Information System Evaluation through an Emergence Lens

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Abstract: The development and expansion of evaluation theory and practice is at the core of several different disciplines. There exist different traditional Information System (IS) evaluation approaches, like experimental, pragmatic, constructivist, pluralist and realist IS evaluation. IS evaluation approaches are influenced by the way they address to technology. Recently actor network theory (ANT) and sociomateriality are two influential information systems (IS) entanglement perspectives. Additionally, El Sawy identified three faces of IS views: connection, immersion, and fusion. In terms of IS evaluation approaches, connection and immersion view are the dominant views in which these approaches are positioned. We believe the IS fusion view calls for IS evaluation approaches to be revised. This paper uses the relational emergence theory, based on the philosophy of critical realism to theorize and operationalize the fusion view, as it lacks a theoretical grounding and as well to push forward the traditional IS evaluation research approaches. At the core of relational emergence theory is the emergence concept, in which parts are structured by the relations among each other to create an entity as a 'whole'. Based on this, we present and discuss the implications for IS evaluation in terms of how to evaluate a process as well as the output of the process. The discussion on IS evaluation is illustrated through an empirical example, drawn on a longitudinal research study within a police organization. This paper concludes that in the fusion view, the evaluation process shall embrace a holistic perspective. The focus of the evaluation process shall be the emergent entity consisting of IS, users, task and processes structured by means of relationships among each other. The properties exhibited by this emergent entity shall be evaluated.

Keywords: Information System evaluation, IS evaluation approaches, fusion view, IS views, relational emergence theory

1. Introduction

The development and expansion of evaluation theory and practice is at the core of several different disciplines. It is important to scrutinize theories, approaches, and models used in evaluation (research) as well as evaluation research approaches' philosophical underpinnings (Carlsson 2003).

Information Systems (IS) evaluation and IS evaluation research have been stressed as critical means in advancing the IS field (Bjørn-Andersen & Davis 1988). Generally, IS evaluation is concerned with the evaluation of different aspects of real-life interventions in the social life where IS are critical means in achieving the interventions' anticipated goals. Different evaluation approaches such as: the experimental approach, the pragmatic approach, the constructivist approach, the pluralist approach and the realistic approach (Carlsson 2003) have been researched and applied.

Driving the development and use of IS evaluation are IS theories and how IS are perceived (viewed). Recently, in the IS field, different theories have changed the way we address to technology and we believe that these theories drive the type of approaches evaluators embrace. This type of research can be characterized with the label 'entanglement in practice' and the main influential entanglement perspectives are Actor Network Theory (ANT) and the notion of sociomateriality (Orlikowski 2010). ANT's main focus is the construction of a network of actors, humans and non-humans. In the network the users divide their roles and may invite other actors in the network. The main mechanism by which this network is created is by means of the translations, which invite the actors and create links among them. The associations which keep these actors together are important for the continuation of the network. Both human and non-human actors are aligned together, so there is no discrimination among them in terms of emphasis (Elbanna 2012). Stability of the network is reached when all the actors within the network are aligned and they have reached one common interest (Callon 1991). Sociomateriality is another perspective which is related to the constitutive entangling of the material and social. It refers to the blurring of boundaries between technical and social matters and the importance of materiality in activities and relations. Said Orlikowski and Scott (2008: 455–456): 'In other words, entities (whether humans or technologies) have no inherent properties, but acquire form, attributes, and capabilities through their interpretation . . . Any distinction of humans and technologies

is analytical only, and done with the recognition that these entities necessarily entail each other in practice'. In sociomateriality, both the social and the technical are intertwined and they cannot be separated, but instead conceptualised as such during their entanglement in practice.

Additionally, El Sawy (2003) presented three different views on IS: connection, immersion, and fusion. He contends that it may be time for a natural shift of emphasis from the connection view to the immersion view to the fusion view as IT continues to morph and augment its capabilities. In the connection view, IT and IS are viewed as separable artefacts and artificial systems that are used by people as tools. They are separable from work, processes, and people. In the immersion view, IT and IS are immersed as part of the business environment and cannot be separated from work, processes, and the systemic properties of intra- and inter-organizational processes and relationships. This view stresses work context and systemic relationships and mutual interdependencies. In the fusion view, IT and IS are fused within the business environment, such that business and IT and IS are indistinguishable to standard time-space perception and form a unified fabric. Hence, IT-enabled work and processes are treated as one.

Most, if not all, of the existing IS evaluation approaches have been developed based on the IS connection and immersion views. The fusion view will influence the way IS is evaluated and the already existing approaches have drawbacks if used in fusion view. IS evaluation based on the principles and philosophy of critical realism can be used to develop an IS evaluation approach well linked with the fusion view (Carlsson 2003). Critical realism (CR) sees structure as "…*the constituent components [of structure and agency]"* and "*cannot be examined separately....In the absence of any degree of autonomy it becomes impossible to examine their interplay*" (Archer 1988). The relational emergence theory, based on the philosophy of critical realism (Elder – Vass 2010), presents a perspective which overcomes the critique of ANT for treating all actors, human and non-human in the same way and the critique towards sociomateriality as pointed out by Leonardi and Barley (2010: 35) 'Whereas Orlikowski urges us to weave the social and the material together conceptually, we argue for unravelling them empirically in order to study how each contributes to the whole. At the very least, this means that, in addition to studying social processes, researchers need to pay attention to what a technology lets users do, to what it does not let them do, and to the workarounds that users develop to address the latter'.

Therefore we propose another IS evaluation approach based on the emergence concept. Emergence refers to an entity (system) created by different parts, which exhibits different behaviour as a result of interactions between its composite parts (Elder-Vass 2010). An emergent entity is characterised by the dependency upon interactive parts; fundamental changes to the parts will lead to fundamental changes in the whole; its effects cannot be broken down to the part level (Morgan 2007). The parts are organised such that the sum of the whole is greater than its parts (Odell 2002). Emergence is a way to address fusion based on a specific philosophy and a way to "operationalize" the fusion concept. Both fusion and emergence refer to different parts coming together by interacting and acting as one identity. If the parts are split up, the same entity with the same properties will no longer be obtained.

This paper has two main contributions. The first is theoretical, in which fusion view introduced by El Sawy (2003) will be discussed and elaborated from a CR and emergence perspective. The second contribution will be a discussion on the implications of IS evaluation in the fusion view, in terms of how to evaluate a process as well as the output of the process. The discussion will be illustrated by means of an empirical example.

The remainder of the paper is organized as follows. The next section presents a brief summary of the main IS evaluation approaches and their corresponding views. Section 3 discusses the emergence concept and its properties which are adopted. This is followed by an empirical example. Conclusions are presented in the final section.

2. IS evaluation approaches

This section reviews the major IS evaluation (research) approaches and points out their major strengths and weaknesses. The approaches are the experimental approach, the pragmatic approach, the constructivist approach, the pluralist approach, and the realistic approach (Carlsson 2003). Next, the approaches are positioned to the IS view(s) they can be applied to.

2.1 Experimental IS evaluation

The experimental IS evaluation approach is the oldest IS evaluation approach and it builds on the logic of experimentation: take two more or less matched groups (situations) and treat one group and not the other. By measuring both groups before and after the treatment of the one, an evaluator can get a "clear" measure of the impact of the treatment.

Evaluators and evaluation researchers have recognized the practical difficulties in doing pure experimental evaluation, and thus the idea of quasi-experimental evaluation was developed (Campbell & Stanley 1963). Quasi-experimental evaluation research does not meet the experiment requirements and therefore does not exhibit complete internal validity. According to Carlsson (2003) there are two major problems with experimental IS evaluation. First, the studies are to a large extent a-theoretical and non-theoretical. In discussing DSS evaluation—especially presentation formats in DSS—Carlsson and Stabell conclude: "As we see it, part of the problem is research without a suitable theory, at time without any theory. Typically such work does not present a coherent theoretical argument for how alternative presentation formats might make a difference in the decision context considered." (Carlsson & Stabell 1986). Second, to meet the experiment requirements an experimenter (evaluator) must in most cases create an unrealistic situation and reduce intermediary variables that might affect the outcome. In other words, experimental IS evaluation tries to minimize all the differences, except one, between the experimental and the control groups. This means stripping away the context and yielding results that are only valid in other contextless situations.

2.2 Pragmatic IS evaluation

Pragmatic IS evaluation research was developed, in part, as a response to the problems associated with the experimental IS evaluation approach. The pragmatic evaluation approach represents a use-led model of evaluation research, stressing utilization: the basic aim of IS evaluation is to develop IS initiatives (implementation of IS) which solve "problems"—problems can be organizational problems like reduced competitiveness or far from good customer services. The problems addressed in an intervention and the intervention's goals are not given, but are politically colored and defined by stakeholders. Following Patton's (1982, 2002) view on evaluation, this approach stresses that the test bed is whether the practical cause of IS intervention is forwarded or not. It is not a question of following certain epistemological axioms. The pragmatic IS evaluation approach has a toolbox view on evaluation methods. Pragmatic evaluation is comprised of standard research tasks. Evaluation research success is depending on a researcher's sheer craft and this craft is primarily learned through exemplars. In doing evaluation an evaluator or a researcher selects the appropriate tools and measures from the available toolbox. The rule of thumb is that the evaluation mandate comes from the stakeholder(s) responsible for the development, implementation, and use of the information systems. The more explicit the mandate is the more compressed and technical is the evaluator's role. Since the evaluation mandate is coming from stakeholders this can lead to "evaluation (evaluator) for hire" which is one of the major problems with pragmatic IS evaluation.

2.3 Constructivist IS evaluation

In line with the general development in many social sciences during the 1970's, phenomenology, hermeneutic, and interpretative approaches influenced IS evaluation. This meant that focus came to be on social processes. The constructivist evaluation approach argues that IS initiatives should not be treated "…as 'independent variables', as 'things', as 'treatments', as 'dosages'." (Pawson & Tilley 1997). Instead all IS initiatives are "…constituted in complex processes of understanding and interaction" and an IS initiative (IS implementation) will work "through a process of reasoning, change, influence, negotiation, battle of wills, persuasion, choice increase (or decrease), arbitration or some such like." (Pawson & Tilley 1997). Following Guba and Lincoln (1989) it can be argued that the social world is fundamentally a process of negotiation and so are IS initiatives. Hence, evaluation is a process of negotiation and evaluators are the "orchestrators" of negotiation processes. The major problem with the constructivist IS evaluation approach is its inability to grasp those structural and institutional features of society and social organization which are in some respects independent of the agents' reasoning and desires but influence (affect) an IS initiative and the negotiation process. To develop theories of why an IS initiative (IS implementation) works for whom and in what circumstances requires an evaluator or a researcher to generate some means of making independent judgments about the institutional structure and power relations present in an IS initiative. This is

something not possible in constructivist IS evaluation, but institutional structure and power relations affect—working as constrainers and enablers—an IS initiative and the negotiation process.

2.4 Pluralist IS evaluation

Having presented three "traditional" IS evaluation approaches and noted their strengths and weaknesses, one can imagine the attractiveness of developing an approach combining the strengths of the three approaches: an approach combining the rigor of experimentation with the practice of pragmatism, and with the constructivist's empathy for the voices of the stakeholders. The pluralist IS evaluation approach was developed more or less on these premises. The major problem of the approach is that it does not address what it is with an IS initiative which makes it work. It also lacks an ontological position.

2.5 Realistic IS evaluation

Driving realistic IS evaluation is the aim to produce ever more detailed answers to the question of *why* an IS initiative—IS, types of IS, or IS implementation—works for *whom* and in *what* circumstances. This means that evaluators and evaluation researchers attend to how and why an IS initiative has the potential to cause (desired) changes. Realistic IS evaluation is applied research, but theory is essential in every aspects of IS evaluation and IS evaluation research research design and analysis. The goal is not to develop theory per se, but to develop theories for practitioners, stakeholders, and participants.

2.6 IS evaluation approaches in relation to IS views

The previous sections presented a short description of the four major IS evaluation approaches and an alternative IS evaluation approach (realistic evaluation). **Table 1** shows the approaches' primary target(s) in relation to El Sawy's IS views.

Table 1: IS evaluation approaches

IS evaluation approach	Short description	Views
Experimental	By measuring the treated and untreated groups before and after the treatment of the one, an evaluator can get a "clear" measure of the impact of the treatment.	Connection
Pragmatic	Represents a use-led model of evaluation research, stressing utilization: the basic aim of IS evaluation research is to develop IS initiatives (implementation of IS) which solve problems	Connection
Constructivist	All IS initiatives are "…*constituted in complex processes of understanding and interaction*" and an IS initiative (IS implementation) will work "*through a process of reasoning, change, influence, negotiation, battle of wills, persuasion, choice increase (or decrease), arbitration or some such like*." (Pawson and Tilley 1997).	Connection, Immersion
Pluralist	Combines the strengths of the three approaches: an approach combining the rigor of experimentation with the practice of pragmatism, and with the constructivist's empathy for the voices of the stakeholders.	Connection, Immersion
Realistic	Its aim to produce ever more detailed answers to the question of *why* an IS initiative—IS, types of IS, or IS implementation—works for *whom* and in *what* circumstances.	Connection, Immersion (potentially Fusion)

In general, the IS evaluation approaches described are positioned mainly in two IS views: the connection and immersion view. The approaches consider IS either as a tool, separated from the work and process (in the case of the connection view), or as immersed in the work and process (in the case of the immersion view). None of them consider the evaluation of IS, when it is fused in the organization and as such IS is not treated as one together with tasks, processes and people. The CR-

based concept emergence could be an alternative for developing an IS evaluation approach for the fusion view. The realistic approach with its idea of mechanism-based explanations (Hedström and Ylikoski, 2010) and its emergence perspective (Elder-Vass 2010) has the potential for being used in the fusion view.

Taking into consideration the emergence of IS towards fusion view, there is a need for the evaluation approaches to be revised. IS can no longer be separated from its environment (context), as it is already fused into it. During the evaluation process, IS has to be considered as a whole, together with users, tasks, processes, etc.

3. Emergence in critical realism

Critical realism has become an important perspective in modern philosophy and social science (Archer et al. 1998; Robson 2002), but critical realism has to a large extent been absent in IS research. We argue that IS evaluation and IS evaluation research based on the principles and philosophy of critical realism overcomes some of the problems associated with "traditional" IS evaluation (research) approaches.

CR's manifesto is to recognize the reality of the natural order and the events and discourses of the social world. It holds that "we will only be able to understand—and so change—the social world if we identify the structures at work that generate those events and discourses … These structures are not spontaneously apparent in the observable pattern of events; they can only be identified through the practical and theoretical work of the social sciences." (Bhaskar 1989).

Emergence is a cornerstone in critical realism. Smith (2010: 25–26) writes that emergence refers to the process of constituting a new entity with its own particular characteristics through the interactive combination of other, different entities that are necessary to create the new entity but that do not contain the characteristics present in the new entity. Emergence involves the following: First, two or more entities that exist at a "lower" level interact or combine. Second, that interaction or combination serves as the basis of some new, real entity that has existence at a "higher" level. Third, the existence of the new higher-level entity is fully dependent upon the two or more lower-level entities interacting or combining, as they could not exist without doing so. Fourth, the new, higher-level entity nevertheless possesses characteristic qualities (e.g., structures, qualities, capacities, textures, mechanisms) that cannot be reduced to those of the lower-level entities that gave rise to the new entity possessing them. When these four things happen, emergence has happened. The whole is more than the sum of its parts.

Elder–Vass (2010) introduced the relational emergence theory based on the philosophy of critical realism. He provides a general ontological framework to discuss the social structures and human individuals as entities with emergent properties which determine the social events. An entity is a 'whole', which consists of parts structured by means of the relations among each-other. Emergent entities possess some properties produced by mechanisms which depend on the properties of individual parts and the way the parts are structured in order to form the entity (whole). The properties which derive from the entity are not possessed by its individual parts. The way the parts are related at a certain point in time will depict the joint effect they will have. Therefore the relation between the entity and its parts is not of causation, but of composition (Elder-Vass 2010).

The importance of the interactions between the parts is expressed by Holland (1998:121-122) as:

Emergence is above all a product of coupled, context-dependent interactions. Technically these interactions, and the resulting system, are nonlinear: The behavior of the overall system cannot be obtained by summing the behaviors of its constituent parts… the whole is indeed more than the sum of its parts. However, we can reduce the behavior of the whole to the lawful behavior of its parts, if we take the nonlinear interactions into account.

There are some elements which an emergent entity should have (Elder-Vass 2010). First of all, the different parts which an emergent entity consists of should be recognized. The relationships between the parts which cause this type of entity should be identified. The emergent entity should be explained in terms of morphogenetic and morphostatic causes. Morphogenetic refers to "those processes which tend to elaborate or change a system's given form, structure or state" (Buckley, 1967: 58-59). Morphostasis refers to the causes which maintain an entity either internal (the causes which maintain

the parts in a certain relationship) or external (the causes coming from the environment). The latter, Buckley (1967: 58-59) defines as "those processes in complex system-environment exchanges that tend to preserve or maintain a system's given form, organization or state".

Additionally, De Wolf and Holvoet (2005), based on a literature review, have listed different properties possessed by an emergent entity:

- *Interactive Parts*. The interaction between the parts is responsible for the emergent system (Odell 2002; Heylighen 2002).
- *Micro-Macro level effect*. An emergent properties that an emergent system shows as the results of the interaction between its components (Holland 1998).
- *Novelty*. Emergent properties cannot be understood by the properties of the components. Anyhow, they still can be studied via the components and their relations in the context of the whole system (Holland 1998; Elder-Vass 2010).
- *Coherence*. An emergent property tends to maintain its own identity during the time, by converting the interactive parts into a 'whole' (Heylighen 2002).
- *Dynamical*. Emergent properties of a system are related to the time dimension, meaning that they can arise or change over time (Holland 1998).
- *Decentralised Control*. No parts alone can direct or control the emergent properties of a system (Odell 2002).
- *Two-Way Link.* The interaction between the parts influences the emergent system, which on the other hand can influence its individual parts (Odell 2002).
- *Flexibility*. As no single part is fully responsible for the emergent properties of a system, its substitution or non-functionality will not lead to a total failure of the emergent entity (Odell 2002).

4. IS evaluation in the fusion view

As previously discussed, different approaches have been used to address 'entanglement in practice', including sociomateriality and ANT. Additionally, the fusion concept introduced by El Sawy (2003) tries to explain how the advances in technology are fusing IS/IT in organisations. To address the technology fused we take a holistic perspective grounded in the relational emergence theory. The parts which constitute the whole and their relations should be recognised in order to understand the generation of events and impacts.

In the fusion view, IT and IS are fused within the business environment and are indistinguishable. They can no longer be separated from work, processes and users, but instead they should be treated as one. Both IS fusion and the emergent entity refers to different elements merging together by interacting and acting as one identity. If the parts are split up, no longer will the same entity with the same properties be obtained. Using emergence as a conceptual lens we argue that, in the fusion view, different parts such as IS, tasks, users, etc., structured by relations among each other, give rise to an emerging entity showing different emerging properties. In this sense we try to operationalize and theorise fusion.

IS fusion view calls for IS evaluation approaches to be revised. The traditional IS approaches described in Section 2 do not meet the challenges of the fusion view. IS evaluation based on the emergence theory will move IS evaluation from the connection and immersion view, towards the fusion view. The result of an IS evaluation is a concept of interest which represent an emergent property. We need to identify the entity which produces this property and the relations between its parts. It is also important to explain the mechanisms of how they interact to produce these events. IS can no longer be evaluated separated from its users, processes and tasks. The evaluation process should take a holistic perspective. The parts which constitute the whole and their relations shall be recognized in order to understand the generation of the impacts and events. Hence, the impacts of the entity as a whole shall be evaluated—since the result of IS evaluation is produced by the entity—shifting the focus from the evaluation of IS per se to the entity in which IS is part of. When evaluating the impacts and benefits of IS the macro – level impacts should be considered. It means that the emergent properties need to be evaluated instead and the mechanisms which bring the emergent properties should be described. In this way, based on the evaluation results, changes in different

parts can be undertaken if necessary to maintain the whole as such and keep IS fused in the organization.

To illustrate the emergence concept in an evaluation process we will in the next section use an empirical example. Possible emergent entities will be observed and evaluated by means of the emergent properties, and based on the theoretical framework discussed above.

4.1 Empirical example

In this section we will illustrate via an empirical example how to begin an IS evaluation based on the emergence theory. The empirical example is based on a longitudinal research study we have been performing in a police organization since 2009. For more details about the case, see Carlsson et al. (2010).

Skåne is the third largest police authority in Sweden and it has approximately 3240 employees, where approximately 2340 are police officers and 900 civil servants. The Business Intelligence (BI) system, created with the software QlikView, started as a single application based on the system RAR (a system for crime statistics, where all reported crimes are registered). (QlikView is a BI/DSS software company, see: http://www.qlikview.com). The system was used by crime analysts to forecast when and where crime could occur. The main objective of the system was to support decision-making processes in order to increase efficiency and effectiveness. The system creates associations on the processed data which makes it easy to distinguish relationships between them. The information can be visualized by diagrams, tables or dashboards. The BI applications existed primarily in two categories: 'view' and 'analyse'. The view applications were available to all employees through the police intranet. The analysts had the same access as the viewers, but also the option to do more detailed analyses.

The police organizations' BI system is slowly emerging to the fusion view. We will evaluate the societal impact of an entity consisting of: BI system users and other policemen, BI system, and the specific tasks to be solved with two different examples. The first example is a single-shot analysis for solving a crime. The second example is an on-going analysis of crimes for improving crime prevention.

Case 1: Finding the serial shooter. BI usage in the police organization in Skåne proved to be successful in the solution of a crime which was scaring the citizens of Malmö (a city in Skåne). During the last years, a serial shooter in Malmö shot many people (emigrants, second generation emigrants, and refugees) in the streets, at bus stops, and in the victims' cars. Many were seriously wounded and one was killed. For this case, after finding a suspect, the police in Skåne gathered all the reports dating back to 1998 and found that there were about 58 reports connected to the shooter. The police used a BI application, which can read about 1.5 million reports in less than 10 minutes. According to one of our interviewees the specific application took about "*four hours to build—because we knew how to do it*". During the analysis 6–7 key words were used in the free-text search application. The analysis produced "*27000–32000 rows* [of information] *in Excel with 11–13 words in each row*". This information identified the reports that should be read and evaluated. Reading and evaluating had to be done the old way (manually).

Case 2: Crime prevention. One example of 'car theft' prevention in Malmö shows how "hot spot" analyses can be both effective and efficient in terms of crime prevention. According to Weisburd and Telep (2010), crime hot spot strategies for fighting crime have been embraced recently by some police forces. The idea underpinning the crime hot spot strategy is that crime is better prevented by focusing on areas (hot spots), for example, specific streets, buildings, blocks, and areas within a community or zone, rather than by focusing on individuals. The process started by using the BI system to point out some areas with the highest number of car thefts. Further analyses, by means of other systems, proceeded to identify the parking lots and streets of those hot zones. Action was taken to allocate the patrol forces to the hot spots. This strategy revealed to be effective in relation to reducing crime not only in the hot spot areas but also in most zones of the city. Thus, the BI system enabled the police to implement the hot spot strategy.

The successful Malmö-cases show BI usage in crime solutions. The case against the shooter was stronger in court (the shooter was sentenced to life in prison). In this case the interaction between at least four parts—BI system, BI system users and other policemen, and the task to be solved—led to

macro-level effects. Based on the specific type of organization, we refer to these effects as societal benefits. The users constructed the necessary application within BI to read the reports, saving months of work. In this case, time is critical as the police have to handle a serial shooter and the sooner he is caught, the better. Hence, we deduce that the interaction between the parts resulted in time reduction (enhanced efficiency) and strongly supported the crime solution.

The same type of analyses can be applied to the 'car theft' example. As a result of the interactions between BI system, the BI system users and other policemen, and the task to be solved, societal benefits in terms of crime prevention are produced. The entity—the parts and the interactions—has brought *novel* ways of dealing with crime prevention, hot spot, which cannot be achieved by the parts operating on their own. Although hot spot analyses have been criticized for moving the crime to the "next corner", many other studies and experiments have concluded that hot spot analyses are followed by the diffusion of crime prevention benefits (Weisburd and Telep 2010). This study supports the arguments of Weisburd and Telep (2010) because the benefits of crime prevention were not limited to the hot spots but also extended to the nearby areas. Now the police can identify hot spots and better allocate their resources with the main intention of preventing crime. The parts and their interactions have improved efficiency in terms of reducing the number of target spots and allocating resources better, leading to improved crime prevention. Hence, we observe some sort of emerging entity giving rise to macro effects by means of the interacting parts, which cannot produce these results on their own in isolation. Considering this process in terms of *morphogenic* causes, the interaction between BI and the users for a specific task, the capabilities of the BI system to analyse data very fast, and the ability of the employees to interpret the data are the main contributory causes which give rise to the exhibition, by the emerging entity, of *macro-level effects* which cannot be reached on a micro-level.

It is worth considering that in both examples the interaction between BI and users existed only during the first phases of the crime analyses, where all the data needed are collected. Afterwards, the users had to carry out manual work: for instance in the Malmö case they had to analyse the reports manually and in the case of 'car theft' they had to use other sources to obtain more details regarding the specific 'hot' streets and blocks. However, we believe that extra BI capabilities to support all of the phases of analytical work will drive BI even more towards the total fusion view. This study support the arguments of El Sawy (2003) that more technological advances in BI will shift it to fusion view and at the same time we will observe more solid emergent structures.

In *coherence* terms, in the case of the serial shooter some identity properties are shown. The news headline "Swedish Police Arrest Man over Malmö Racist Shootings" (Associated Press in Malmo 2010) demonstrates how neither the analyst group nor the BI system whose interaction saved so many months of work were mentioned, but the entity was given another name: the Swedish police. The entity is recognized by the organization's name, as the interaction between the BI and users to solve the crime takes place within the context of the police organization. One question in this case is: will the macro-level effects drive micro-level behaviour in leading to a *two-way link*? Basically, the success of this interaction between the users and the BI in crime solution and prevention may lead the users to a more extensive usage of the system in other cases, where their needs will also drive updating of the BI system or inclusion of other technological capabilities in it. For instance, during the 'hot spot' analysis, the users realized that the integration of a map in their BI system would further improve hot spot analyses, and would, as stated by a respondent, "take our work very, very far". In its current state BI displays the hot crime zones by means of zone numbers, but it is unable to direct the police to specific streets or buildings referred to as spots. Additionally, we can observe the characteristic of *flexibility*. If we substitute the users with others, nearly the same effects and benefits will be obtained, and also if the BI system is down some of the work can be done manually, but that would result in a waste of time, and in some cases time can be critical, for instance in crime prevention or solution. For example in the case of the Malmo serial shooter, if the BI system went down, the users could still manage but the work would take about nine months, which could even lead to the release of the suspect until the evidence was ready. To summarize, this was an empirical example where the evaluation of societal impact was focused on the emergent properties of the entity (the pars and their interactions).

5. Conclusions

This paper has discussed the implication of IS evaluation in the fusion view (El Sawy 2003). We presented a short description of the main IS evaluation approaches which all target the IS connection

view or the immersion view. The fusion view, calls for the IS evaluation approaches to be revised. This paper uses the relational emergence theory based on critical realism to theorize and operationalize the fusion view and discuss its impact on IS evaluation. Based on the emergence concept, within IS fusion view an emerging entity rise, where IS is a part constituting this entity. We discussed the implications of the evaluation process when IS are positioned in the fusion view. We suggested that the evaluation process should embrace a 'holistic' perspective, where IS, users, task processes, etc. should be considered as one entity. The relationship between the parts and the entities' properties should be evaluated. Therefore emergence is used as a conceptual lens and we illustrated the idea by evaluating the organizational and societal impact of a BI system in a police organization in a holistic perspective. The arguments of El Sawy (2003) that with more technological advances fusion view will be reached are supported in the example. Once more capabilities will be implemented in the BI system, it will be extensively used and other emergent properties may emerge.

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