1993a, p. 238-278) examines the interaction in human systems through the presentation of personal intelligences and particularly the interpersonal intelligence. The essence of interpersonal intelligence is captured in the following sentences.

“[Interpersonal intelligence] turns outward, to other individuals. The core capacity here is the ability to notice and make distinctions among other individuals and, in particular, among their moods, temperaments, motivations, and intentions.” (Gardner 1993a, p. 240)

Elaborating on the systemic interactions and the possibility of elevating them for some purpose, Gardner concludes as follows.

“In an advanced form, interpersonal knowledge permits a skilled adult to read the intentions and desires – even when these have been hidden – of many other individuals and, potentially, to act upon this knowledge – for example, by influencing a group of disparate individuals to behave along desired lines.” (Gardner 1993a, p. 240)

The third and final dimension of team learning I intend to discuss within this scope is dialogue. As stated by Senge (1990, p. 237), mastering practices of dialogue and discussion – the two ways teams converse – is vital in team learning. Dialogue is characterized by free and creative exploration of both subtle and multi-faceted issues, deep
‘listening’ to other team members as well as suspension of the single team member’s own views (Senge 1990, p. 237). Discussion, on the other hand, is the process of presenting different views on subject in a search to discover the best candidate for the situation prevailing (Senge 1990, p. 237). In this sense I get the impression that a discussion bears resemblance to a debate, whereas a dialogue is more similar to an instance of brainstorming. Senge continues to assert that these two forms of communication are potentially complementary – that is, if they are properly harnessed. Equally important is the ability to deal creatively with the forces hindering dialogue and discussion (Senge 1990, p. 237). Senge explains these destructive forces as habitual ways of interacting, the purposes of which are to reduce the risk of embarrassment and mistrust (see also Senge 1999). In the wake of this weakened dialogue team learning is obviously diminished. Dialogue is also mentioned by Saarinen et al. (2003) – with references to Bohm (1996) and Isaacs (1999) – as one of the pillars of Systems Intelligence. The true engagement in dialogue is described by Slotte (2004) as a full engagement of oneself in that relation in all particular situations, the last part of which I interpret as something being done with respect to all surrounding aspects. Slotte (2004) continues to state that in order for a dialogue to come true, a “trustful turning towards to other” is needed. I propose that this way of approaching dialogue is imperative in teamwork as well as team learning, and, thus, an important asset as for the inhibitors of dialogue brought forward by Senge.

**The Final Steps**

In this final section covering the application of the TOC working model in teamwork only the third step serves a purpose of being discussed in detail. The fourth and fifth step – elevate the system’s constraints and go back to step one to avoid inertia, respectively – are to be considered standard TOC procedures, the functions of which are to complete the logical circle in the process of focusing. However, the essence of these routines should not be forgotten: they ensure the successful implementation of the process of ongoing improvement.

The third step of the TOC working model suggests that all other components of the system be subordinated in accordance with the decision made to exploit the system’s constraint. In
the context of teamwork this generically translates into a need to adjust all unnecessary team functions to support the maximum efficiency of the identified constraint. According to Lockamy and Cox (1994) nonconstraint resources contain either productive capacity, which can be used to support the constraint throughput, or idle capacity, which is intended as protection against system disruptions. Using the same terminology one may conclude that nonconstraint resources utilized beyond their productive capacity do not improve throughput but only increase inventory (Rahman 1998, p. 338). As for teamwork this usually means wasting critical resources.

My hypothesis in reference to the third step suggesting subordination of nonconstrained resources is as follows. I believe that an appallingly large portion of a team’s efforts, in particular related to business scenarios, is futile, rendering the efforts merely ends in themselves. This hypothesis stems from the assumption that a great number of team routines are governed by images that limit us to familiar and learned manners of thinking and acting. Senge (1990, p. 174) refers to these images as “mental models”, deeply held internal models or images of how the world works. According to Senge our mental models are severe development barriers in the sense that they prevent new insights from being put into practice. In fact, even the best systemic insights may be overwhelmed by the inertia of deeply entrenched mental models (Senge 1990, p. 177). Senge views the discipline of managing mental models as a promise of a significant breakthrough for building learning organizations. Interestingly, Saarinen et al. (2003) also devote a section to the relationship between mental models and Systems Intelligence. Saarinen et al. (2003) suggest that especially mental models associated with beliefs are to be given due attention with regard to Systems Intelligence. This statement is backed up by the suggestion that the possibility of change in a person’s beliefs in turn represents a major window of opportunity of change. As Systems Intelligence may be viewed as skillfulness in complex system environments, it arises as a great asset to the ability to analyze and change deeply rooted mental models.
In the following list I have gathered some possible scenarios of futile team or team management efforts.

– Pushing the team to the limit out of principle.

– Removing team critical benefits or privileges in order to decrease noncritical costs.

– Abusing deadlines; forcing the team to meet deadlines which are not strategically vital with respect to the team’s overall performance.

– Exaggerated and unmotivated bureaucracy.

– Team feedback and reporting sessions marked by restrained dialogue.

The challenge presented in this section is highlighted by the intrinsic organizational resistance to change. Mabin et al. (2001, referring to Kanter 1985) provide a comprehensive list of factors that actually cause resistance to change. It is not my intention to analyze them in this context, but just to mention the most interesting ones.

– Fear of the unknown.

– Loss of control.

– Loss of face; feeling embarrassed by the fact that you might have done something wrong.

– Need for security.

– Force of habit; fear of loosing the comfortable familiar routines.

Saarinen et al. (2003) present Systems Intelligence as a philosophy of change. One of the cornerstones in the Systems Intelligence theory is the belief that a system itself can change as a result of even a relatively small intervention. Due to this inherent susceptibility a
system comprises an enormous potential of leverage (Saarinen et al. 2003). Moreover, Saarinen et al. (2003) propose Systems Intelligence as a tool to achieve higher-order change, or second-order change as Watzlawick et al. (1974) describes it. From the point of view of TOC the dynamic perception and action-driven attitude advocated by Systems Intelligence serves as a forcible asset.

### Identifying Constraints through Systems Intelligence

The ability to identify the constraints in an intricate system is pivotal as one seeks to successfully implement TOC in order to obtain second-order change. According to the TOC principles identifying constraints essentially translates into locating the most acute and pressing bottlenecks of the system. However, since TOC represents a highly generic management tool a generalization of the concept of system constraints might serve as a gateway to a more intuitive understanding of TOC examined in an arbitrary context. The first principle of TOC – presented in the introduction of this paper – states that every system is accompanied with at least one constraint. My hypothesis is that the part or function of a system acting as the prime obstruction of momentous progression and enrichment does not necessarily correspond to a constraint but rather to a catalyst, or more accurately, an inactive or unexploited catalyst. I believe that in many systems and systemic scenarios the most profound changes and improvements can be realized not by attacking and desperately striving to resolve the ostensibly apparent problem, but by acknowledging the underlying interactive structure of the system and, thus, identifying the trigger point of the system. I wish to define the trigger point as the most effective source of or channel for systemic leverage – that is, the constraint or catalyst that acts as the most crucial inhibitor or most potential activator, respectively, of enhancement.

In describing the laws of the fifth discipline Peter Senge (1990, pp. 63-65) conveys a similar pattern of thought as the one presented above.

> "Small changes can produce big results – but the areas of highest leverage are often the least obvious." (Senge 1990, p. 63)
Senge (1990, p. 63) argues that the most apparent solution indeed not only fails to resolve the problem but also might worsen the situation in the long run. According to Senge (1990, pp. 63-64) remarkable, enduring improvements may be achieved through relatively small but well-focused actions provided they are implemented in the correct loci, i.e. at the identified trigger points. And in equivalence with the challenge of establishing the system constraints in the application of TOC, Senge (1990, p. 64) accentuates the paramountcy of being able to pinpoint where the high leverage of the system resides.

Turning his attention to rules or procedures for identifying high-leverage changes, Senge (1990, p. 65) suggests that the ability to see underlying ‘structures’ instead of ‘events’ represents an effective starting point. However, this ability also constitutes one of core ideas of Systems Intelligence. As stated in the final paragraph of the previous section, Saarinen et al. (2003) present Systems Intelligence as a dynamic tool to accomplish higher-order change. In addition, Saarinen et al. (2003) put forth that a higher-order change requires a change of perspective as to the way a problem is viewed. This in turn induces a shift of thinking enabling the potential realization of higher-order change. The relationship between Systems Intelligence and the quest for higher-order change is summarized in the following words.

“Systems Intelligence is about getting out of the reactive loop and onto the tracks of higher-order possibilities. A systems intelligent person acknowledges the fact that her perception of the system in which she operates might be distorted, one-sided or mistaken. She is constantly on the look-out for possible redefinition of her very perception of the system – for possibilities of a higher order.” (Saarinen et al. 2003)

Taking the problem-solving and change-seeking potential of Systems Intelligence one step further, it is my intention to launch Systems Intelligence as a viable vehicle for intuitively identifying the trigger points of a system. I believe that the systems intelligent person has a high-level capability to grasp and marshal the complex processes and interactions that ultimately dictate the systemic environment, and, consequently, to accurately establish the constraints as well as the catalysts of the system. In fact, I wish to hypothesize that a systems intelligent person automatically perceives a system as a field of opportunities –
that is, an environment with certain trigger points the leverage potential of which he seeks to unleash.

Conclusions

During the course of writing this article I have become convinced of the competitive edge that Systems Intelligence is able to offer the Theory of Constraints, especially in the context of teamwork. Not only do Systems Intelligence and the Theory of Constraints complement each other, but they also mutually reinforce each other, creating an abundant source of synergy. The Theory of Constraints represents a powerful problem-structuring and problem-solving methodology, presenting management with an intuitive yet highly capable tool to address shortcomings in efficiency. Systems Intelligence, on the other hand, represents the new wave of thinking in all realms of life – intelligent systemic behavior actively interpreting interactions and enabling the individual to succeed through an enhanced holistic frame of reference.

Obviously there is still much research to be done. As I pointed out regarding the causes of team unalignment, distorted measurement of success and team pessimism both constitute interesting areas of analysis. However, the commonality of purpose or lack thereof combined with team learning is too vast a subject to be covered within the scope of this article. Nevertheless, it is my hope that this article will raise some interesting questions concerning both Systems Intelligence and the Theory of Constraints and that the connection between Systems Intelligence and the Theory of Constraints will grow stronger in the future. In light of this article I am definitely also looking forward to a teamwork case study realizing the inspiring and innovative power implicit in the combination of these two principles. And finally, I would like to refer to the updated version of Systems Intelligence: A Programmatic Outline by Saarinen et al. (2003), renamed Systems Intelligence: Connecting Engineering Thinking with Human Sensitivity (Saarinen and Hämäläinen 2004). This paper provides an even deeper understanding of the concept as well as the potential of Systems Intelligence. Also from the point of view of the Theory of Constraints the ideas developed by Saarinen and Hämäläinen (2004) serve as an interesting area of future research.
The teamwork benefits of the Theory of Constraints approach leveraged by Systems Intelligence are, I believe, without limit.

"Without changing our pattern of thought, we will not be able to solve the problems we created with our current pattern of thought." (Albert Einstein)

References


Internet Sites


Acknowledgements

Grateful thanks are due to Professor Esa Saarinen and Professor Raimo P. Hämäläinen for their advice and encouragement. Especially the valuable input by Professor Esa Saarinen regarding the identification of constraints through Systems Intelligence is much appreciated. In addition, the research assistance provided by Professor Raimo P. Hämäläinen is acknowledged. The author also wishes to thank Ville Handolin for his kind support.

Author

Martin C. Westerlund is an IT project manager and a student at Helsinki University of Technology, Department of Engineering Physics and Mathematics, pursuing a Master’s degree (M.Sc.) in Strategy and International Business with a minor in Systems and Operations Research.