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Reworks: A robust system efficiency measure

Ralph Renger
University of North Dakota, USA

Brain Keogh
Cobalt59, Australia

Andrew Hawkins
Charles Darwin University, Australia

Jirina Foltysova
Walden University, USA

Eric Souvannasacd
University of North Dakota, USA

Abstract

The article reports on the inaugural Australian-American system evaluation summit convened in Wyoming, USA, focusing on the application of system evaluation theory (SET). The think tank noted SET's efficiency principles and published illustrations are emergency response sector specific and pondered whether efficiency measures could be identified for systems targeting complex social problems. The article describes how the think tank used the concept of system waste as a springboard to identify reworks as a universal system efficiency measure. Reworks were defined as repeating all or part of a system standard operating procedure (SOP) or adding additional steps to the SOP to satisfy externalities to the primary purpose. The article then describes the think tank conclusions regarding the utility of reworks as a proxy measure for the four SET factors influencing system efficiency: training, information technology, leadership and culture. The think tank concludes with a discussion of the cautions evaluators should observe when interpreting reworks.

Corresponding author:
Ralph Renger, Center for Rural Health, University of North Dakota, Grand Forks, ND 58202, USA.
Email: ralph.renger@med.und.edu

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In the summer of 2018, the inaugural Australian-American system evaluation summit convened in Wyoming, USA.[1] Summit participants engaged in an intensive, two-week think tank focused on understanding the potential application of system evaluation theory (SET).

Renger (2015) published SET to provide evaluators a framework for defining and evaluating modern day systems.[2] SET consists of three steps: defining the system, evaluating system efficiency and evaluating system effectiveness. In a series of follow-up articles, Renger and his colleagues provided greater detail about how to define systems (Renger, Foltysova, Ienuso, Renger, & Booze, 2017) as well as detailing the evaluation of cascading failures and feedback loops (Renger, 2016; Renger et al., 2017).

The focus of this article is on the think tank reflections as they relate to evaluating system efficiency (i.e., step 2 of SET). The think tank noted SET's efficiency principles and published illustrations are emergency response sector specific. In these examples, variations of time are the system efficiency measures. For example, in an emergency response to cardiac issues, time is of the essence. All cardiac care subsystems work toward completing their work as quickly and safely as possible (Eisenberg, 2013). In a public health emergency response, such as establishing points of dispensing (POD) for mass vaccination/immunization, the goal of all subsystems is to maintain constant timing and steady throughput (Bautista, Alfaro, & Batalla, 2015; Bautista & Cano, 2008; Bukchin & Masin, 2004; Renger & Granillo, in press). In these contexts, defining and measuring system efficiency using time is relatively straightforward and easily quantified.

The think tank reasoned defining efficiency measures in other contexts might be more challenging, for example, for systems addressing complex social problems such as poverty, recidivism, domestic abuse and so forth. For SET to be useful, it must be applicable to all system types. Therefore, if robust system efficiency measures are defined, then evaluators could be assured of completing an evaluation using SET regardless of the problem complexity. This would allay evaluator concerns of investing resources in defining a system (i.e., SET step 1) only to discover there was no way to evaluate system efficiency.

As a starting point for defining robust system efficiency measures, the think tank began by noting efficient systems produce minimal waste (Arnheiter & Maleyeff, 2005; Bentley, Effros, Palar, & Keeler, 2008). The concept of system waste is well-documented in the business management literature (Hicks, 2007; Teich, 2013; Womack, 1990). A frequently used measure of system waste is the number of reworks. In business management, a rework is restarting a process due to product defect or incorrect implementation (Love, Li, & Mandal, 1999; Love et al., 2000). However, a more encompassing definition is the addition of extra process steps required to deal with external complications and/or to recover from internal complications (Fuller, 1985).

Therefore, within the SET framework, *reworks are defined as repeating all or part of a system standard operating procedure (SOP) or adding additional steps to the SOP to satisfy externalities to the primary purpose.* An SOP details the necessary steps within and between subsystems to meet the common system goal (Renger, 2010; 2015).

SET notes four general factors impacting system efficiency: training, information technology, leadership and culture. The think tank's conclusions regarding the extent to which reworks may serve as a proxy for evaluating the efficiency of each of these factors are now discussed.

Training

To operate efficiently, system actors need to possess the competency and capability to execute the SOPs for which they are responsible (Renger, McPherson, Kontz-Bartels, & Becker, 2016). Training inefficiency would be evidenced by a system actor repeating, or reworking, *all or part* of an SOP. The evaluation would consist of directly observing system actors and comparing what they are doing with what they are supposed to be doing (i.e., the written SOP). Repeating all or part of an SOP will take more time (and perhaps other resources). Presumably, the longer the rework takes as compared to the established standard, the greater the inefficiency.

Currently, SET only notes the importance of detailing the SOP steps when defining a system (Renger et al., 2017). Therefore, one think tank recommendation is to amend SET to include the time standard by which the SOP should be executed. This should be done simultaneously when defining the subsystem SOPs with subject matter experts. It should include any benchmarking that may be possible and the explicit recognition of any steps designed to deal with 'complications' not aimed at fulfilling the primary purpose.

The think tank also noted it was unlikely all system SOPs operate on a 'complete as fast as possible' standard like is in the case in many emergency response systems. Rather, it is reasonable to assume there is an ideal time associated for a system actor to execute a SOP; the timing between steps may not be uniform and may require a specific pacing to optimize efficiency. Sometimes it may be necessary to have pauses between steps, for example, to allow other subsystems to respond or to properly process the step before being able to move on to the next step.

In summary, the think tank concluded that the number of reworks and time to complete a rework are reasonable indicators of training efficiency for any system. To evaluate reworks due to training deficiencies requires (a) the evaluator compare the SOP steps against the extent to which the system actor executes the steps with fidelity, (b) the system actor completes the SOP in an established time standard and considers complications and (c) the extent to which the system actor adheres to the overall idiosyncratic pacing of the SOP needed for optimal system efficiency.

Information technology

According to SET information technology (IT) is a core feature of any modern social system. When IT infrastructure goes down, systems waste time and resources in troubleshooting and restarting. Evaluating IT reworks can be relatively straightforward such as rebooting a computer system, reinstalling software, resending emails and resetting passwords. All these factors require a rework and often at considerable system cost (Dynes, Johnson, Andrijcic, & Horowitz, 2007; Harper, 2014). However, the impact of IT can also be subtler. IT is often interwoven in system actors' ability to execute all or part of an SOP. In some cases, the IT itself is programmed to meet the idiosyncratic SOP pacing. For example, systems often use IT to gather feedback. The timing between initial data request, reminders, analysis and timely feedback is critical to system inefficiency. If the timing is out of synch, then reworks are inevitable.

Leadership

Leadership is the key to providing the resources necessary to ensure optimal system efficiency. There is no single best leadership style (Benner, 2003; Carlisle, 2006; Fiedler, 1987; Xenikou, 2017). Rather, leadership creates efficiency through a match of leadership style with actors within a particular environment (Vera & Crossan, 2004). The more unstable the environment, the more innovation needs to be encouraged (Snowden & Boone, 2007). Leaders must encourage both exploration (new SOP possibilities) and exploitation (improving current SOP; Benner, 2013; Rosing, 2011; Uhl-Bien, 2018). Obtaining a balance between exploration and exploitation is one key component of working in a complex system (Cao, Gedajlovic, & Zhang, 2009; March, 1991; Smith & Tushman, 2005).

As a consequence, a leader can make a process more efficient through:

1. Incremental adjustments – continuous improvement through ongoing minor changes.
2. Step-change adjustments – the reconstruction of parts, or all, of the SOP.

Incremental change means empowering actors (Bowen, 1992; Dombrowski, 2013). Empowerment means the leadership must distribute power, information and knowledge to all system actors while giving clarity on the boundaries of this empowerment (Bowen, 1992; Simmons, 1995). Empowered system actors collectively share responsibility and actively engage in quality improvement (Faraj & Sambamurthy, 2006). Step-change adjustments require much stronger innovation that moves beyond the boundaries of incremental change. This is when major parts of the SOP require adjustment, or complete rework, to accommodate a new strategy and/or innovations in the surrounding environment.

The three elements of reworks that give indications related to leadership are as follows:

1. The relative importance of the rework in terms of the primary purpose of the process and the standards set by the subject matter experts.

2. The rework impetus emanating from outside the system boundaries, with the system but from a neighboring system led by someone else, or within the subsystem itself.
3. The length of time the rework has been in place relative to the leadership tenure.

Culture

A culture of excellence is essential to system efficiency (Eisenberg, 2013). However, defining a culture of excellence for evaluation purposes is challenging. Renger (2015) suggests that a positive culture exists when all subsystem leaders and actors are aligned toward the common goal. This alignment toward a common goal would lead to optimal system efficiency. Leaders and actors in positive cultures minimize reworks by adhering to quality control initiatives and remaining vigilant throughout the production process (Oyewobi, Ganiyu, Okwori, & Ibrahim, 2011; Stare, 2012).

By extension, then, a negative culture (or siloed efforts as is common in modern bureaucratic systems) could lead to misalignment within and between subsystem leaders and actors. This misalignment is akin to the concept of activity traps in the program evaluation literature (Renger & Titcomb, 2002). Misalignment would be evidenced by reworks and thus serve as a potential indicator of poor system culture. That is, when subsystem actors are misaligned they work redundantly (i.e., reworking the same SOP) or worse, work against each other (i.e., undermining each other's SOPs). Note that this is not the same as reworks due to a training issue. Here, the SOPs may in fact be executed with the highest fidelity where system actors are doing things right, they just aren't doing the right things (Coşkun, Akande, & Renger, 2012; Renger & Titcomb, 2002).

Conclusion

The focus of this article was whether the concept of reworks can serve as a robust efficiency measure applicable to most, if not all, types of modern social systems. The think tank concluded while each system likely has idiosyncratic efficiency measures, reworks can serve as a robust indicator of efficiency for any system. *However, whether the observed reworks are due to leadership, training, IT or cultural issues is something the evaluator must carefully consider before making improvement recommendations*.

The evaluator should be aware that not all system inefficiencies will necessitate correction. For example, leadership and system actors are likely to weigh the cost of making system efficiency changes (e.g., retraining, IT changes, SOP changes) relative to system effectiveness. The result may be to make a change or accept the inefficiency (Hackman & Wagerman, 1995; Widener, 2007). This does not negate the evaluation's utility, rather the cost of making change was simply too high (Patton, 2010).

The think tank cautions evaluators to closely examine the *rework quality*. As noted earlier, reworks are of two types: redoing the same SOP steps over or adjusting SOP steps. These two rework types are qualitatively different. When reworks reflect SOP step adjustments, the rework itself may be in a response to a system inefficiency. That is, the changed SOP steps may actually represent a remedy to a system inefficiency.

For example, out of necessity, system actors may be adjusting established SOPs. When evaluating efficiency, the adjustment will reveal itself as different SOP steps. The astute evaluator must examine whether the observed SOP changes are in response to an existing system inefficiency (and thus represent a remedy to the established SOP) or whether they are due to, for example, system actor training issues.

With each new publication, the utility of SET in addressing limitations associated with traditional theory-driven evaluation approaches in evaluating systems is being established (Paquibut, 2018). Although SET was intended for evaluating modern day systems, the think tank believes there is merit in examining the utility of the SET principles in evaluating programs, particularly those involving interventions into complex social systems involving multiple agencies using a placed-based or collective impact approach (Bellefontaine & Wisener, 2011; Burstein & Tolley, 2011; Dillman & Peck, 2012; Doherty & Eccleston, 2016; Kania & Kramer, 2011; Nichols, 2013). In collective community efforts involving multiple systems, inefficiency may be evidenced by a *duplication of effort* between community agencies – a form of reworks occurring across subsystems.

The think tank concluded that SET possesses great promise in providing evaluators another tool to address problems that do not fit the available program evaluation approaches. The think tank encourages fellow evaluators to use SET when appropriate and to share their findings to establish SET's utility and application boundaries.

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2. Ericson (2011) defines a modern day *system* as

   > an integrated composite of components that provide function and capability to satisfy a stated need or objective. A system is a holistic unit that is greater than the sum of its parts. It has structure, function, behavior, characteristics, and interconnectivity. Modern day systems are typically composed of people, products, and environments that together generate complexity and capability. (p. 402)

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