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Managing *(In)Stability* in Complex and Dynamic Software Teams: A Sporting Momentum Perspective

[A Working Paper]

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ABSTRACT

How should complex and dynamic software teams manage stability and instability? Contemporary information systems development (ISD) methods such as agile have been commonly cited as the answer to this question. However, there is evidence to suggest that these methods possess certain limitations which constrain their ability to effectively manage the impacts of turbulent environments. This research-in-progress paper introduces a new approach to understanding stability and instability in ISD teams, drawing on the concept of momentum. The concept of momentum, drawn from sports literature, is based on the view that team performances transition between states of stable peak performance (positive momentum) and states of unstable suppressed performance (negative momentum). Successful sporting teams possess an innate ability to not only sustain states of constant peak performance but also possess a cogent ability to counteract the impacts of critical game instances or momentum breakers which destabilise their performance. This research presents a projected performance model and draws on sporting exemplars to explain the momentum existence. Implications of this model for understanding momentum in ISD teams are briefly considered.

Keywords

Momentum, sport, stability, instability, information systems development

INTRODUCTION

“It is never the size of your problem...it’s a lack of momentum. Negative momentum punches you in the gut every step of the way. But positive momentum makes everything easier” (Maxwell, 2007).

Momentum is defined by the Oxford English Dictionary as “the impetus and driving force gained by the development of a process or course of events” (Harker et al., 2013). According to Markman and Guenther (2007) “there appears to be widespread cultural acceptance of the existence of the concept of momentum and recognition of how it can powerfully influence performance...individuals can experience momentum while they are designing a computer program, writing a paper, or cleaning an apartment”. The conceptualisation process in field research has also been cited as exhibiting momentum whereby “the first formulating of ideas is usually followed by an onslaught of subsequent ones that snowball and grow excitingly” (Glaser and Strauss, 1967, as cited in Adler, 1981). Momentum is a “pervasive force in companies, whereby past practices and, trends and strategies tend to keep evolving in the same direction...eventually reaching dysfunctional extremes” (Miller and Friesen, 1982). When momentum is lacking, even the most mundane tasks seem impossible. On the contrary, “when momentum is on your side, the future looks bright, and obstacles appear small. An organization with momentum is like a train that’s moving at sixty miles per hour” (Maxwell, 2007).

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Reel (1999) identified the ability to sustain momentum was one of the most critical success factors for managing information systems development (ISD) projects. Reel (1999) asserted that “building momentum initially is easy, but rebuilding it is dreadfully difficult”. Momentum changes often during the course of a development effort. These changes add up quickly, so it is crucial to quickly offset the negative shifts with positive ones”. Momentum is often used as a metaphor for being a powerful change agent in ISD research whereby the term is commonly used to describe how “the team lost momentum” or “the shift in momentum had disastrous consequences for the project”. For example, a study by Dyer (2006) highlighted how loss of momentum was identified as a primary root cause for IT project failures. The author argues that “teams start out and gain momentum over time. When problems and issues arise, it causes a loss of momentum...it is therefore imperative that you have a clear process for resolving issues quickly” (Dyer, 2006). Modern ISD environments are characterized by high levels of change, complexity and dynamism which can significantly disrupt momentum by promoting uncertainty and instability in product development (Revilla, Prado and Prieto, 2008, Conboy, 2010, Schmidt and Buxmann 2011, Cecez-Kecmanovic, Kautz, and Abrahall, 2014). Contemporary ISD agile methods (e.g. scrum, extreme programming, lean software development etc.) have been widely championed as exemplars for building and managing momentum within complex and dynamic ISD teams. For example, according to Dyba and Dingsøyr (2008) agile methods can be used to address the challenges of an unpredictable world by emphasizing, “a rationalized, engineering-based approach in which it is claimed that problems are fully specifiable and that optimal and predictable solutions exist for every problem”. However, agile methods do possess certain limitations. For instance, it has been argued that agile methods are more appropriate for smaller teams than for larger projects (Cohen, Lindvall and Costa, 2004), maintaining an on-site customer is unsustainable for long periods (Martin, Riddle and Noble, 2004) and pair programming can lead to instances of frustration where there is a large competency differential between the pairs (Tessem, 2003). In addition, there is only very anecdotal evidence that contemporary agile methods can build and sustain momentum. In fact, there is a logical argument that agile methods can actually cause a lack of momentum in some ways. For example, agile methods are inherently people centric whereby they rely on “people and their creativity rather than on processes” (Dyba and Dingsøyr, 2008). Thus, agile methods, are subject to diverse understanding and implementation of practices. Moreover, agile methods encourage forced iterations (e.g. stop-start), mandatory scheduled reviews (e.g. retrospectives, stand up meetings), disparate modular work allocations (e.g. user stories, unit tests) and task switching (e.g. assigning people to multiple projects). Also, numerous surveys (e.g. VersionOne annual state of agile survey 2015), which have been conducted to identify why agile projects fail, have highlighted that certain impediments (e.g. lack of management support, communication problems, lack of training) can make it very challenging to build momentum and can also make it very easy for an agile project to lose momentum. This is particularly relevant to organizations who are transforming their traditional software development methods (e.g. waterfall) to agile methods for the first time.

There is strong evidence from the literature pertaining to the successful transference of sporting concepts (e.g. peer coaching, metrics, sigma lean belts and so on) to business environments (See Davenport 2014, Johnathan Liu et al., 1998, Soane, 2014). Modern organizations are now using sporting analogies and training methods, to enhance the performance and ability of their employees for greater efficiency, productivity, and company profits. The reasoning for this is that the sports industry is one of the most scrutinised in the world, whereby the use of “analytics to measure performance in the sports world has much to teach managers about alignment, performance improvement and business ecosystems” (Davenport, 2014). There are also commonalities between sports teams and business team contexts. For example, both environments can be characterised by a similar ethos of competitiveness, incentives, individualism, camaraderie and achievement (Peters, 1996, Dovey and Singhota, 2005, Soane, 2014). Miller and Friesen, (1982) argue that organizations can attenuate the dysfunctional extremes of momentum by using mitigating influences to warn of the dangers of momentum excesses. However, there is currently a dearth of research which has investigated how to effectively build and, more importantly, how to sustain momentum in an ISD context. Moreover, there is a dearth of literature which has examined the concept of momentum and its role pertaining to managing stability and instability in dynamic and complex software teams. One concept which has received increasing attention in the sporting literature, and which also possesses promising transference potential to the information systems development field (ISD) and in particular may assist with the identification of how critical instances can lead to instability and loss of momentum, relates to the concept of sporting momentum (Cornelius 1997, Ferreira, 2011). Thus, this study is primarily motivated recent calls to extend nuanced research perspectives on ISD (Cecez-Kecmanovic et al. 2014). Whereby, we investigate the process of sporting momentum and introduce a model that has both theoretical and practical significance in an ISD context.

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The paper proceeds as follows. We first delineate the concept of sporting momentum and discuss its relevance in a sporting context. We then explicate a sporting momentum perspective, the projected performance model, which could be used as a lens for studying ISD practices. Next, a proposed research methodology is outlined. Finally, we conclude with a discussion pertaining to the potential research contributions.

THE CONCEPT OF SPORTING MOMENTUM

In a sporting context, momentum involves shifts in performance in either a positive or negative direction (Taylor & Demick, 1994; Cornelius et al., 1997). According to Fry & Shukairy (2012) “the concept of momentum is often cited by coaches, players, commentators and fans as a major factor in determining the outcome of the game and, consequently, in-game decision making”. The concept of sporting momentum was conceived by Adler (1981) to be a bi-directional concept which impacted either the probability of winning or losing as a function of the outcome of a preceding event. Adler (1981, p.29) defined momentum as “a state of dynamic intensity marked by an elevated or depressed rate in motion, grace, and success”. According to Silva, Hardy and Crace (1987), Adler’s perception of momentum encompassed “the tendency of an effect to be followed by effect...[whereby] the operation of positive momentum would predict that success increases the probability of subsequent success. Negative momentum would indicate the opposite direction, that is, failure increases the probability of subsequent failures”.

Competitive sporting contests are subject to specific critical incidents, or what Adler (1981) refers to as “momentum breakers”, which can significantly disrupt the momentum of an athlete or team’s individual or collective performance. Critical incidents are a generic quality of sporting contests whereby “critical incidents are its specificities” (Ferreira, 2011). According to McGarry (2009) when a critical incident occurs in a sporting contest it may or may not result in an athlete or team’s momentum transitioning from a state of optimal performance (or stability) to a state of suppressed performance (or instability). This has led to the common saying that “the momentum shifted in favour of...” following the occurrence of a specific critical incident in a sporting contest. Also, some of the most famous sporting events in history have involved contests where teams have made an improbable comeback to win a game. Examples of these extreme momentum shifts have occurred in the NFL, (e.g. the Indianapolis Colts overturning a 4th quarter 21 point deficit against the patriots in 2007), NBA (e.g. the Boston Celtics overturning a 35-14 first quarter deficit against the LA Lakers in 2008), sailing (e.g. Oracle team USA overcoming a 8-1 deficit to become Americas cup champions in 2014), and golf (Europe Ryder cup comeback at Medinah in 2012). The sporting literature reveals that the most successful athletes and teams possess an innate ability to control the ebb and flow of momentum during a sporting contest. For example, they can not only sustain stability within a contest by operationalising coping strategies to smooth out the impacts of critical incidents, but they also demonstrate a cogent ability to rapidly restabilise their performance to optimal levels when a critical incident does disrupt their normal momentum (Hughes et al., 1998, McGarry, et al., 2002, McGarry, 2009). Research on different momentum models in the supporting literature relate game events with consequent shifts on the immediate team’s performance (Vallerand et al., 1988; Taylor and Demick, 1994; Cornelius et al., 1997). For example, the momentum construct has been explored in sporting contexts from a binomial relationship of time-score perspective (Kozar, et al., 1994), a multidimensional perspective (Taylor and Demick, 1994), an incidental perspective (Burke et al., 1999), a weighting system of game actions perspective (McCutcheon 1997) and a projected performance perspective (Cornelius, Conroy and Petersen, 1997). The projected performance model is an example of a sporting momentum model which possesses cogent sport to ISD transference potential.

The Projected Performance Model

The projected performance model (see Figure 1) proposed by Cornelius et al., (1997) explains normal how fluctuations in performance and the forces that operate to return these variations to mean levels can be beneficial to sports athletes and teams. The model “labels performance fluctuations exceptionally above the mean as positive momentum and exceptionally below the mean as negative momentum. Declining from optimal performance is labelled positive inhibition and improving from suppressed performance is labelled negative facilitation” (Cornelius et al., 1997). This model is primarily motivated by the research of (i) Silva, Hardy and Grace (1988) which introduced the concepts of positive inhibition and negative facilitation to the sporting

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momentum literature and (ii) Tversky and Kahnemans (1974), which explored the tendency of sports athlete's and team's performances to fluctuate around a mean performance level.

Positive Inhibition, Towards Performance Instability

When a positive momentum is occurring, a team or player is outscoring their opponent, but suddenly due a specific inhibitory force trigger the performance decreases below the average to a suppressed performance level. This process is referred to as the positive inhibition phenomenon: a shift from positive momentum to a negative one. According to Cornelius (1997) an example of this in tennis would be “after winning the first set easily, competitors may ‘coast’ or ‘let-up’ or they may ‘go for it’ more than usual,” as a result of an inhibitory force which causes their performance to deteriorate.

Negative Facilitation, Restoring Performance Stability

The inverse of this phenomenon is referred to as negative facilitation, a process which encompasses the use of facilitative forces to shift from negative momentum to positive momentum. Revisiting the tennis example, “after an especially disappointing performance in a set, players may come out for the next set more focused and motivated, and their play may improve due to specific facilitative forces” (Cornelius, 1997). Thus, negative facilitation delineates a positive change in performance following a deteriorating performance. For example, a recent paper by Chassy (2013) highlighted how Barcelona football club possess a cogent ability to operationalise specific collective facilitative strategies (e.g. self-organisation capability, tactical awareness, physical conditioning) which enable them to decrease the time they spend in the suppressed performance zone when inhibitory forces create positive inhibition or instability within a game. Using the mean performance level as a reference the projected performance model may offer salient insights pertaining to momentum, particularly where performance fluctuations may be sensitive to changes in team's performance. These processes may explain the collapse of the US team (positive inhibition) and the resurgence of the European team (negative facilitation) during the during the 2012 Ryder Cup, a feat which has been coined the “miracle at Madinah”. Table 1 provides an overview of typical (i) inhibitory force triggers which can result in sports teams experiencing positive inhibition and (ii) facilitative forces used by sports teams to promote the negative facilitation process in order to restore positive momentum.

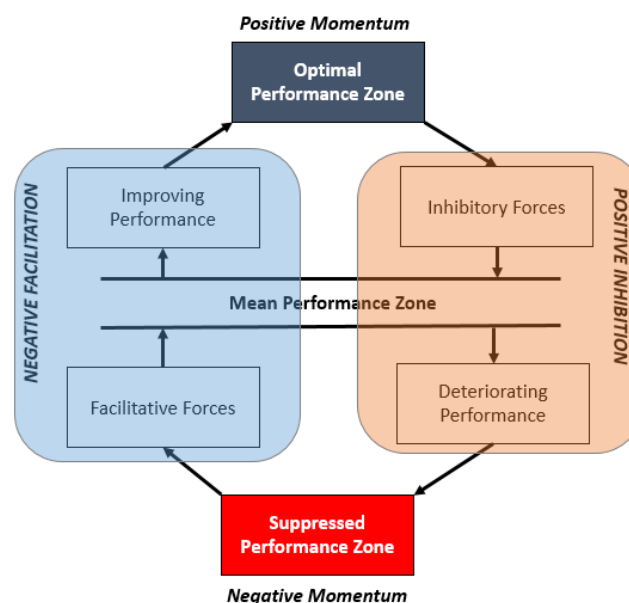


Figure 1: Predicted Performance Model (Cornelius et al., 1997)

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Table 1: Inhibitory forces triggers and facilitative forces sporting examples

Inhibitory Forces Triggers	Facilitative Forces
Pressure, Lack of confidence, Lack of communication, Unusual environment, Complacency, Fatigue, Egoism/Individualism/Overconfidence, Playing opponents of higher ability, Passive leadership (e.g. coach, captain), Lack of perceived ability, Negative criticism, Lack of encouragement (e.g. team, crowd, coach, captain), Official decisions	Pressure management, Confidence, Previous experiences, Positive attitude, Attacking opponents weaknesses, Self-organisation capability, Physical conditioning, Team cohesion, Back to basics, Leaders take ownership, Tactical awareness, Ability to frustrate opponents, Positive encouragement (e.g. team, crowd, coach, captain), Official decisions

Sources: Adapted from Chassy (2013); Moesch and Apitzsch (2012), Jones and Harwood (2008); Cornelius et al., (1997).

Cornelius et al., (1997) describes how the predicted performance model can be used to identify which factors or characteristics which could be used to facilitate the maintenance of extreme levels of performance (good or bad). According to Adler (1981, pg. 104) “a team’s organisation, interaction, cohesion and potential for contagion (e.g. transmission of momentum from person to person) have marked effects on performance which is the ultimate measure of momentum”. Unsuccessful teams often become “anchored in negative momentum...which wreaks a patterned havoc that’s increases the distance to the goal (Adler, 1981, pg. 63). Successful teams maximise their time in the optimal performance zone by resisting “the inhibitory forces that naturally occur to return performance to the mean... [they operationalise] specific strategies which assist them to ride the wave as long as possible” (Cornelius et al., 1997). Table 2 highlights the strategies deployed by successful teams in order to maintain positive momentum. Additionally, a recent research paper by Davenport (2014) delineated how the domain of professional sports is currently excelling more than any other industry with regards the use of big data predictive analytical initiatives in order maintain high performance levels. For example, successful sporting teams deploy data and analytics to: support individual game strategies (e.g. competitive intelligence, tactical options), empower players to take ownership of their performance improvement and predict the likelihood of injury occurrence.

Table 2: Team and individual strategies that increase chances of maintaining positive momentum

Strategy	Source
Goal setting and visualisation	Den Hartigh et al., (2014), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Maintaining concentration	Den Hartigh et al., (2014), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Changing tactics	Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008))
High engagement	Moesch and Apitzsch (2012), Jones and Harwood (2008)
Task orientated	Den Hartigh et al., (2014), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Peak conditioning	Den Hartigh et al., (2014), Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Good preparation and planning	Den Hartigh et al., (2014), Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Good communication	Den Hartigh et al., (2014), Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008))
Repeated positive reinforcement	Den Hartigh et al., (2014), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Use of time and space	Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008)
Ability to control pace	Den Hartigh et al., (2014), Chassy (2013), Moesch and Apitzsch (2012), Jones and Harwood (2008)

Conversely, to minimize time in the suppressed zone, successful teams complement the facilitative forces that would return performance to mean levels...this process involves recognition that regression to the mean is likely to occur” (Corneilus et al., 1997). These teams purposely design interventions whose primary objective is to

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decrease time in the suppressed performance zone. For example, successful teams execute carefully planned training sessions in which they replicate and mimic critical game scenarios which are likely to perturb their performance (Davenport, 2014, Elberse, 2013, Hodge et al., 2006). A Harvard business review case study of Alex Ferguson, Manchester United's former manager (1986 – 2013), revealed how he would repeatedly get his players to train specifically for decreasing the team's time in the suppressed performance zone. According to Elberse (2013), "Alex Ferguson's teams regularly practiced how they should play if a goal was needed with ten, five, or three minutes remaining...they knew what it would take to be successful in those situations". Similarly, Robbie Deans, the former all blacks rugby coach (2001-2003), described how his training sessions were used to effectively simulate game scenarios: "The emphasis was to put players under pressure. Ideally the training would be more difficult than the match. It's only by putting yourself under pressure that you can raise the threshold of performance" (Hodge et al., 2006). According to Taylor and Wilson (2005) this repeated exposure to critical game scenarios during training provides several key benefits. First, it demonstrates the team's competence to perform well in challenging conditions. Second, it equips teams with skills which enable them to perform at a higher level. Finally, it motivates teams to react positively when they inevitably experience adversity or "momentum breakers" in a competitive contest.

PROPOSED METHODOLOGY

To date, the following research has encompassed a comprehensive theorising and review process of the sporting and ISD literature. The proposed next steps for this research are as follows. First, an exploratory phase (e.g. pilot study or expert interviews or focus groups), encompassing in-depth face-to-face interviews with experienced software developers, will be conducted in order to bring clarity to the concept of momentum in ISD. In order to provide structure to these interviews, the discussion will be guided using the constructs contained within the projected performance model. The primary objective of this exploratory phase will be to refine the research model and assist with the development of research question(s) and an interview protocol. Second, the primary data collection phase will encompass a number of case studies which will be used in order to answer the study's central research question(s). Case studies, using within case and cross-case analyses, are deemed appropriate for studying complex and dynamic organisational environments (Eisenhardt and Graebener, 2007) and for also elucidating how and why research questions (Yin, 2013). The research sampling approach will be directed by evolving theoretical concepts, whereby the researchers will identify organisations and people from which it is expected to elicit the majority of insights into the phenomena of interest (Strauss and Corbin, 1998). The case study interviews (including follow-up interviews) will be conducted until theme exhaustiveness is reached and no new themes emerged. All interviews will be transcribed, proof read and annotated and then coded using NVivo 10. Extensive field notes and observations will be taken immediately after each interview. Supplementary evidence in the form of archival documents (e.g. meeting minutes, project management plans etc.) will also be collated and analysed. This form of document analysis constitutes natural occurring evidence and serves as a cogent complement to interviews (Silvermann, 2006). The data analysis phase will follow a two stage process of open and axial coding building upon the recommendations of Strauss and Corbin (1998). This proposed methodology adopt a praxis-based or "phronetic" research approach which focuses on self-reflexivity, context and thick description (See Tracey, 2012). Phronetic research can provide powerful insights into the practical context-specific wisdom (often tacit) of research informants in order to "uncover the rhythms" of the focal points of enquiry (Halverson, 2004). In the case of ISD, this places a premium on gaining insights into the experiences of software development team members (contextualised knowledge) and how the unique attributes inherent to their environments saturate the research experience. For example, detailed narratives and concrete examples of specific practices used to effectively maintain momentum throughout a project will allow for the elucidation of salient phronetic insight.

PROPOSED CONTRIBUTION

The primary objective of the following research is to make a number of proposed theoretical and practical contributions. First, this research has raised the issue and has also provided examples of how contemporary ISD methods such as agile may be unsuitable for managing and sustaining momentum in complex and dynamic software team environments. Subsequently, these methods may be limited in their capacity to deal with instances of instability which may cause deteriorating project performance. Second, we have applied the concept of momentum to a new domain. This nuanced sporting perspective presented in the following research paper is intended to serve as a springboard for further investigation into the concept of momentum in ISD environments.

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Third, it is envisaged that, using the projected performance model as a reference, the next empirical data collection phases will provide salient insights into how ISD teams manage and sustain momentum in complex and dynamic environments. For example, referring back to Table 1, the research findings may identify inhibitory forces triggers and facilitative forces coping strategies which are specific to ISD teams. These findings will be compared and contrasted with the practices of elite teams from the extant sporting literature. For instance, it can be logically argued that ISD individuals and teams may operationalise a majority, if not all, of the strategies identified in Table 2 in order to increase their chances of maintaining positive momentum. Thus, the aim of the following research is to identify exemplars of how elite sports teams operationalise differentiating strategies in order to sustain competitiveness. Finally, this research is also fertile in potential applicability for exploring the concept of momentum in other research disciplines. Moreover, there is promising potential for this research in terms of business to sport transference, whereby the practices of successful ISD teams may be replicated by sports practitioners and may be used by sport researchers in order to further develop theory. It has been argued that business to sport transference represents an area which is ripe for further exploration (Soane, 2015) and exploitation (Davenport, 2014).

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