Building High Performing Agile Development Teams

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Abstract

This paper explores the research of high performing teams and applies it to teams that have adopted the Agile methodologies. Research into high performing teams illustrates the defining characteristics and the components that are required for teams to be effective. From the research of Agile approaches, there are specific practices and processes that relate to the way the team works together. A framework is derived that highlights the importance of motivation and reward model, skills and team selection, the organizational impacts, leadership, communication and collaboration, and the physical and virtual work environments. There has been a fair amount of work to establish these best practices in traditional software development teams. Recommendations are presented that can help teams new to agile project management or looking to increase team effectiveness. The importance of this research is to apply the best of effective team practices to the strengths of Agile methodologies

Dedication

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Introduction

The modern world of Agile systems-software product development and delivery presupposes we work faster and better, do more with less, change continuously, and invent new ways of working. And part of this presumption includes the idea that if a group of people are assembled and called a team, they will be immediately effective and productive. Additionally organizations where project teams have been applied effectively to solve problems using a more traditional development approach then decide to leverage the benefits of Agile methods may not be prepared for the challenges and impacts this will have on the team. What has been missing is the development and application of a framework for high performance *Agile* teams.

This paper will explore the research of high performing Agile development teams as well as broader team effectiveness perspectives. A framework for building high performing Agile teams will be presented that attempts to bridge this gap between traditional high performing team practices and agile methodologies. The framework will focus on practices around:

- Motivation and Reward

- Skills and Team Selection

- Organizational Impacts

- Leadership

- Communication

- Physical and Virtual Work Environments

While the framework may not be exhaustive, it will highlight the key areas that need to be addressed when adopting Agile in an organization and how to ensure that teams are set up for success.

Research Objective

The objective of this Applied Research Project is to review the research related to high performing teams and how it relates to the relatively new field of Agile development projects. It is proposed that Agile is a methodology that can enable teams to be more effective than traditional development approaches. It is not clear however what team effectiveness components relate to Agile teams or if there are components of Agile teams that can contribute to the overall field of research on high performing teams.

The outcome of this research will ideally be a framework for building a high performing Agile team, as well as the areas for further research and the guidelines for supporting and effectively adopting Agile methodologies in the organization.

Background

There has been much written in terms of team effectiveness in traditional development projects. Recently, there has been a rapidly emerging area of Agile development methodologies. These are dynamic, iterative approaches that are strikingly different in approach over more structured waterfall development approaches. These methodologies are typically applied in the area of information technology or software development. These approaches (of which Scrum, XP, Extreme, Rational Unified Process, and Evo are among) place new and unique challenges on the traditional development organization. In particular the impact on team development and effectiveness is a challenge that needs to be addressed.

Agile is not defined by a set of practices. This is very different from traditional software development methodologies. Agile has been articulated as a set of principles (Poppendieck & Poppendieck, 2003). Practices for one domain will not necessarily apply to other domains. Principles, however, are broadly applicable across domains as long as the guiding principles are translated into appropriate practices for each domain. (Poppendieck & Poppendieck, 2003)

Specific Agile development methodologies such as Lean, Scrum, XP, Evo, Crystal, and DSDM, do have specific practices; pair programming, continuous builds and integrations, and test driven development for example (Highsmith, 2004). While these have an impact on how teams are run, they are not in the scope of this paper. Instead of focusing on "how" teams do things, this paper is focusing on what high performing Agile teams are doing that makes them effective.

Despite extensive interest in the topic, a clear definition of teamwork continues to be elusive (Salas, Sims, & Burke, 2005). There are also many differing views and related research on what makes a team effective. There are many sources of advice about how to make the most of a team but there are no easy rules or procedures. A team comprises a group of distinctive and independent personalities; we cannot generalize very easily about how these personalities will interact and how the team will progress (Holcombe, 2008).It does, however, seem reasonable to conclude that teams can indeed be designed for high performance (Stewart, 2006).

Literature Review

Agile Methodology

Agile is a relatively new paradigm for software development. While Agile manufacturing has been around for some time, its application to software has only recently been formalized. There are key differences between traditional software engineering and Agile software development. These principles are further reflected in the Agile Manifesto, a defining set of guidelines that have formed the basis of Agile Methodologies (Agile Alliance, 2001):

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

> **Individuals and interactions** *over processes and tools*
>
> **Working software** *over comprehensive documentation*
>
> **Customer collaboration** *over contract negotiation*
>
> **Responding to change** *over following a plan*

That is, while there is value in the items on the right, we value the items on the left more.

One of the originating contributors of Agile and Lean Development, (Poppendieck & Poppendieck, 2003) highlighted seven principles of lean or Agile methodologies:

- Eliminate Waste – Waste is anything that does not add value to a product

- Amplify learning – Development is an activity in discovery

- Decide as late as possible – Late decisions are effective in domains where there is a high degree of uncertainty

- Deliver as fast as possible – Shorter iteration cycles, faster and earlier rounds of feedback

- Empower the team – Involve developers in the technical decisions

- Build Integrity In – Software integrity has a coherent architecture, scores high on usability and fitness of purpose and is maintainable, adaptable, and extensible. It comes from wise leadership, relevant expertise, effective communication, and healthy discipline

- See the whole – Making decisions based on the big picture of the project vision and objectives

From Boehm, also one of the original authors of Agile methodologies, there are key defining practices of Agile teams (Boehm & Turner, 2005):

- Embracing change: Seeing change as an ally rather than an enemy. Change allows for more creativity and quicker value to the customer.

- Fast cycles, frequent delivery: Scheduling many releases with short time spans between them forces implementation of only the highest priority functions, delivers value to the customer quickly, and speeds requirements emergence.

- Timeboxing, for example, establishes specific time frames that are then filled with as much prioritized functionality as can be developed.

- Simple design: Strip designs down to cover just what you're developing. Since change is inevitable, planning for future functions is a waste of effort.

- Refactoring: Restructuring software to remove duplication, improve communication, simplify, or add flexibility without changing its behaviour; just-in-time redesign.

- Pair programming: A style of programming in which two programmers work side by side at one computer, continually collaborating on the same design, algorithm, code, or test.

- Retrospective or reflection: A post-iteration review of the effectiveness of the work performed, methods used, and estimates. The review supports team learning and estimation for future iterations.

- Tacit knowledge: Establishing and updating project knowledge in the participants' heads rather than in documents (explicit knowledge).

- Test-driven development: Developers and customers incrementally write module or method tests before and during coding. Supports and encourages very short iteration cycles.

There are specific processes and tools for running an Agile project. Tools such as project war rooms, and self-directed teams, daily brief meetings (scrums), pair programming, and whole team together approaches are reflective of the importance of the focus on people and interactions versus processes and procedures (Larman, 2004).

These practices have direct impact on how teams work, and there can be significant stress on traditional organizations and teams. There practices have a high focus on flexibility, change, openness and transparency, trust, responsibility, and accountability, which many people and organizations will be uncomfortable with. This paper will explore the changes that these principles require in the team to be able to adhere to the principles effectively.

Scrum (one Agile methodology) was introduced in one company because they wanted to improve their ability to deliver iteratively and on time, increase the quality, improve the team-feeling and team communication (Moe & Dingsøyr, 2008). These relate to the "Big Five" core components of teamwork, as identified by Salas (2005), described in the Components of Team Effectiveness below. Scrum provides companies with the means to combine the various skills, talents and perspectives of a group of individuals to achieve corporate goals (Siebdrat, Hoegl, & Ernst, 2009).

Working software is often a better measure of progress than a force-fit earned-value ratio (Boehm & Turner, 2005). Unnecessary or low-value functions can be identified early and therefore the organization does not spend time implementing them. Short cycles force the organization to focus on specific capabilities, provide more specific descriptions of functionality, and identify misconceptions between the customer and developer earlier. This requires a different focus for an Agile team versus a traditional team.

Agile is more suited to emerging requirements and capability-based specifications than traditional top-down approaches. Agile provides rapid value to the customer, often delivering capability while traditional methods are still sorting out plans. Agile methods empower developers who might be suffering from the over-constraint of heavy processes. Agile practices aren't new, have been proven over time, and generally work as well as or better than some currently accepted practices (Boehm & Turner, 2005).

Benefits of High Performing Teams

There are a number of reasons why this research is important. Teams have been shown to be more effective than individuals at performing tasks, and high performing teams are unique in a number of characteristics that make them more effective than many teams. High performing teams are defined in (Quader & Quader, 2009):

> *Team high performing as making big steps forwards in a very short timeframe with limited resources, and … a high performing team has the right tools in terms of interpersonal skills, discipline and governance to resolve issues and to manage these issues well as to what needs to be done first, meaning that these teams excel in prioritizing.*

Nedelko (2008) pointed out six benefits that highly effective teams generate:

(1) increasing resources for problem solving, because the team is usually comprised of members, who belong to different areas in the organization and have different and/or complimentary knowledge;

(2) fostering creativity and innovation – the team could create more ideas/alternatives in comparison to individuals;

(3) enhanced commitment to tasks – because the team members are part of the decision making process;

(4) improved quality of decision making process and decisions made – because views of all team members are confronted before the final decision is made;

(5) satisfaction of team members – employees have needs for belongingness and affiliation, therefore, working in teams can help employees meet their needs; and

(6) raised motivation and morale of the employees in the organization, because many employees could become a part of a team.

Ineffective teams cause organizations to waste resources, fall short of performance objectives, rework designs, and extend time to market (Ross, Jones, & Adams, 2008). Developing effective teams is a common goal of organizations, and organizations that are adopting Agile have unique challenges that will be explored in this paper.

Characteristics of High Performing Teams

There have been many frameworks for defining the characteristics of high performing teams in the literature. Seven constructs of effective teaming as discussed in (Ulloa & Adams, 2004); clearly defined goals, common purpose, role clarity, psychological safety, mature communication, productive conflict resolution, and accountable interdependence. High performance teams at IBM are characterized by the collection of highly trained technical and scientific experts from diverse sources to work collectively and simultaneously on complex technological projects where the demands for rapid development create an intensely challenging environment (Daniel & Davis, 2009).

A literature review by (Ross et al., 2008) points to the hypothesis that team effectiveness can be evaluated by five broad principal variables: performance, behaviour, attitude, team member style, and corporate culture. (Hoegl & Proserpio, 2004) also highlighted seven factors of common purpose, interdependencies, clarity of role and contribution, satisfaction from mutual working, mutual and individual accountability, realization of synergies, and empowerment. Other research supports this with some variation or reiteration of these factors. Thamhain's seven variables directly correlated to team performance are: interesting and stimulating work, clear organizational objectives, job skills and expertise, accomplishment and recognition, conflict and problem resolution, ability of dealing with risk, and effort and commitment to results (Thamhain, 2004).

Components of Team Effectiveness

So far, the benefits of high performing teams, and the defining characteristics of high performing teams have been well documented. Where the research starts to diverge is in defining what components will result in effective or high performing teams.

Salas and his team researched 20 years of team effectiveness research and reviewed 138 models, and distilled the most frequent and consistent core components of team effectiveness: Team leadership, mutual performance monitoring, backup behaviour, adaptability, and team orientation (Salas et al., 2005). Each of these factors are required for team effectiveness, but may manifest themselves in different ways depending on the constraints of the team task and varying needs of the team. On Agile teams, these components can be adapted specifically to benefit the Agile approach.

Leadership.

Leadership on a team is the ability to direct and coordinate the activities of other team members, assess team performance, assign tasks, develop team knowledge, skills, and abilities, motivate team members, plan and organize, and establish a positive atmosphere (Salas et al., 2005). The leader on the team can:

- Facilitate team problem solving.

- Provide performance expectations and acceptable interaction patterns.

- Synchronize and combine individual team member contributions.

- Seek and evaluate information that affects team functioning.

- Clarify team member roles.

- Engage in preparatory meetings and feedback sessions with the team

Effective leadership can be a problem on Agile teams. Scrum puts emphasis on self-organizing teams and coaching, but does not give clear advice on how this should be implemented (Moe & Dingsøyr, 2008). In Scrum, the Team figures out how to maximize its productivity itself; the job of planning and executing the work belongs solely to the Team (Schwaber, 2004). However there is a role for a project manager on Agile teams, and the role of the project manager is explored further in this paper.

Mutual performance monitoring.

The ability to develop common understandings of the team environment and apply appropriate task strategies to accurately monitor team-mate performance (Salas et al., 2005). This enables the team to identify mistakes and lapses in other team members' actions, and provide feedback regarding team member actions to facilitate self-correction.

Agile places a great deal of focus on this component of team performance. Iterations checkpoints, retrospectives, daily scrum meetings, shared issues/risks/next steps (Highsmith, 2004) are key practices in all Agile-based methodologies.

Backup behaviour.

Backup behaviour is the ability to anticipate other team members' needs through accurate knowledge about their responsibilities. This includes the ability to shift workload among members to achieve balance during high periods of workload or pressure (Salas et al., 2005). Backup behaviour provides for:

- Recognition by potential backup providers that there is a workload distribution problem in their team.

- Shifting of work responsibilities to underutilized team members.

- Completion of the whole task or parts of tasks by other team members

Pair programming, a technique in XP supports backup behaviour (Moe & Dingsøyr, 2008). As well, the roles of tester and developer on Agile teams are often performed by generalists, who can bring business domain, technical skill set, testing, and project management experience together as needed to support the other members of the team.

Adaptability.

Adaptability is the ability to adjust strategies based on information gathered from the environment through the use of backup behaviour and reallocation of intra-team resources. Altering a course of action or team repertoire in response to changing conditions (internal or external) (Salas et al., 2005). At team that is adaptable can:

- Identify cues that a change has occurred, assign meaning to that change, and develop a new plan to deal with the changes.

- Identify opportunities for improvement and innovation for habitual or routine practices.

- Remain vigilant to changes in the internal and external environment of the team

Adaptability is the key to Agile processes. Adaptive teams form the core of Agile project management (Highsmith, 2004). Through frequent delivery of work product, client checkpoints, and team retrospectives at the end of each iteration, the team receives frequent feedback and adjusts to changing requirements, understanding, and opportunities.

Team orientation.

The focus on the team by the team members is evidenced by a propensity to take other's behaviour into account during group interaction and the belief in the importance of team goal's over individual members' goals (Salas et al., 2005). The team takes into account alternative solutions provided by team-mates and appraising that input to determine what is most correct. And there is increased task involvement, information sharing, strategizing, and participatory goal setting by members of the team.

Agile teams accomplish this by defining their work processes and team structure. This includes properly defined interfaces, task responsibilities, reporting relations, communication channels, and work transfer protocols (Thamhain, 2004).

Coordinating mechanisms.

These big-five factors required three coordinating mechanisms: Shared mental models, closed-looped communication, and mutual trust.

Shared mental models.

Shared mental models is an overall knowledge structure of the relationships among the task the team is engaged in and how the team members will interact (Salas et al., 2005). On Agile projects it is supported by product owner participation, involvement of the stakeholders, daily scrums, retrospective meetings, and shared planning sessions.

Closed-looped communication.

Communication is a key factor on any team, and in particular on Agile teams. It is the process of making sure that messages that are sent are received. The importance of the daily scrum meeting, and following up with retrospective meetings, planning meetings, review meetings are to reinforce the communication. People need to follow up to see if the message is received and the receiver needs to acknowledge receipt or ask for clarification (Salas et al., 2005).

If the project team is to succeed, the organization must foster a high-communication environment for your team, and part of doing so is to actively remove barriers to communication whenever you discover them (Aguanno, 2005; Highsmith, 2004).

Mutual trust.

Mutual trust is the shared belief that team members will perform their roles and protect the interests of their team-mates. (Salas et al., 2005). Where mutual trust is not fully developed, it can result in problems not being reported and a lack of self-organization (Moe & Dingsøyr, 2008).Trust enables team members to share half-baked ideas without the fear of ridicule. (Highsmith, 2004)

One of the key principles of Agile is to Amplify Learning (Poppendieck & Poppendieck, 2003). Development is an exercise in discovery. Individuals will try various approaches to solving the problem, and mistakes will be made. This is when learning occurs, and the team can take from the experience and improve on the solution as a whole. This requires a great deal of trust between team members, and between the team and the external stakeholders. The best approach to improving a

software development environment is to amplify learning (Poppendieck & Poppendieck, 2003).

Motivation and Reward

Motivation and reward models are important to generating the desired behaviour of individuals and the team. Reward system needs to be perceived as fair, and that individuals can affect the objectives in their development plans and goals are set that they can influence (Quader & Quader, 2009). As organizations emphasize Agile teams, reward programs become more complicated. Juggling the individual's performance as part of a team effort can be a delicate balancing act. Lazy team members can be a thorn in the team's side. The organization's motivation and reward model needs to create an environment that supports the objectives of the Agile development team.

Rewarding individuals sets up a pecking order and a competitive environment that can undermine the team's objectives (Isaacs, 1998). The traditional approach of giving individuals credit for team effort and fostering competition that creates winners and losers is a good way to kill team motivation (Poppendieck & Poppendieck, 2003) on Agile teams. Juggling the individual's contribution with the team effort can be a delicate balancing act. In North America organizations cannot practically eliminate the individual reward model (Isaacs, 1998).

For team rewards to work they need to be innovative, they need to be objective, and they need to be flexible, yet they can't disregard the individual (Isaacs, 1998). Reward systems need to be reoriented to recognize both individual and team contributions (Boehm & Turner, 2005). The adoption of an Agile approach will significantly alter the behaviours required of many of the employees. If the reward system is not changed, then the staff's behaviour will resist change as they continue to act in ways that are rewarded (Koch, 2004).

Variable cash programs were found to be the most effective tools in supporting teams. These plans were commonly used to promote a team mind-set in organizations with strong team programs (Zobal, 1999). These programs include a strong individual pay component, with pay for performance incentives tied to team performance. Non-financial rewards such as public recognition, meaningful work, providing new training and growth opportunities, and personalized rewards are effective on high performing teams. Experimenting with more creative rewards often has a more meaningful and long lasting impact (Isaacs, 1998).

Skills and Team Selection

Initially the research supports the importance of getting the right team, meaning the right mix of specialist knowledge, interpersonal skills and role behaviour, the first time. Failing to do so causes costs and delays of delivering the results and reduces the team's effectiveness (Quader & Quader, 2009). One of the factors that might contribute to smooth coordination early in the existence of the team is a clear definition of

responsibilities, as a lack of clarity may lead to confusion, frustration, and disincentive.(Jarvenpaa & Leidner, 1999)

Diversity.

The importance of information exchange on teams and diversity was highlighted by Cummings (2004). Diversity comes from geographic locations, functional assignments, reporting managers, and business units. Structurally diverse teams (Cross Functional, business units, reporting levels in the organization, demographics) are better equipped to take advantage of knowledge shared with outsiders (Cummings, 2004). However, structural diversity can increase the complexity of communication and work coordination. The implications are that organizations need to design work groups to include members with strong external networks, look for ways to improve connectivity among employees, and foster a culture that supports knowledge sharing.

Roles on the Agile Team.

There are new or redefined roles in Agile teams. These often parallel similar titles in traditional development teams, but there are new roles and important differences in the responsibilities that are important to understand (McGeachy, 2008):

- **Project Manager** - Scrum Master, manages issues and removes roadblocks

- **Architect** - Responsible for overall system architecture and development quality and processes

- **Developer** - Participates in design, creates unit tests, builds and delivers code

- **Tester** - Dedicated testers assigned to each track of development

- **Test Lead** - Responsible for organizing and planning testing efforts and mentors testers

- **Client Proxy** - Helps remote teams clarify requirements and resolve issues in real time

- **Product Owner** - Client owner who participates in Kick-offs and Iteration closures, as well as provides feedback

Hiring for an agile team.

It would be ideal to have a team of high achieving individuals to staff every team, but that isn't realistic. By definition, half of the people in the organization will be below the median in performance. However, it is important to hire for skill and experience

in Agile development. There's no substitute for capable people, especially for small teams or organizations (Poppendieck & Poppendieck, 2003). While general good hiring practices are still required, there are specific attributes that candidates should possess to be successful on an Agile team.

To be effective at developing software in a fast-paced world, project teams (especially a small one) require people who are not simply specialists in their own activities but are able and willing to learn new roles and step in and give a hand (Schuh, 2004). For developers, they will participate in more project management activities. The biggest shift is perhaps the attitude of "owning" the project and its problems (Larman, 2004). The ability and willingness to communicate and collaborate effectively with other members on the project team on a frequent basis should be considered an inviolate requirement for any new member of an Agile team (Schuh, 2004).

An individual with intellectual integrity will provide the honesty and responsible citizenship required by Agile projects. This is the type of person who readily admits to making mistakes, strives to provide realistic reports and estimates, and attempts to understand the purpose of an exception instead of simply writing code to swallow it (Schuh, 2004). People who ask questions and do not simply accept the answers written on the page in front of them are more likely to spot the gaps in requirements and less-than-optimal solutions.

The Project Management Institutes (PMI) has focused on teaching work decomposition and tasks managed individually, that creating and following a plan is the essence of project management, and scope control is fundamental. This view of project management tends to encourage local sub optimization (Poppendieck & Poppendieck, 2003). While many good techniques can be learned in the course of obtaining PMI certification, its theoretical foundation tends to be incompatible with Agile thinking (Poppendieck & Poppendieck, 2003). Hiring PMP prepared project managers needs to heavily focus on their practical experience delivering Agile projects.

Agile-minded organizations are often very serious about selecting new employees based on these and other Agile-friendly qualities. These organizations will ensure that potential hires are interviewed by members of the team they are likely to work with. Some organizations will even go so far as to request that serious candidates for programming positions come in for half a day of pair programming with other members in the organization (Schuh, 2004).

Finally, if organizations want to hire for Agile development teams they will need to be ready to pay for above average people. One repeatedly stated explanation for the success of Agile projects is their tendency to use fewer but more competent people.

Staffing the team.

At British Telecom, Qauder (2009) described an approach where one part of the team selection process is having people apply for the open positions, so that affinity or alignment with the goals and objectives of the team are promoted. There are problems however for the project manager by having people self select for teams. Most of the time project managers cannot choose the team members and have to make the best of what they have got. Politics set in the company or the realities of current staffing or resource shortages can determine which team members get assigned to the project team.

Staff and organize the project team properly. Teams that are hastily organized with people who are poorly matched to the job requirements are frequently subject to conflicts, low morale, sub-optimum decision-making, and ultimately, poor project performance (Thamhain, 2004). Pick good people and reward the results of pilot projects. The organization doesn't need to create a dream team, but definitely eliminate the underperforming individuals in the pilot projects. Show appreciation for the team's work, regardless of the outcome (Boehm & Turner, 2005). Aggregations of personality, cognitive ability, and expertise do correspond with team performance. Who is included in the team does matters (Stewart, 2006).

Understanding the roles, skills, and functional areas required on a typical Agile team and the process for hiring and staffing teams are important to the overall performance of the team.

Physical and Virtual Work Environments

There is significant research into the best practices and approaches to defining physical work arrangements and the technologies and processes that can be used to minimize the impact of virtual or geographically dispersed teams, and enhance the effectiveness of communication and teamwork.

Teams can be spatially separated, temporally separated (spanning different time zones), configurationally uneven (for example, five members in one location and two in another) and culturally diverse (Siebdrat et al., 2009). Working in virtual teams is an emerging phenomenon in organizations "collection of individuals who are geographically and/or organizationally or otherwise dispersed and who collaborate, using varying degrees of communication and information technologies in order to accomplish a specific goal" (Curseu and Wessel, 2005, p. 271).

In a study of 145 software development teams, Hoegl and Proserpio (2004) related the degree of co-location with six performance related facets of team's collaborative process.

(1) **Open sharing of information** – ability to have ad-hoc, real time conversations and regular face-to-face meetings

(2) **Task coordination** – close interaction allows team members to observe each other's progress, initiate restructuring of work sequences and contents as new information becomes available

(3) **Balance of member contributions to problem solving** - the ability of the team to utilize each member's potential to its fullest.

(4) **Mutual support** – Helping each other out, noticing when assistance might be needed or would be beneficial, easier to ask for guidance.

(5) **Cohesion** – Build a good team environment, socially connected, positive personal relationships, frequent interactions

(6) **Effort** – Reduces social loafing, increases mutual performance monitoring

Research suggest that even low levels of geographic dispersion (e.g., on the same premises or within the same building) can have detrimental effects on important team processes (Hoegl & Proserpio, 2004). Potential issues include difficulties in communication and coordination, reduced trust, and an increased inability to establish a common ground. In contrast, proximity tends to promote more frequent communication and the development of closer and more positive interpersonal relationships. Regular physical presence of coworkers improves people's feelings of familiarity and fondness, and frequent informal interactions serve to strengthen social ties.

Distance also brings with it other issues, such as team members having to negotiate multiple time zones and requiring them to reorganize their workdays to accommodate others' schedules (Siebdrat et al., 2009). Geographically dispersed teams can also see dysfunctions as low individual commitment, role overload, role ambiguity, absenteeism, and social loafing may be exaggerated in a virtual context (Jarvenpaa & Leidner, 1999). The lack of past and future association decreases the potential existence of trust. Teams need to mitigate this by increasing the opportunities to build in person connections, and long term associations (Maznevski & Chudoba, 2000).

Physical distance decreases closeness and affinity, which then leads to a greater potential for conflict. In such situations, frustration and confusion can ensue, especially if coworkers are regularly unavailable for discussion or clarification of task-related issues. (Siebdrat et al., 2009). Geographic dispersion can greatly complicate team communication and work coordination. (Hayashi, 2004). Specific attention must be devoted to fostering social elements of the team process such as mutual support, cohesion, and work norms of high effort (Hoegl & Proserpio, 2004).

Given the real-time nature of Agile and the increasingly distributed nature of teams, there is an increased demand on tools and technologies to meet the communication and coordination needs of teams. Research indicates that teams that share knowledge, both intragroup and externally tend to perform better. (Cummings, 2004). There is no substitute for getting people together in the same room, so plan on team member

rotation, focused especially on sharing tacit domain knowledge.(Poppendieck & Poppendieck, 2003)

Regular physical presence of coworkers improves people's feelings of familiarity and fondness, and frequent informal interactions serve to strengthen social ties (Siebdrat et al., 2009). Physical distance decreases closeness and affinity, which then leads to a greater potential for conflict. When Agile practices are used with global teams, use the frequent milestones of an iterative development cycle to keep people from drifting apart (Poppendieck & Poppendieck, 2003).

There are some strongly held beliefs in the community that Agile teams must nearly always be collocated. The typical Agile workspace requires pair-programming stations, walls for status charts and assignments, a layout that allows team members to easily converse to share information, and sufficient equipment to support continuous integration and regression testing (Boehm & Turner, 2005). That being said, Agile has been successfully adapted to work with the realities of geographic dispersion in today's organization (Schuh, 2004).

Spend additional effort to foster mutual support, cohesion, and work norms of high effort. Communication will need to be enhanced to reduce the impact of the dispersion. Potential issues include difficulties in communication and coordination, reduced trust, and an increased inability to establish a common ground (Siebdrat et al., 2009). Thus, in low proximity groups, the more social aspects of teamwork should be initiated by a face-to-face kickoff meeting and reinforced by frequent and scheduled meetings (Maznevski & Chudoba, 2000). Maznevski et al also found that the effectiveness of teams was improved with initial and then regular face-to-face meetings, followed by less intensive, shorter interaction incidents using various media. The frequency of face-to-face meetings depended on the level of interdependence required by the task and the degree of shared view and strength of relationships among members (Maznevski & Chudoba, 2000).

Managers should carefully choose individuals for virtual teamwork; such qualities as responsibility, dependability, independence, and self-sufficiency, while desirable even in face-to-face settings, are crucial to the viability of virtual teamwork (Jarvenpaa & Leidner, 1999). Managers can take advantage of this organizational structure by assembling employees from different locations in such networks to create a team that can optimally integrate the different pools of expertise to perform a particular task(Siebdrat et al., 2009). Virtual teams tend to incorporate higher levels of structural and demographic diversity than do collocated teams, and both types of diversity can be highly beneficial (Siebdrat et al., 2009).

Groupware technologies.

Groupware is a technology that addresses the vast area of collaboration, focusing on the human-human interaction through digital media. Most general definitions define groupware as any computer-based system that help groups/teams to work

better collaboratively over digital media (Nedelko, 2008). But on the other hand, it is also important to emphasize that usage of groupware in teams importantly impacts the way that people communicate with each other. Instead of face-to-face collaboration, groupware requires computer-mediated collaboration among people (Nedelko, 2008).

If properly utilized there are some key benefits of groupware for Agile project teams (Nedelko, 2008):

- groupware enhanced communication among employees in the organization

- groupware facilitates and reduces needed time for handling certain activities

- use of electronic share calendars and appointment calendars could lead to better coordination among employees in the organization; and

- better and quicker decision-making process, which could lead to improved overall organizational performance.

There are different groupware tools depending on the nature of the communication, if it is occurring in the same physical place, and if it is occurring at the same time (synchronously), or different times (asynchronously):

(1) same time/same place – Team members can use tools to support face-to-face meetings. Examples include group decision support systems, presentations systems, whiteboards, and document sharing. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation (Agile Alliance, 2001).

(2) same time/different place – Groupware supports online meetings of geographically distributed team members. Examples include audio conference, video conference, electronic mail, voice mail, web-based conferencing, chat systems, and electronically shared whiteboard. Instant messaging is very useful, but may require some adjustment of work hours when time zones are far apart (Poppendieck & Poppendieck, 2003).

(3) different time/same place – Team members sharing messages or information in the same work location. Examples include workflow management system, document sharing, electronic mail, voice mail, and video conference playback (Nedelko, 2008). Visualization of information on the walls is promoted in Agile. Large diagrams and font size is important for ease of viewing. White boards and large format plotters are faster and easier, and should be leveraged where possible (Poppendieck & Poppendieck, 2003).

(4) different time/different place – Systems are used to support information exchange off-line, for example document storage system, workflow

management systems, document sharing, video conference playback (Nedelko, 2008). Invest in collaboration support tools such as shared source code repositories, build systems, and collaborative IDEs (iterative development environments)

Collaboration and Communication

One of the key principles of Agile teams highlights the importance of collaboration and communication. Teams tend to perform better when members exchange knowledge freely among themselves and outsiders (Hayashi, 2004). Every member of a high-performance team possesses unique knowledge that contributes to the development and refinement of the emerging technology. (Daniel & Davis, 2009)

The strength in Agile teams comes from the depth and breadth of experiences of the diverse team members. Diversity among team members leads to better performance because of the range of viewpoints and experience of the different individuals (Hayashi, 2004). Diversity has its drawbacks however, and these need to be managed to mitigate the impact on the team. When work groups have to report to different functional managers, they might get contradictory demands or experience role ambiguity.

(Aguanno, 2005) pointed out that Agile team can improve their communication through:

- **Physical proximity.** The closer people are to one another, the greater the opportunities for communication.

- **Temporal proximity.** Whether or not two people are working at the same time affects communication.

- **Amicability.** The willingness of someone to hear the thoughts of another person with good will and to speak without malice is an important success factor.

- **Tools.** Simple, inclusive tools, including whiteboards, Post-It™ notes, flip charts, and index cards, are easy to work with and are flexible, making them more likely to be used in team situations.

- **Anxiety.** When a group of people are collaborating, they need to find techniques that they are comfortable with, or at a minimum that they can learn to tolerate for the duration of their involvement with each other.

Intrateam cooperation exhibits a positive relationship with performance (Stewart, 2006). Managers need to be explicit about the importance of knowledge sharing. (Cummings, 2004). All teams have to promote what they do and influence others (Margerison, 2001).

Facilitating collaboration and sharing.

There are many ways that teams and organizations can facilitate the communication process, and improve the collaborations and knowledge sharing between team members and between teams:

- Cross-functional workshops and requirement/development sessions (Cummings, 2004)

- Hold "Knowledge fairs" or information sharing sessions. Have key knowledge holders run a "brown-bag" lunch seminars

- Tie sharing of information to the team and the rest of the organization to performance evaluations based on how well team members exchange knowledge

- Ideally co-location of the team, or regular face-to-face checkpoints to build trust and connections

- Use of team collaboration tools such as shared databases, email, instant messaging, conference calls, web meetings to breakdown the geographic barriers

- Building corporate knowledge assets such as wikis, centrally stored lessons learned, guides, best practices, templates

Defining the group norms or ground rules can be effective in supporting collaboration. Managers should assist the team in developing a set of ground rules. These are not meant to reduce conflict and contention, but direct them in positive ways. As described by (Highsmith, 2004), these rules can include such rules as:

- Everyone has an equal voice

- Everyone's contribution is valuable

- Attack issues, not people

- Keep privacy within the team

- Respect each other and your differences

- Everyone participates

These rules should be decided on by the team, and posted prominently in the team shared environment.

Self-organization.

The best architectures, requirements, and designs emerge from self-organizing teams (Agile Alliance, 2001). One of the principles of Agile is to empower the team (Poppendieck & Poppendieck, 2003). When equipped with necessary expertise and guided by a leader, they will make better technical decisions and better process decisions than anyone can make for them. (Poppendieck & Poppendieck, 2003)

Ensure team involvement early in the project lifecycle. This planning and involvement is especially important for technology-based project work, where high levels of complexity, uncertainty, and risk - along with the need for innovation - make it nearly impossible for the project leader to work out a project plan that is seen as realistic, unless performance is the result of collective efforts by the entire team. (Thamhain, 2004)

Scrum relies on high-bandwidth, face-to-face communication and teamwork; cubicles and unneeded artifacts promote isolation and misunderstandings (Schwaber, 2004). Most of the practices of these methods make the assumption that team members are going far beyond simply following orders and doing what was assigned. They expect that each person is exercising his or her professional judgment to take the path that he or she believes is best at each juncture of the project, or at least to raise questions and concerns to be discussed with the team, management, and the customer.(Koch, 2004)

Team building.

Team building is important for any team, but Agile teams need to gel quickly and become productive early to deliver on the initial iterations. A mixture of focus-team sessions, brainstorming, experience exchanges, and social gatherings offer powerful opportunities for developing the work group into an effective, fully integrated, and unified project team. Team building builds belonging. Team members respect each other and are honest with each other.

A team's first sprint is the roughest and most imprecise (Schwaber, 2004). As the team works together building the requirements into functionality on the selected technology, they get better. They unearth more of the unknowns (Schwaber, 2004). Before the initial Agile projects can begin, all the individuals who will be involved must be trained in the new method (Koch, 2004). Begin to use the new method immediately after the training. Allow people to gain practical experience with using the information they received before they can forget it.

For small projects, much the envisioning can be done in a single "kickoff" week. For larger projects, requirements gathering, additional training, resource procurement, and product visioning collaboration sessions may take longer. (Highsmith, 2004)

When team members are able to develop and show mature communication, accountable interdependence with their teammates (knowing each other's role, and trusting that the roles will be fulfilled), psychological safety, have a common purpose and have a clear understanding of what their role is when working in teams, their team experience will contribute and support a better attitude toward working in teams in the future. In other words, success on project teams will lead to good experiences and support for effective teams in the future. (Ulloa & Adams, 2004)

Leadership

The role of the leader on Agile teams needs to shift from more traditional hierarchical organizations. The tendency for managers to exert power over people at the lower levels of the organizational hierarchy produces fear, passivity, and ambivalence, which are in conflict with the real needs of humans (Crother-Laurin, 2006). Progressive and healthy leaders tend to foster creativity in their constituents. Where work was once based upon task and mission accomplishment, now it is based on the ability to retain talented people and manage effective teams who want to put the leader's vision into action.

The six key building blocks of coaching and team development are focusing the team on delivering results, molding a group of individuals into a team, developing each individual's capabilities, providing the team with required resources and removing roadblocks, coaching the customers, and orchestrating the team's rhythm.(Highsmith, 2004)

The softer side of managing and leading people is more important than the technical or procedural approach. Results show that team leader emotional intelligence is significantly related to the presence of emotionally competent group norms on the teams they lead, and that emotionally competent group norms are related to team performance (Koman & Wolff, 2008).

Leadership is a commitment to the success of the people around you (Crother-Laurin, 2006). Transformational and empowering leadership thus appears to be particularly potent for teams regardless of situational differences (Stewart, 2006). Agile development depends on individual and team commitment and enthusiasm. The challenge for leaders is to harness individuals' passions and motivate them to want to tackle the task in hand.(Kelly, 2008)

The role of the project manager.

The role of the project manager on an Agile team has a different focus. They need to be focused on getting the right people. They are a facilitator to articulate the product vision, encourage interaction, and participate in decision making. The team has the accountability and responsibility to get the work done, and the project manager steers rather than controls the process.

The project manager will serve as the social architect who understands the interaction of organizational and behavioural variables, who facilitates the work process, and who provides overall project leadership for developing multidisciplinary task groups into unified teams, and for fostering a climate conducive to involvement, commitment, and conflict resolution (Thamhain, 2004)

The Agile manager role is one that fills a void on Agile projects, because most Agile methodologies do not clearly define a role for project managers. The role of the Agile manager is to lead the delivery of business value by establishing APM [Agile project management] principles and practices and by embodying APM values. (Spann, 2006). Spann goes on to define eight behaviours of Agile project managers.

- Agile managers identify themselves as change agents, are innovative. This behaviour means the individual feels comfortable in fast changing environments and is willing to take risks and to consider new and untested approaches.

- Agile managers are strategic. This behaviour expects that the individual takes a long-range, broad approach to problem solving and decision making through objective analysis, thinking ahead, and planning.

- Agile managers can generate excitement on their team. This behaviour means the individual operates with a good deal of energy, intensity, and emotional expression and has a capacity for keeping others enthusiastic and involved.

- Agile managers are hands on or tactical. This behaviour emphasizes the individual's ability to produce immediate results by focusing on short-range, hands-on, practical strategies.

- Agile managers are very good at communication. This behaviour means the individual states clearly what is wanted and expected from others; clearly expresses thoughts and ideas; and maintains a precise and constant flow of information.

- Delegation is a strength of Agile managers. This behaviour means enlisting the talents of others to help meet objectives by giving them important activities and sufficient autonomy to exercise their own judgment.

- Agile managers exemplify and drive production on their teams. This behaviour means the individual adopts a strong orientation toward achievement; holds high expectations for self and others; and pushes self and others to achieve at high levels.

- Finally, Agile managers build consensus within the team and the stakeholders. This behaviour means the individual values the ideas and

opinions of others and collects their input as part of the decision-making process.

At the heart of the process is the team working without interruption for the 30-day Sprint [or the defined iteration length].(Schwaber, 2004) The project manager plays a big role in removing distractions so the team can focus on their task. The ScrumMaster coaches the Team to use the inspection and adaptation of the Daily Scrum to guide itself, the visibility aspects of Scrum to guide the required quality of its work, and the Sprint retrospective meeting to reflect and adapt again and again.(Schwaber, 2004)

Project managers need to build a high-performance image. Project leaders and senior managers can help build a favourable project image by making the project visible and stressing its importance through media exposure, management involvement, and budgetary actions, as well as by emphasizing critical success factors and professional opportunities and rewards (Thamhain, 2004)

It is important to stimulate enthusiasm, excitement, and professional interests. Managers should try to accommodate the professional interests and desires of their personnel. Interesting and challenging work is a perception that can be enhanced by the visibility of the work, management attention and support, priority image, and the alignment of personnel values with organizational objectives (Thamhain, 2004)

The project manager's concern for the project team's members and enthusiasm for the project fosters a climate with high levels of motivation and involvement with the project and its management. It also promotes open communications and a collective focus on desired results (Thamhain, 2004). For managers, perhaps this biggest shift is to step back and avoid assigning tasks or directing work, not being the task master (Larman, 2004). By coaching the team and the team members, the project manager can help them with the change to Agile development and help to direct and improve their learning (Kelly, 2008).

Stakeholders coordination.

Failure research reveals that lack of client or end-user engagement is a major factor in software project failure. Developing in iterations and having per-iteration demonstrations of working output requires the presence and feedback of clients, and this increases their engagement.(Larman, 2004)The imprecision of the communication from customer to salesperson to marketing to development to a designer to a coder to a tester to a system that does what the customer wants is immense (Schwaber, 2004). A central element in their interpretation of Agile was collaboration with the customer: they were able to discuss the product with customers on the same level, delivering a solution closer to their needs. (Abdelnour-Nocera & Sharp, 2008)

Stakeholder participation is critical to success because it is the stakeholders who are the source of requirements, information, and priorities — without their participation, the team cannot possibly build systems that meet their needs (Aguanno, 2005). Another critical coaching job of the project manager is coaching the customer team (Highsmith, 2004). The project manager needs to focus on ensuring the stakeholders and the project team are in alignment with their expectations. Failing to do this can lead to unrealistic project schedules, lack of acceptance, and poor accountability on the customer side for making decisions.

It is important to ensure senior management support of the Agile team. The manager needs to negotiate with the sponsor and support organizations for the required resources; this individual must also obtain a commitment from management that these resources will become available when these are needed.(Thamhain, 2004)

Organizational Factors

Today's organizations are littered with failed improvement programs (CMM, ISO9000, TQM, Six Sigma, Malcolm Baldridge). It is notoriously difficult to implement successful improvement programs, and even more difficult to sustain them over time (Poppendieck & Poppendieck, 2003). There is good reason for organizations to feel sceptical of the hype around Agile. Many of the Agile messages are not new, but it is the Agile practices as a whole that are new and fresh and for organizations that embrace them as a whole can take quantitative steps forward in effectiveness (Larman, 2004).

Poppendieck (2003) highlighted key points the organization can do to help the team gain and hold a sense of power:

- Start with a clear and compelling purpose

- Be sure the purpose is achievable

- Give the team access to the customers

- Let the team make its own commitments

- Management's role is to run interference

- Keep sceptics away from the team

The organization must grant and support autonomy. Stewart (2006) found that there was a positive relationship between team autonomy and performance. Autonomy is a key factor of Agile methodologies, and should be encouraged. With autonomy come the trust and the space to make mistakes. When people are asked to try to do a little more than the possible, they will continue to try if they aren't punished for not achieving everything.(Schwaber, 2004)

A mature Agile organization looks at the whole system; it does not focus on optimizing disaggregated parts. A mature organization focuses on learning effectively and empowers the people who do the work to make the decisions (Poppendieck & Poppendieck, 2003).

On small, stand-alone projects, Agile practices are less burdensome and more in tune with the software industry's increasing needs for rapid development and coping with continuous change. However, there are challenges scaling up and integrating them into traditional, top-down systems development organizations (Boehm & Turner, 2005).

Boehm et al highlighted that development process conflicts, business process conflicts, and people conflicts are the critical challenges to software managers of large organizations in bringing Agile approaches to bear in their projects. Development process conflict may arise with the integration of Agile, lightweight processes with traditional, legacy processes. Variability in subsystems can mean that different teams may produce radically different artifacts that may not integrate well. Different lifecycles and milestones in traditional processes will conflict with the rapid, continuous delivery of functionality. And managing legacy system changes can prove difficult to adapt Agile processes to, as it can be challenging or prohibitively difficult to refactor or build in increments.

The greatest disconnect between Agile and traditional projects stems from Agile teams' seemingly incongruent project metrics (Barnett, 2008). Agile projects use different reporting tools; teams report on velocity (rate at which teams deliver business value), burn charts (trends in remaining effort or task completion), test coverage, and running tested features (features delivered to the business). These are excellent measures of the teams' progress towards high quality delivery, and align with the business' need to respond to global competition. Businesses often are still looking for traditional reports on time, budget, and risk analysis information. It is not difficult for Agile teams to identify and bridge this reporting gap. Then, over time, project teams can work with project management offices (PMOs) introduce more responsive reporting mechanisms.

In the modern organization there can also be business process conflicts. Organizations must learn to accommodate human-resource issues such as timekeeping, position descriptions, team-oriented versus individual rewards, and required skills. HR Processes may get in the way of empowering people to pursue non-traditional approaches.

Finally, people conflicts can arise as well. Traditional organizations utilize earned-value or statistical process controls that tend to cast employees and interchangeable parts. Managers often associate employees with specific roles that might conflict with the multifunctional roles that Agile teams adopt. Project managers need to act as a barrier between the organization and the team, to allow them to focus on the current sprint.

Process changes represent complex organizational change and cannot be accomplished merely by replacing tools and techniques. Adopting Agile development is

no different from other organizational change events in this sense, and several authors have identified key challenges from their experience (Abdelnour-Nocera & Sharp, 2008). In particular, the importance of ensuring that all stakeholder groups are consulted and engaged in the adoption process, and that existing practices need to be understood and taken into account in devising new procedures. A key issue faced by individuals and groups appears to be coming to terms with what adopting Agile means to everyday processes.

Adopting Agile

When an Agile project crashes headlong into a real-world environment, there is no right prescription for a solution (Schuh, 2004). There can be challenges for an zzzzzteam will struggle with the new practices, skills, and organizational adoption issues. The research has identified some of the pitfalls of new Agile teams. Silva et al (2008) mention that the best way to learn Agile methods is putting it in practice in some active project.

>   **Lessons learned.**
>
>   Teams suffer from a lack of infrastructure (Silva et al., 2008). Time is required to setup the team space, meeting rooms, desks and IT equipment, and ideally development hardware, software and physical and logical environments
>
>   Lack knowledge in the Agile development methodology can lead to mistakes in the initial planning of the project (Silva et al., 2008). Lack of familiarity in the used technology on the project leads to inaccurate task size and effort estimation and sequencing (Silva et al., 2008). Teams may need to focus early iteration on training and ramping up the team, or bringing experts to seed the team. The technical skills of the team must be evaluated before planning the project.
>
>   First and foremost was the establishment, communication and understanding of the team's mission as a shared team agenda (Daniel & Davis, 2009). Ineffective communication can be caused by a lack of regular face-to-face meetings (Silva et al., 2008). Distractions caused by team members have responsibilities on other project (Silva et al., 2008). Full time allocation to Agile projects is a best practice. While this is not always possible, it should be a goal for the key developers and testers.
>
>   Weakness in team performance could have been remedied with (1) problem solving and relationship; (2) roles and goals assignment; and (3) feedback and structure (Albert & Fetzer, 2005). Equally important was the creation of an operational team structure that would enable easy cross-functional inter-relationships (Daniel & Davis, 2009).

Measuring team satisfaction.

One key indicator of the effectiveness of Agile adoption in the organization is the impact on team satisfaction. (Koch, 2004) identified the following measures of team satisfaction and adoption of the Agile approach:

- *Have they embraced the opportunity to self-organize and self-manage? Have they done a good job of taking control of their projects and making them work well?*

- *Has your more collaborative management model motivated them to greater ownership of their projects? (This assumes your managers have successfully adopted such a model!)*

- *Has incremental planning helped them maintain control over their projects?*

- *Have they embraced incremental development, short cycles, time-boxing, and continuous integration and exploited them for their projects' benefit?*

- *Do they find that closer interaction with the customer has helped them do a better job?*

- *Does the customer's evaluation of each increment help the team produce a product that satisfies the customer?*

- *Has defining requirements only at a high level, then working out the details during the project proven to be effective for them?*

- *Has more face-to-face communication and fewer documents helped them be more efficient?*

- *Have they worked less overtime?*

- *Have the tool and process changes (e.g., CM) been helpful to them?*

- *If they have used Pair Programming or a new code ownership model, have these things worked well?*

- *Has refactoring been used effectively? Has it resulted in better software?*

- *Have they accepted greater responsibility for the quality of their software? Have they become effective testers of their own code?*

- *Have regular project retrospectives or postmortems provided insights into how your teams can become more effective?*

Scaling agile to larger teams.

As with traditional teams, there are inherent issues as the team size grows. Agile is no different in this regard but there are ways that this can be addressed and maintain the Agile principles. Typically, as a team exceeds twenty or more individuals, there will need to be a divide and conquer approach. Each subteam should be responsible for one or more subsystems, enabling them to work as a small Agile team responsible for delivering working software on a timely basis (Ambler, 2009).

There are additional roles on a large Agile program. There is a need for an overall architecture owner. This person is responsible for facilitating the architectural direction on sub-teams, and working with as part of the architecture owner team to establish the overall architectural vision and resolving dependencies or issues. As well, there is a need for an integrator that can take the outputs of each of the sub-teams and regularly integrate and build the entire integrated solution and work with the testing roles to perform overall system integration tests.

Ambler (2009) also raised several key issues that the larger Agile team will face and will need to address:

- Project management activities get more complicated, and require coordination of management activities of the whole team. Contract management, dependency, resourcing, vendor tracking, and third party integration become more critical

- The overall architecture becomes more complex. This is managed partly by the architecture owner role and the coordination of dependency and isolating interfaces to reduce the coordination required by the sub-teams.

- Requirement complexity increases, and there are often multiple product owners. There is an increase in the conflicts of requirement priority, and additional communication required to clarify and coordinate requirement analysis between the sub-teams and the product owners.

- System integration becomes more complex and there are dependencies between the components of each sub-team. This can be addressed by building mock-ups to stand in for integration points that have not been developed, inclusion of the integrator role mentioned previously, and regular integration of the whole system and system integration test by an independent test team.

Literature Summary

The question raised in this paper is what are the characteristics of high performing teams and how should these practices be adapted for Agile development projects? The

traditional literature on team building, effective teams, and organizational impacts of adopting project teams yielded a wealth of opinion on what makes for a high performing team. A parallel emerged between the principles of Agile and effective teams. The Agile research focuses on the specifics of implementing Agile practices, but provided more of a secondary viewpoint on the practices of the team. The importance of people and teamwork to the success of Agile projects however was highlighted.

As organizations and teams challenge themselves to adopt Agile and realize the benefits, they will need a solid understanding of how to build and support high performing teams. The key focus of this research is to merge the body of knowledge on traditional team effectiveness with the emerging field of Agile methodologies.

Research question

As a result of the literature review, the following question will be answered:

What are the characteristics of high performing teams and how should these practices be adapted for Agile development projects?

The key focus of the project will be to merge the body of knowledge on traditional team effectiveness with the emerging field of Agile methodologies. Traditional literature on team building, effective teams, and organizational impacts of adopting project teams has been discussed at a broad level without specific application to Agile project teams. The theories and practices around Agile Development have been very specific on the best practices and approaches to the actual team activities of design and development of software projects, but not on the people and organizational changes that need to occur and the best way to effect change in traditional organizations looking to adopt Agile as a methodology and be successful.

The gap to be addressed is the understanding of a broader view of team effectiveness and how it can be applied specifically to Agile project teams.

Research Methodology

The topics of team building, project management, coaching and leadership have been well researched and there is a wide body of work to explore. This paper leveraged journal articles and books in business and project management, psychology, human resource management published in the last 10 years. The theories of effective team development evolve rapidly, and older materials may not be as up to date with current practice. Keywords that are applicable included: **Team building, team effectiveness, high performing teams, project management**.

Agile development is even more recent, having its origins with the creation of the Agile Alliance in 2001 (Agile Alliance, 2001). There have been a few seminal works published by the key architects of the Agile methodology, (Aguanno, 2005; Ambler, 2009;

Highsmith, 2004; Holcombe, 2008; Poppendieck & Poppendieck, 2003; Schwaber, 2004) that have been repeatedly referenced.

An exciting aspect of Agile is the community and socially sourced contributions through new dynamic means of publication. There are numerous online forums, discussion boards, blogs, and conferences where the body of knowledge is debated, expanded, and reviewed. As well, given the dynamic and "Agile" nature of the field, much of the scholarly and practical discussion has occurred at global conferences (such as Agile 2009, XP2009) and on key websites and blogs (www.amblesoft.com, www.Agilealliance.com, www.Agile-software-development.com). The development and improvement of the methodology is in itself following an Agile approach. An effective way for the specific focus on high performing teams to be addressed will be to leverage these new forms of communication.

Findings

The results of this paper will focus on the summary and conclusions drawn from the research on the best practices and defining characteristics of high performing Agile teams. It is expected to provide an overview of the impacts and change requirements organizations will need to address if they wish to be successful in adopting Agile development methodologies.

The results of the research have provided a number of interesting insights. Agile as a methodology "changes the game"; it is a fundamental shift away from traditional software development approaches. Organizations are looking to Agile to reduce cycle time and risk on their projects, and in general improve productivity and increase the value that projects deliver to the business and the clients. As a general statement, high performing teams are better than average or underperforming teams. They communicate and work together, there is a higher level of productivity, the quality is higher, and the team members are more satisfied with the experience. There are key characteristics of high performing teams that also can apply to agile teams. There are certain components to building a high performing team. From these components a framework can be developed.

While projects in general benefit from effective teams in charge, Agile highlights the importance of teamwork. The original Agile Manifesto references the focus on individuals and interactions [on teams], driven through practices such as pair programming, frequent retrospectives, and building tacit knowledge as a group. The principles of empowerment and integrity are core to lean or Agile methodologies. The practice of delivering early and often places demands on the productivity of the team. Time-boxing and short iterations of complete development can be new to traditional software development. Less effective teams or individuals not contributing fully may survive in a traditional organization but the transparency, integration, and trust on an Agile project will quickly highlight these weaknesses.

Organizations have identified Agile as an approach to increase quality, reduce delivery timelines, reduce waste, and drive business value. Agile provides a quantifiable measure of progress through working units of business functionality. It is highly suited to problems where the requirements emerge through discovery. And Agile promotes cross-functional involvement, higher team satisfaction, and if well implemented a more sustainable workload with improved productivity.

Developing higher performance in the project teams helps organizations meet these goals. As noted in the research highly effective teams are better at solving problems, support innovation and creativity, raise motivation and morale, and team satisfaction. They are more committed to tasks and make better decisions. Where inneffective teams have contributed to business failing to deliver projects on time or on budget, high performing teams are set up for success.

The different frameworks from the literature can be distilled into a common set of characteristics of high performing teams

- A clearly defined and shared vision or purpose

- Well defined and understood roles and responsibilities

- Trust and support within the team

- Effective communication and conflict resolution

- Interdependence

- Empowered and Accountable for issue and resolutions

- Enjoyment and satisfaction from working together

These characteristics form a set of competencies that are the basis of high performing teams. Teams with a balanced set of these competencies will be rated as higher performing teams or may have a high likelihood of being successful.

The question then is: what are the building blocks, or components that lead to team effectiveness? The research summarized five components, and as well these were very much supported by Agile principles. Leadership plays an important role on Agile teams, even with the focus on self-organizing teams. Mutual Performance Monitoring is a key part of Agile, through the frequent team and stakeholder communications that are a part of frequent feedback and review. Pair Programming, shared roles, and collective tacit knowledge building supports the Backup Behaviour component. One of Agile's benefits is the high degree of Adaptability; the ability to identify and react to changes circumstances (requirements, team, and environment). Finally, a Team Orientation is needed as the core to Agile is the approach of leveraging project teams to produce the work outputs that meet the business requirements.

Framework

Motivation and reward.

The research did not specifically address reward models on Agile teams, but the conflict of traditional individual reward models and team objectives high noted. Reward models need to be oriented to individual and team contributions. A variable cash program, where a strong individual pay component, plus pay for performance incentives tied to team performance appeared to be the most aligned to supporting Agile. Non-financial rewards play a more prominent role on effective Agile teams, highlighting growth opportunities, training and new experiences, and personalized rewards.

Skills and team selection.

The selection of the right team members were highlighted as key success criteria for Agile teams. There needs to be a focus on diversity, both on cross-functional and domain representation, as well on experience and roles. While this can increase challenges on communication and work coordination, this is outweighed by the benefits of creativity, knowledge sharing, and alignment of the solution to the overall business requirements.

There are new roles on Agile teams that call for selection and promotion of individuals who are strong in the role, as well as principles of Agile. The soft skills of honesty, accountability, and team work are equal in weight to the hard technical skills. Organizations will need to look for individuals who can adapt to the transparency of Agile, and who can collaborate in an environment that is not as well defined, but relies on the team to define roles and determine the most efficient manner to accomplish the work at hand.

Leadership.

While self-organization is a feature of Agile teams, to help assure success, Agile Project Managers can play a leadership role. They can establish the project's context. They can manage the team's environment, encourage team decision making, and promote autonomy whenever possible. An Agile Project Manager expects the best out of people, elevates the individual, and gives them respect. They help foster a team culture that values people and encourages healthy relationships. Most importantly, they can serve as a buffer between the team and distracting forces in the environment, allowing them to focus on delivering the current iteration's scope of work.

The leader also needs to drive stakeholder coordination. This is necessary to understand and share expectations on requirements, information, and priorities. Internally the project manager provides the bridge between the team and senior management and the company's leadership. This coordination is necessary to

negotiate required resources and close on contractual and project commitments. Organizations need to support and champion the Agile approach and generally allow the teams the space to make mistakes, discover requirements and solutions, and remove barriers preventing the teams from being successful.

Organizational impacts.

As mentioned above, in order for project teams to be successful they need to be supported by the organization. Agile teams can execute the practices very effectively but fail through lack of organizational alignment and support. There is a fair amount of scepticism with the various process improvement programs that have been introduced and abandoned in the past. The key conflicts that can be addressed at the organizational level are business process conflicts between Agile and the traditional reporting and control process and process conflicts with traditional functions and roles in the organization. Process changes are complex organizational changes. It is important to ensure that all stakeholder groups are engaged and that existing business practices are reassessed and adapted over time to support the Agile methodology.

Communication.

Communication is a key element in any highly effective team, and a fundamental in Agile projects. In particular given the emphasis on shared knowledge building (and the defocus on written documents), Agile teams perform when members share their knowledge and experiences, raise issues, and collaborate on solutions. Diversity in teams (different organizations, geographies, social background, or business units) is an asset when people share the range of viewpoints and experiences. Effective communication does not just happen, and project managers and organizations need to plan for it and mitigate any issues that provide roadblocks to communication.

Agile relies on high bandwidth, face-to-face communication and team work. Teams need to be involved early in the project lifecycle. The best solutions emerge from sel-organizing teams, and this necessitates regular collaboration and communication. This is not simply to share issues, risks, and status. The core of Agile is to uncover unknowns early, build strong designs, and develop the simplest yet the best solution to the problem early and frequently. There is a reliance on the maturity, accountability, and professionalism of the team members to participate fully and develop the trust and honesty that builds success.

Physical and virtual work environments.

Physical collocation is the ideal model for Agile, but the research recognizes that in the modern organization some level of geographic dispersion is a necessity. As distance and time zone separation grows, challenges in communication, coordination, and trust increase. Specific Agile processes such as pair programming are near impossible if the team does not sit close together. The solutions include

decoupling dependencies with local sub-teams, bridging the gap with communication tools and technology, and increasing the frequency of face-to-face meetings, in particular at the beginning of a project. That being said, Agile has been successfully adapted to work with the realities of geographic dispersion in today's organization

Technology plays a key role in supporting this type of team culture. For co-located teams, the collaboration solution may be a mix of physical and technology. But as companies form distributed teams, the requirements for technology-based solutions increase. Teams need real-time collaboration, flexible programming environments, and visibility into all project artifacts and metrics. Data must be collected seamlessly, without impeding the team's productivity or disrupting communication. Developers should not have to halt their daily activities to enter status data into secondary tools. This is an issue that has plagued development teams for decades; the advent of short iterations makes non-intrusive metrics collection even more critical.

Planning Agile adoption

The adoption of Agile in an organization or a project team needs to be well thought out and supported with training, leadership, organizational support, and motivated team members. Building a successful high performing Agile team needs to have a solid adoption plan. The team or organization should collaborate to research and select an Agile framework and/or processes that align procedurally and culturally with the organization. All teams should have access to training and coaching to enable the successful adoption of Agile development practices and processes. Plan and communicate a rollout strategy that accounts for organizational structure, project and team hierarchies, roles and responsibilities and training and education plans. Institutionalize the planning and delivery cycle (i.e. strategy, release, iteration, daily, continuously) for the organization. Agree generally on project and team roles and responsibilities. And select and standardize on the communication and collaboration tools that the team has configured and been trained on their proper use.

It is also important to devise a set of internal guidelines and standards for teams to take advantage of such as

- Standard meeting guidelines

- Planning and estimation standards and units

- Team definition of "Done"

Define the initial set of measures (velocity, burndown, cumulative flow, test status, etc.) for planning and tracking progress. The team will be have a much easier time of communicating if the definitions and terminology is well understood and being applied in a consistent manner.

Further research and next steps

There is a fair amount of research into high performing teams, as shown in this paper. The principles and practices of Agile strongly support an environment conducive to high performing teams. A framework of high performing Agile teams that focuses on motivation and reward models, skills and team selection, leadership, organizational impacts, communication, and physical and virtual work environments is derived from the research. While this appears to be supported by the research into high performing teams, the next step in the research is to apply the framework in multiple organizations, and develop practical implementation guidelines. Agile is a methodology which by its nature is at conflict with structure and process, but a tool box of team practices and processes that can be adapted and adjusted to suit the specific requirements of a new Agile organization would be of great contribution to the Agile community.

As well, this research will be presented at upcoming conferences and shared on Agile social networking sites such as blogs, the Agile Alliance forums (http://www.Agilealliance.com), and in practical application on Agile teams. The feedback and review will be incorporated and applied.

Analysis

Agile is rapidly becoming the de facto standard software development process for high-performance teams and the real question for software managers and executives is no longer if you adopt Agile, but when and how. Although successfully adopting Agile is not a trivial exercise, Agile done correctly is highly rewarding for organizations and to the individuals involved.

This paper explored the research of high performing teams and applied it to teams that have adopted the Agile methodologies. From the research of Agile approaches, there are specific practices and processes that relate to the way the team works together, and these were summarized and applied. While a framework is derived that highlights the key learning, there is a lack of validation and verification in real world situations. The findings need to be tested, and the relative importance of the components of the framework should be assessed. As discussed in the summary of the research, the framework would benefit from practical application and comment and review from the Agile community to build more specific practices and processes for building high performing teams in the

Recommendation

There are many small actions that can be taken to improve the effectiveness of the team, but from the analysis there are a few key recommendations or critical success factors.

Ideally, teams should ideally be collocated. The team should work physically in the same office space, with access to a dedicated team meeting room. Communication and

collaboration tools should be used to share and disseminate knowledge, in particular if the team is dispersed.

Where agile purists would propose that an Agile team does not require a project manager, a strong Agile project manager would provide an important leadership role on the team. In any organization there are more traditional processes that will always need to be followed to secure resources, operationally deliver the project, and manage communication and status with the larger organization. The project manager also plays an important role to coordinate and drive stakeholder expectations and acceptance.

The organization must support Agile projects through autonomy, space to make mistakes, and assistance to resolve issues that then arise. Agile teams do not function alone, and the leadership of the organization can assist in championing the Agile principles and helping to negotiate with the sceptics.

It is important to ensure that the right people are staffed on to Agile projects. There are specific roles on an Agile team that were mentioned above and need to be built into the organization's resource model. While building a team, there should be a healthy diversity of roles, functional assignments, experience, and business units to promote innovation and a balance of opinion.

The persona of an ideal Agile team member has a high level of intellectual integrity. They will appreciate the importance of owning the project and collectively resolving issues. They will possess the skill in their discipline, but also be eager to learn new roles and jump in to assist other team members when required.

Finally it is most important to facilitate collaboration and communication on the project team. This includes providing the tools to facilitate communication such as establishing group ground rules, providing space and resources such as whiteboards, flexible work environments, and groupware technologies.

Conclusion

Agile methods are helping software organizations improve their performance. In a recent survey presented at Agile 2008, Agile teams were found 37% faster to market and 16% more productive(Quantitative Software Management Associates, 2009). High performing teams can not only support the Agile process but also deliver exceptional results over average teams. The Agile Manifesto includes self-organizing teams as a key principle, saying that "the best architectures, requirements, and designs emerge from self-organizing teams"(Agile Alliance, 2001, ¶11).

The research highlighted the benefits of highly effective teams. In particular for Agile, teams that are high performing can make big steps forward in short timeframes, and they balance the interpersonal skills, discipline and capability to manage issues. The characteristics of high performing teams were identified to serve as a guide-stake for

base lining current performance and measuring improvement from implementation of the recommendations in this paper.

The research indentified the components of team effectiveness, and from this a framework was introduced to consider when forming a new Agile team, or coaching an existing project team to improve. The key elements of the framework were:

- Motivation and Reward

- Skills and Team Selection

- Organizational Impacts

- Leadership

- Communication

- Physical and Virtual Work Environments

These elements play a major contribution to the effectiveness of Agile teams, organizations should develop a strategy to address the recommendations in each of these areas. Finally a summary of recommendations was presented to help summarize the key findings for executive consumption.

It is peoples' beliefs, understanding and perspectives as well as their unwillingness and ability to change makes being Agile hard. Part of the challenge can be addressed by providing a clear plan for adopting best practices and promoting the benefits of effective teamwork. There has been a fair amount of work to establish these best practices in traditional software development teams. The importance of this research is to apply the best of effective team practices to the strengths of Agile methodologies

While the framework may not be exhaustive, it will highlight the key areas that need to be addressed when adopting Agile in an organization and how to ensure that teams are set up for success.

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