THE ORIGINS OF ...

AGILE AND ITERATIVE METHODS

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Abstract: Agile methods and iterative and incremental development (IID) have attracted significant attention in recent years. They are widely applied in many industries quite dissimilar to their origins in manufacturing and information system development. Agile methods and IID are part of a rich stream of research and practice that can be traced back to the 1930's, but much of this history has been lost in recent rhetoric about these methods. The purpose of this paper is to consolidate the many streams of research and practice that have contributed to Agile and IID forms of project management.

This paper presents a systematic literature review connecting the fragmented streams of academic and applied literature that have historically contributed to the development of Agile methods and IID, allowing a deeper view of recent past iterations of how these methods are commonly represented. We argue that although the roots of the currently popular approaches can be traced back to 1930s', these have been mostly disassociated from present Agile and IID practices due to a combination of barriers to transfer of knowledge such as divergent use of language and terminology between fields, attention decay, and the current industry-led narrative. Mapping and clarifying these historical links provides a useful perspective on contemporary project management practice and opens further possibilities for deeper research into Agile project management methods.

1. INTRODUCTION

"Everything has been said before, but since nobody listens, we have to keep going back and beginning all over again." (Andre Gide, 1891)

Agile methods and iterative approaches to delivering projects are not new, but they have rapidly increased in popularity in recent years. While Agile methods and iterative and incremental development (IID) were largely the remit of those directly focused on manufacturing or software development, these approaches are now more broadly recognized across different organizational levels. Senior management is now driving the adoption of Agile methods (VersionOne Inc., 2017), resulting in a rapid increase in their uptake, including in industries that have previously had little exposure to these ways of doing business.

The ideas, processes, tools, and techniques that underpin Agile methods and IID trace back to the 1930's. However, recently published peer-reviewed literature seldom recognizes this history. This is even more prevalent in grey literature. Examples of this myopia are found in debates about whether Agile project management and IID are a passing fashion (Cram & Newell, 2016; Moczar, 2013; Janes & Succi, 2012; Sharp, et al., 2006), or here to stay (Dingsoyr, et al., 2012; Holmstrom, et al., 2006; De Cesare, et al., 2010; Nerur, et al., 2005); debates that typically fail to acknowledge the already long history of these methods.

Since 2001, many have either suggested or implied (e.g., Parolo, et al., 2015; Pariser, 2011; Cameron, 2014; Scrum Inc®, 2017; Cockburn, 2014; VersionOne Inc., 2017; SCRUM Alliance®, Inc., 2016), that Agile methods and IID started with the Agile Manifesto (Beck, et al., 2001). This paper challenges assertion that the signatories to the Agile Manifesto are originators of Agile methods (e.g., Cram & Newell, 2016), instead of building upon and raising awareness of earlier research and accumulated knowledge.

Industry-led narratives that market Agile as a 'new' set of tools and techniques are one factor that has contributed to this misconception. Parolo, et al. (2015) also attribute the cycles of rediscovery of lessons lost to attention decay, or degradation of attention over time. Wirth (2008, p. 32) similarly laments that this is common within the computer industry, adding that *"…it is unfortunate that people dealing with computers often have little interest in the history of their subject. As a result, many concepts and ideas are propagated and advertised as being new, when in fact they existed decades ago, perhaps under a different name."*

This paper explores the literature on Agile and IID methods, to understand the intellectual origins of these practices. The paper focuses on the development of these approaches before the publication of the Agile Manifesto, to construct a history of how these practices have developed, and to facilitate access to the wide and diverse field of references that have contributed to the early development of Agile and IID methods.

2. METHODOLOGY

This history of the development of Agile methods and IID has been methodically constructed using a structured narrative literature review that relies on published literature as the primary data source. The purpose of the literature review has been to retrospectively map the evolution of Agile methods and IID back to their roots in the 1930's. The process of constructing this history of Agile methods and IID has been a process of uncovering evidence of the use of specific management practices; practices which are not always explicitly discussed, either because they were tacit, and thus unnoteworthy, or because commercial concerns restricted their disclosure. As a result, uncovering a clear line of intellectual and practical development has been a complicated task. To achieve this, the literature review has focused on uncovering evidence of practices commonly associated with Agile methods and IID, such as rapid prototyping, development of a minimum viable product, iterative development, an emphasis on adaptability, local empowerment and participation, and visual daily stand-up meetings.

Construction of this history has relied on transparent and auditable systematic literature review design principles to ensure that a less than exhaustive review remains valid and scientifically repeatable (Booth, et al., 2012; Hammersley, 2013; Parris & Peachey, 2013). This review is not designed to cover every last article on Agile methods and IID, but has systematically collected, analyzed, and processed the existing literature to establish the history of these concepts, methods, tools and techniques. The process has aimed towards sufficient breadth, depth, rigor, consistency, and clarity to be considered scientific (Mulrow, 1994; Hart, 1998).

An exhaustive review, if ever possible, would, of course, reduce the risks of confirmation bias affecting reproducibility (Noblit & Hare, 1988), but on a practical level it is sometimes difficult to know when one is being exhaustive, particularly when not all studies are published, or are not publicly available (Cooper, 1984; Hunter, et al., 1982; Light, 1980); a challenge experienced in this research.

The literature review methodology was based on the standards set by the Cochrane Collaboration (2011) and the Campbell Collaboration guidelines (2014). The mnemonic SALSA (Search, AppraisaL, Synthesis, and Analysis) (Grant & Booth, 2009) provided structure to the process of reviewing the literature, as follows.

2.1 Search

A staged approach in the search for literature was designed in line with guidelines from Hammerstrøm, et al. (2009), and Booth, et al. (2012, p. 72). This included an initial search, applying a pearl-growing technique (Ramer 2005). Search term definition commenced during the initial scoping of the research topic. Search terms were iteratively refined during the search process to refine the selection of candidate papers returned. Reviewing reference lists of discovered articles proved effective in identifying unexpected relationships, and uncovered weaknesses in recent literature.

A search of the grey literature was performed to provide a measure against publication bias (Mcauley, et al., 2000; Campbell Collaboration, 2014), including websites, blogs, reports, and older official publications. The grey literature yielded many valuable sources as:

1. A large proportion of project management research comes from industry and the military funded research;
2. Sources on Agile methods and IID are often found outside of peer-reviewed academic journals as many authorities on publish outside of peer-reviewed academic journals.

Key articles identified from earlier searches were also examined to identify missed studies, as recommended by Papaioannou, et al. (2010). Caution was taken to avoid introducing bias by:

1. Following one author's line of argument alone;
2. Ensuring that counter-arguments were adequately considered by reviewing related research;
3. Consulting industry experts as part of the literature review process. Grey literature that would otherwise not have been located was obtained using this process.

2.2 Appraisal

All literature went through a three-stage critical appraisal process to assess its validity. The process used to critically appraise literature was developed from existing multi-disciplinary guidelines (Gough, 2007; Centre for Reviews and Dissemination, 2009). As reference material included peer-reviewed literature, government and industry-sponsored reports, news articles, websites, and blogs; heavy reliance was placed on cross-referencing assertions back to peer-reviewed literature to demonstrate validity. Grey literature was appraised for its overall applicability, extrinsic, and intrinsic value (Booth, et al., 2012).

2.3 Analysis and Synthesis

Analysis and synthesis were undertaken to make a new whole out of the parts (Pope, et al., 2007). Noblit and Hare's (1988) seven-step meta-ethnography method was adapted to qualitatively analyze, then synthesize the selected literature. This involved organizing key concepts in a table, to allow for cross-study comparison and abstracted interpretation (Booth, et al., 2012).

3. EARLY EVIDENCE OF AGILE AND IID METHODS

There are five interconnected streams of development that have contributed to what are broadly thought of as Agile methods and IID; each of which will be considered in turn in subsequent sections. These five streams of development are:

1. Manufacturing Quality;
2. Aerospace Projects;
3. Software Development;
4. Formalization in Standards; and
5. Participatory Design.

3.1 Manufacturing Quality

The earliest direct evidence of the practices that are now associated with Agile methods or IID is found in the work of Shewhart during the 1930s (Shewhart, 1939; Deming Institute, 2016).

Shewhart, a quality expert at Bell Labs, proposed a series of short "plan-do-study-act" (PDSA) cycles for quality improvement (Larman & Basili, 2003; Deming Institute, 2016). This test-and-learn approach is broadly regarded as a foundation of agility within project management, and is referenced in the dominant normative practitioner texts (PMI, 2017; Bennett, 2017), and many Agile methods texts. Deming promoted Shewhart's PDSA cycle (Deming, 2003; Deming, 1986) from the 1940's. Other influential American quality management researchers that promoted similar cyclical quality management techniques that were later applied to Agile project management include Joseph Juran (Juran, 1999), and Armand Feigenbum (Feigenbaum, 1961).

3.1.1 The Rise of Japanese Manufacturing

Following World War 2, there was a significant advancement in quality management concepts now associated with Agile methods and IID, particularly in Japan, where quality manufacturing principles were promoted by organizations like the Japan Union of Scientists and Engineers (JUSE), founded in 1946 (Union of Japanese Scientists and Engineers, 2015). JUSE supported research and development, inviting foreign experts such as Deming and Juran to collaborate with local experts like Ishikawa (Deming, 2003; Ishikawa, 1985; Ishikawa & Loftus, 1990; Union of Japanese Scientists and Engineers, 2015), seeking to improve Japan's international reputation for manufacturing (Deming, 2003; Liker, 2004).
Lessons from American quality management techniques were combined with Japanese manufacturing principles and techniques (Liker, 2004; Ohno, 1988; Takeuchi & Nonaka, 1986) to contribute to the development of higher efficiencies, and competitive advantage (Porter, 1980; Deming, 1986; Takeuchi & Nonaka, 1986; Port, 1991).

This cross-fertilization led to a rich stream of research in Japan during the 1980s that influenced Agile methods and IID, including team dynamics described as a 'Scrum' (Takeuchi & Nonaka, 1986), and quality circles involving regular group meetings of workers who perform the same or similar work, to solve common problems (Ishikawa & Loftus, 1990). The Ishikawa diagram technique contributed to Lean techniques, and directly influenced the evolution of Agile methods and IID.

The Toyota Production System (TPS) proved effective in improving quality, costs and lead times while maintaining safety and morale (Ohno, 1988; Liker, 2004). Bicheno (1994) argued the importance of Ohno's and Shingo's TPS "trilogy" of Just-In-Time, Total Quality, and Team Involvement in the ascendency of Japanese manufacturing. Desai (1998) highlighted the importance of supplier involvement, distribution logistics, effective design and attention to service in TPS. Ohno's (1988) kanban, heijunka, hansei, kaizen, and Kaoru Ishikawa's (1985) quality circles, among others, have strongly influenced the inclusive characteristics of modern Agile methods and IID.
Readers are referred to Funk (1993) for a summary of product development strategies used by Japanese manufacturers, and Liker (2004) for a comprehensive review of TPS.

Following these developments is a more widely acknowledged intellectual lineage from Scrum, quality circles, and the TPS to the development of Total Quality Management (Saraph, et al., 1989; Boje & Winsor, 1993; Ishikawa, 1985), Six Sigma (Klefsjö, et al., 2001; Schroedera, et al., 2008), Lean (Andersson, et al., 2006; Ballard & Howell, 2003), and then Agile Manufacturing (Port, 1991; Anonymous, 1993; Maital, 1994; Youssef, 1992; Yeo, 1993; Yin, 1994). However, their links to Agile software development, perspectives on agility, and organizational management are less commonly acknowledged.

3.1.2 The North American Response to Japanese Manufacturing

The success of Japanese manufacturing led to a competitive response from American organizations (Deming, 1986). A series of methods were developed, including a manufacturing paradigm defined as 'agility' by the Iacocca Institute's (1991) 21st Century Manufacturing Enterprise Strategy: An Industry Led View of Agile Manufacturing. The report's purpose was to identify the mechanisms for U.S. industry to return to manufacturing competitiveness. From this early concept of agility, Lehigh University led the development of Agile Manufacturing (Dove, 1994).

From there, The Agility Forum developed the concept of agility, focussing on its dynamism and positive embrace of change (Goldman, et al., 1995; Agility Forum, 1996; Nelson & Harvey, 1995; Dove, 1994). They contributed to the theory of Agile manufacturing (Agility Forum, 1996), and to an understanding of agility as a company-wide response to unpredicted change (Jordan & Frederick, 2001). In this context, Lutz used terminology now currently in use to describe Agile software development, such as: "nimble, flexible, and adaptable", "modular software", and allowing "development staff to concentrate on areas where the organization can add true value to a system" (Lutz, 2001).

3.2 IID in Aerospace Projects

Parallel to developments in manufacturing, there is also evidence of the practices associated with Agile methods and IID in USA World War 2 aeronautical projects, which adopted IID to develop launch system technology within tight timeframes (Temple, 2005). For example, the XP-80 project in 1943 used rapid prototyping and concurrent engineering practices to enhance the adaptiveness of the project delivery (Bamber, 2002). Both techniques are now regarded as part of the suite of Agile methods and IID. Other comparable projects include those listed in **Table 1**.

During the 1950's American military and NACA-sponsored projects applied IID principles, such as in the Titan program, to develop a dual-purpose intercontinental ballistic missile and manned space launch system. IID practices were also recognized as being a major contributing factor in the success of multiple projects that pushed aeronautical boundaries such as the X-15 Project, completed in 1959 (Dana, 1993; Temple, 2005).

Grumman Aerospace Corporation is recorded as an early adopter of approaches commonly associated with 'modern' Agile methods, such as visual presentation of real-time status information in their action centre to facilitate transparency and decision-making. Parties updated their status daily prior to daily "stand-up meetings" (Mead & Gavin, 1970; Grumman Aerospace Corporation, 1970) to provide a quick-response mechanism to enable more rapid communication and more effective decision making.

It should be noted that visual stand-up techniques were also used in conjunction with other project management techniques commonly associated with predictive models of project management. These included task schedules, budget baselining, and work breakdown structures. Daily stand-up meetings in their action centre complemented their formal system of reporting (Grumman Aerospace Corporation, 1970). The practice of combining Agile and predictive methods, a 'hybrid' approach, is commonly considered a new approach to project management (Ko & Kirsch, 2017). However, it appears that it has been practiced in use in one form or another over several decades.

Evidence of NASA employing similar methods in the 1970's includes daily posting of the working program schedule updates on the Program Control Room wall; and reference to it as a daily "stand-up" meeting:

"The working program schedule is posted on the walls of the Program Control Room and is used to monitor program status at daily "stand-up meetings" " (General Electric Company, 1977, p. 1-1).

Daily stand-up meetings were used during the development of the F-18. Stand-ups were summarised in a newsletter and distributed to a broader cross-section of project stakeholders to facilitate open and rapid communication (McDonnell Douglas Aerospace, 1995). The importance of stand-ups in aerospace projects is highlighted by McGarry, et al. (1996):

Project	Period	Outcomes
XP-80 Shooting Star jet fighter	1943	Designed and built in 143 days. Focus on delivery with a minimum number of appropriately skilled people, working closely and flexibly together, with a minimum amount of documentation, reporting, and meetings (Lockheed Martin Corporation, 2017; Johnson & Smith, 1989).
U-2	1950's	Extended aeronautical, materials, and manufacturing boundaries through rapid prototyping techniques and management approaches employed during the XP-80 Shooting Star project (Johnson & Smith, 1989; Lockheed Martin Corporation, 2017; Bamber, 2002).
SR-71	1960's	

Table 1: Examples of aerospace projects that used IID concepts (summarising Balsmeier and Voisin, 1997)

"Whenever we have allowed the heat of daily activities to postpone or cancel huddles, performance has suffered. I can watch it bounce right back the minute we reaffirm the discipline of the huddles. Even if you miss one or two you will see the effects." (McGarry, et al., 1996).

Many other aeronautical projects have been reported as having applied IID practices, which later evolved into Agile Manufacturing (Lockheed Martin Corporation, 2017; Griesel, 1988; Bamber, 2002; Webster, 2013; Presley, et al., 1995). This evolution of aeronautical techniques into Agile Manufacturing techniques in the early 1990's continues in the aviation industry, as manufacturers seek to control risk, costs, and complexities (Glas & Ziemer, 2009; Kasarda & Rondinelli, 1998).

3.3 Agility in software development

IID practices used in the X-15 Project were also applied to software development in NASA's 1960s Mercury Project (Dana, 1993). The Mercury Project practiced top-down development with stubs (Larman & Basili, 2003); "canned answers" (Fowler, 2007) used to provide ready inputs to a completed software component under test (Microsoft, 2015). Larman and Basili (2003, p. 3) quote Weinberg, who worked on the Mercury project, as saying:

"I think what the waterfall description did for us made us realize that we were doing something else, something unnamed except for 'software development'."

Personnel from the X-15 project transferred their experiences to IBM Federal Systems Division (FSD), an early proponent of IID (Larman & Basili, 2003). During the 1950's and 1960's the earliest explicit IID models of software development were created in projects developing large software systems (Hosier, 1961; Royce, 1970). Dana (1993) quotes Weinberg, about his experiences at IBM as follows:

"We were doing incremental development as early as 1957, in Los Angeles, under the direction of Bernie Dimsdale [at IBM's Service Bureau Corporation]. He was a colleague of John von Neumann, so perhaps he learned it there, or assumed it as totally natural. I do … where the technique used was, as far as I can tell, indistinguishable from XP. … Project Mercury was the seed bed out of which grew the IBM Federal Systems Division. Thus, that division started with a history and tradition of incremental development.
All of us, as far as I can remember, thought waterfalling of a huge project was rather stupid, or at least ignorant of the realities…".

Later, evidence of significant developments in IID can be found in Wirth's (1971) work on stepwise refinement, where requirements are refined by programmers through short iterations; later extended by Basili and Turner (1975).
During the same period, Edmonds (1974, 1978, 1982) worked on human – computer interface development, including "adaptive" software development using simulation models (prototypes and proof of concepts), and workload balancing between concurrent development and test iterations, delaying design decisions as long as practicable. This was proposed to address issues when users cannot predefine requirements. Edmonds' process started by delivering a system with basic functionality, now called a 'minimum viable product' (Duc & Abrahamsson, 2016).

Development of techniques later called 'Agile' continued during the 1980s, including the Cleanroom software engineering at FSD, which was responsible for space and defense systems development (Mills, et al., 1987; Knight, 1981). Cleanroom is a process that replaces debugging before release with statistical measurement of quality (Mills, et al., 1987). It provides a continuous assessment of product quality during development (Selby, et al., 1987; Hausler, et al., 1994).

Morris (1987) built on Wirth's (1971) through a model for iterative alignment to specification. The same approach was adopted in the 1990's by the Chrysler Comprehensive Compensation System (C3) payroll project; a technique later repackaged as XP (Beck, 1999). Another software development model building on these ideas is Spiral, a process model generator designed to adapt to specific projects (Boehm, 1986).

3.4 Standards in the Military and Project Management

Evidence of Agile methods and IID before the publication of the Agile Manifesto is also apparent in US military standards, starting with the 1978 software development standard MIL-STD-1679 (Navy). This early standard suffered from challenges combining linear procurement management lifecycles with the Agile and IID approaches contractors sought to use (NATO, 2008; Pentagon, 1987). Struggles between contractors and the Department of Defence (McDonald, 2010) led to a revision of the standards during the 1970's and '80's, resulting in MIL-STD-498 in the 1990's (Moore & Rada, 1996) to improve compatibility with Agile methods and IID (**Table 2**).

From	To	Standard	Description
1-Dec-78	22-Aug-83	MIL-STD-1679 (Navy)	Weapon System Software Development
22-Aug-83	4-Jun-85	DOD-STD-1679A (Navy)	Software Development
7-Mar-79	15-Jan-82	MIL-STD-1644 (TD)	Trainer System Software Engineering Requirements
15-Jan-82	2-Mar-84	MIL-STD-1644A (TD)	Trainer System Software Engineering Requirements
2-Mar-84	4-Jun-85	MIL-STD-1644B (TD)	Trainer System Software Engineering Requirements
12-Feb-87	5-Dec-94	DOD-STD-1703 9 (NS)	Software Product Standards
4-Jun-85	19-Feb-88	DOD-STD-2167	Defence System Software Development
19-Feb-88	5-Dec-94	DOD-STD-2167A	Defence System Software Development
31-Oct-88	5-Dec-94	DOD-STD-7935A	DOD Automated Information System (AIS) Documentation Standards
5-Dec-94	27-May-98	MIL-STD-498	Software Development and Documentation

Table 2: USA military standards: a precursor to civilian standards

The increasing influence of industry on 'best practice' and the cost of maintaining standards led to the Perry Memo (1994), announcing the outsourcing of military software development project management standards, resulting in J-STD-016 and ISO/IEC 12207 which superseded MIL-STD-498 (Burak & Codur, 2012). The Project Management Institute adopted many aspects of military standards when developing the PMBOK Guide (PMI, 2017). However, it is interesting to note that despite a significant literature on Agile methods and IID, the project lifecycle presented in early PMBOK Guides was an ostensibly predictive model similar to the structure that Royce (1970) warned invites failure.

3.5 Participatory Design

From the 1960s, there was a shift in IID approaches to focus on team collaboration, stakeholder engagement, and addressing positional power (Clement & Van den Beselaar, 1993). For example, Locander et al (1979) presented a case for establishing cross-functional, interdisciplinary teams, emphasizing team growth, coordination and collaboration (Locander et al, 1979). These priorities share similarities with later Agile methods and IID.

Participatory Design, a values-based project management approach, appeared during the 1970's (Clement & Van den Beselaar, 1993). It included a focus on ethics (Lindberg, et al., 2014), social values (Leong & Robertson, 2016; Grönval, et al., 2016), and the way collaborative design can encourage the participation by those affected (Pihkala & Karasti, 2016). It considers the collaborative, social, and political dimensions of technology, particularly when engaging disempowered people (Maldonado Branco, et al., 2016; Makhaeva, et al., 2016). Participatory Design has centred on Europe (Pdworld, 2017), but is also found in North America, Australia and New Zealand (Leong & Robertson, 2016; Clement & Van den Beselaar, 1993; Presley, et al., 1998). The influence of Participatory Design is apparent in later iterations of Agile methods and IID.

4. THE AGILE MANIFESTO AND BEYOND

A review of recent publications (Parolo, et al., 2015; Pariser, 2011; Cameron, 2014; Scrum Inc®, 2017; Cockburn, 2014; VersionOne Inc., 2017; SCRUM Alliance®, Inc., 2016) would suggest that Agile methods and IID started with the publication of the Agile Manifesto in 2001. The story of 17 renegade developers descending the mountain with a signed manifesto is an engaging origin story, but it does not capture the heritage of these ideas. The Agile Manifesto has played a significant role in articulating ideas that were already in practice across multiple disciplines. The purpose of this paper is not to challenge the Agile Manifesto, but to inform those who regard it as the origin of Agile methods and IID. The heritage of the ideas that informed the Agile Manifesto is summarised in **Figure 1**.

At around the time of the publication of the Agile Manifesto, Agile project management frameworks were being enthusiastically packaged and commercialized; marketed as more effective at addressing uncertainty and change (Cockburn, 2007; Beck, 1999; SCRUM Alliance®, Inc., 2016; Scrum Inc®, 2017).

This often involved repackaging already well-developed and widely applied techniques. See, for example, the similarities between stepwise refinement and XP (Morris, 1987; Beck, 1999), or the links between manufacturing quality techniques like the Toyota Production System (Liker, 2004) and Scrum (Takeuchi & Nonaka, 1986; SCRUM Alliance®, Inc., 2016; Scrum Inc®, 2017) and Agile (Deming, 1986; Port, 1991; Maital, 1994; Highsmith, 2001).

Port's (1991) call to arms bears striking similarities to messaging by some signatories of the Agile Manifesto (Highsmith, 2001; Cockburn, 2014; SCRUM Alliance®, Inc., 2016; Scrum Inc®, 2017). The Agile Manufacturing Enterprise Forum (Youssef, 1992; Presley, et al., 1995; Kidd, 1995; Sheridan, 1993; Maital, 1994; Ward, 1994), and other organizations, also sought to use the concept of agility to move from mass-production to customized products well before the Agile Manifesto. Readers are referred to their account of the history of Agile methods and IID, for further consideration of the rich intellectual heritage that has contributed to this area.

5. LIMITATIONS OF THE SYSTEMATIC LITERATURE REVIEW

Systematic literature reviews present a number of challenges. They remain inconsistently developed across areas of science research (Parris & Peachey, 2013); particularly management research. Systematic literature review selection criteria can be designed to ignore positions, creating confirmation bias (Kahneman, 2011). Although an unbiased review has been attempted, this process necessarily involves personal selection and interpretation of texts.

There are limitations applying systematic literature review techniques to Agile methods and IID. Lack of standard terminology can cause problems creating a comprehensive literature review (Parris & Peachey, 2013). Due to the long evolution of these ideas and the diversity of fields involved, there will inevitably be gaps. These were due to an absence or inaccessibility of references, language limitations, or the inaccessibility of material.

6. CONCLUSION

Agile methods and IID have attracted an increasing amount of attention in recent years. Some proponents of the Agile Manifesto, and newcomers to Agile methods and IID, have directly, or indirectly, implied that these methods are recent developments. However, many of the practices associated with Agile methods and IID have a long and rich heritage. The earliest practices associated with these were founded in the 1930's, and became an important part of aeronautical engineering and manufacturing post World War 2. Similarly, iterative techniques such as prototyping and the minimum viable products can be traced back to the mid-20th century.

The purpose of this paper has not been to undermine the benefits of Agile methods and IID, or to criticize how effectively the Agile Manifesto has disseminated these principles and practices, but to highlight earlier work and articulate how these

	Manufacturing Quality	North American Aerospace	Software Development	Standards (Military and PM)	Participatory Design
1930's	1930's Shewhart's PDSA				
1940's	1940's Demming Japan Union of Scientists and Engineers invests in lean manufacturing in 1946 (JUSE, 2005)	XP-80 - 1943 Rapid prototyping & concurrent engineering Lockheed Martin Corporation, (2017); Johnson & Smith, (1989)			
1950's	Juran (1951) Demming and Juran in Japan in 1954	U-2 - 1955 Rapid prototyping Johnson & Smith, (1989); Lockheed Martin Corporation, (2017); Bamber, (2002) Titan - 1958 IID (Dana, 1993; Temple, 2005) X-15 - 1959 IID (Dana, 1993; Temple, 2005)	NASA Mercury Project - 1958-1963 Ideas coming from X-15 (Dana, 1993)		
1960's	Feigenbm (1961)	SR-71 - 1964 Rapid prototyping Johnson & Smith, (1989); Lockheed Martin Corporation, 2017; Bamber, (2002)	IBM Federal Systems Division - 50s & 60s Ideas coming from X-15 (Larman & Basilisks, 2003) Ideas coming from Mercury (Dana, 1993) Practice was indistinguishable from XP		1960s shift to focus on collaboration, engagement, and power dynamics
1970's		Grumman Aerospace Corp. - 1970 Visual real-time information Daily stand-ups and hybrid Mead & Gavin, (1970); Grumman Aerospace Corp. (1970) NASA (General Electric, 1977) Visual real-time information Daily stand-ups Daily stand-ups McGarry (1996)	Stepwise Refinement Wirth (1971) Stepwise Refinement Basili & Turner (1975) Built directly on Wirth Adaptive software development Edmonds (1974, 1978, 1982, 1984) Prototypes, proof of concepts, Equivalent to minimum viable product	MIL-STD-1679 (Navy) First codified standard - linear	Participatory design (Clement & Van Bedelaar (1993) Interdisciplinary teams Locander et al (1979)
1980's	Quality Circles - Ishikawa (1985) Scrum - Tahkeuchi & Nonaka (1986) TPS - Ohno (1988) TQM - Saraph, et al., (1989) Boje & Winsor, (1993)		Cleanroom Testing using incremental development IBM Federal Systems Division (Knight, 1981; Mills, et al., 1987) Spiral - adaptable process model generator (Boehm, 1986) Iterative alignment to specification Morris (1987) Built on Wirth Adopted by Chrysler Comprehensive Compensation Project - 1993 XP (Morris, 1987, Beck, 1999) Based on CCC Project	Conflict between DoD and contractors who wanted to use IID methods (Pentagon, 1987; NATO, 2008; McDonald, 2010)	
1990's	Agile Manufacturing - Iacocca Institute (1991) Port (1991) Anonymous, 1993; Maital, 1994; Youssef, 1992; Yeo, 1993; Yin, 1994 Agile Manufacturing Enterprise Forum (Presley, et al., 1995; Kidd, 1995; Sheridan, 1993; Maital, 1994; Youssef, 1992; Ward, 1994) Agility Forum (1996)			MIL-STD-498 - 1994 Increased compatibility with IID (Moore & Rada, 1996) PMBOK Guide (1st Ed.) (PMI, 1996) influenced by pre-1994 Military standards Did not consider agile and IID	
2000's	Six Sigma - Klefsjö, et al., (2001)		Agile Manifesto (Beck et al, 2001) Scrum (Schwaber & Beedle, 2002)		
2010's				IID appears in PMBOK in 2017	

Figure 1: The development of agile project management and IID methods

streams of intellectual development have contributed to Agile methods and IID as known today. This paper seeks to renew attention towards the full scope of research and practice that has contributed to Agile methods and IID project management, and make this history more accessible. We have highlighted connections obfuscated by the divergent language used to describe similar tools and techniques, unremarked as tacit practices, or hidden in organizational procedures. We hope that clarifying the historical links between the concepts and terms used to describe Agile methods and IID project management will deepen practitioners' understanding of currently popular approaches and open further possibilities for deeper research into Agile methods in project management.

7. REFERENCES

Agility Forum, 1996. "Ramping up 2000" Proceedings of the Fifth National Conference, Agile Manufacturing Enterprise Forum. Boston, Agility Forum.

Andersson, R., Eriksson, H. & Torstensson, H., 2006. Similarities and differences between TQM, six sigma and lean. The TQM Magazine, 18(3), pp. 282-296.

Anonymous, 1993. New manufacturing system slowly emerging. Industrial Engineering, 25(2), p. 8.

Ballard, G. & Howell, G., 2003. Lean project management. Building Research & Information, 31(2), pp. 119-133.

Balsmeier, P. W. & Voisin, W. J., 1997. Rapid Prototyping: State of the Art Manufacturing. Industrial Management, Jan-Feb, 39(1), pp. 1-4.

Bamber, C. J., 2002. Agile Manufacturing in UK Aerospace Manufacturing Small to Medium Size Enterprises, Salford, UK: COrE Research Team, The School of Management, University of Salford, UK.

Basili, V. R. & Turner, A. J., 1975. Iterative enhancement: A practical technique for software development. IEEE Transactions on Software Engineering, December, SE-1(4), pp. 390-396.

Beck, K., 1999. Extreme Programming Explained: Embrace Change. Upper Saddle River, NJ 07458: Addison-Wesley Professional.

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., W., Cunningham, Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R., Mellor, S., Schwaber, K., Sutherland, J., Thomas, D. 2001. Manifesto for Agile Software Development, http://agilemanifesto.org/ Accessed online 16/11/2018.

Bennett, N. 2017. Managing Suddessful Projects with Prince2. Stationary Office Books, London.

Bicheno, J., 1994. Cause and Effect JIT, The Essentials of Lean Manufacturing. 2nd ed. Buckingham: Moreton Press.

Boehm, B., 1986. A Spiral Model of Software Development and Enhancement. ACM SIGSOFT Software Engineering Notes, 11(4), pp. 14-24.

Boje, D. M. & Winsor, R. D., 1993. The Resurrection of Taylorism: Total Quality Management's Hidden Agenda. Journal of Organizational Change Management, 6(4), pp. 57-70.

Booth, A., Papaioannou, D. & Sutton, A., 2012. Systematic approaches to a successful literature review. London: Sage.

Burak, K. & Codur, A. H., 2012. Regulations and software evolution: An example from the military domain. Science of Computer Programming, 77(5), pp. 636-643.

Cameron, N., 2014. NAB shares the key ingredients to digital strategy success. [Online] Available at: https://www.cmo.com.au/article/550602/nab_shares_key_ingredients_digital_strategy_success/ [Accessed 18 June 2017].
Campbell Collaboration, 2014. Campbell systematic reviews: policies and guidelines, version 1.3. Access online at https://campbellcollaboration.org/media/k2/attachments/Campbell_Policies_and_Guidelines.pdf on 26/11/2918.
Centre for Reviews and Dissemination, University of York, 2009. Systematic reviews: CRD's guidance for undertaking reviews in health care, Layerthorpe, York: CRD, University of York.
Clement, A. & Van den Beselaar, P., 1993. A retrospective look at PD projects. Communications of the ACM, June, 36(4), pp. 29-37.
Cochrane Collaboration, 2011. Cochrane Handbook for Systematic Reviews of Interventions. Available online at https://handbook-5-1.cochrane.org/ Accessed 26/11/2018.
Cockburn, A., 2007. Agile software development: the cooperative game, Upper Saddle River. NJ: Addison-Wesley.
Cockburn, A., 2014. A history of agile software development Starter Kit. [Online] Available at: http://alistair.cockburn.us/A+history+of+agile+software+development+Starter+Kit [Accessed 31 July 2017].
Cooper, H. M., 1984. The integrative research review: a systematic approach. Beverley Hills, Ca.: Sage Publications.
Cram, W. A. & Newell, S., 2016. Mindful revolution or mindless trend? Examining agile development as a management fashion. European Journal of Information Systems, 25(2), pp. 154-169.
Dana, W. H., 1993. The X-15 Lessons Learned, tech. report, California: NASA Dryden Research Facility.
De Cesare, S. et al., 2010. Examining perceptions of agility in software development practice. Communications of the ACM, 53(6), pp. 126-130.
Deming, W. E., 1986. Out of the Crisis. Massachusetts: Massachusetts Institute of Technology, Center for Advanced Engineering Study.
Deming, W. E., 2003. The essential Deming : leadership principles from the father of quality. New York: McGraw-Hill.
Deming Institute®, 2016. Timeline. [Online] Available at: https://deming.org/deming-the-man/timeline
Desai, S., 1998. Agile Manufacturing within the UK's Leading Manufacturing Businesses, Salford, UK: University of Salford.
Dingsoyr, T., Nerur, S., Balijepally, V. & Moe, N. B., 2012. A decade of agile methodologies: towards explaining agile software development. Journal of Systems and Software, 85(6), pp. 1213-1221.
Dove, R., 1994. The Meaning of Life and the Meaning of Agile. Production Magazine, November, pp. 23-34.
Duc A. & Abrahamsson P. 2016. Minimum Viable Product or Multiple Facet Product? The Role of MVP in Software Startups. In: Sharp H., Hall T. (eds) Agile Processes, in Software Engineering, and Extreme Programming. XP 2016. Lecture Notes in Business Information Processing, vol 251. Springer, Cham.
Edmonds, E., 1974. A process for the development of software for non-technical users as an adaptive system. GENERAL SYSTEMS, Volume 19, pp. 215-218.
Edmonds, E., 1978. Adaptable interfaces for interactive systems. Liverpool, Proc. Workshop Comp. Skills, pp. 145-152.
Edmonds, E., 1982. The man-computer interface: a note on concepts and design. International Journal of Man-Machine Studies, 16(3), pp. 231-236.
Feigenbaum, A. V., 1961. Total Quality Control: Engineering and Management. New York: McGraw-Hill.
Fowler, M., 2007. Mocks Aren't Stubs. [Online] Available at: https://martinfowler.com/articles/mocksArentStubs.html#TheDifferenceBetweenMocksAndStubs [Accessed 11 4 2017].
Funk, J. L., 1993. Japanese Product-Development Strategies: A summary and propositions about their implementation. IEEE Transactionns on Engineering Management, 40(3), pp. 224-236.
General Electric Company, 1977. Prototype solar heating and combined heating and cooling systems (Quarterly Report No. 5), Alabama: U. S. Department of Energy.
Glas, M. & Ziemer, S., 2009. Challenges for agile development of large systems in the aviation industry. Orlando, Florida, USA, ACM, pp. 901-908.
Goldman, S. L., Nagel, R. N. & Preiss, K., 1995. Agile Competitors and Virtual Organizations Strategies for Enriching the Customer. New York, NY: Von Nostrand Reinhold.
Gough, D., 2007. Weight of Evidence: a framework for the appraisal of the quality and relevance of evidence. Research Papers in Education, June, 22(2), pp. 213-228.
Grant, M. J. & Booth, A., 2009. A typology of reviews: an analysis of 14 review types and associated methodologies. Health Information & Libraries Journal, June, 26(2), pp. 91-108.
Griesel, M. A., 1988. Incremental Development and Prototyping in Current Laboratory Software Development Projects: Preliminary Analysis, Washington, D.C. 20546: National Aeronautics and Space Administration.
Grönval, E., Malmborg, L. & Messeter, J., 2016. Negotiation of values as driver in community-based PD. Aarhus, Denmark, s.n., pp. 41-50.
Grumman Aerospace Corporation, 1970. Phase B Proposal for Space Shuttle Program Study, Bethpage, Long Island, New York ll714: Grumman Aerospace Corporation.
Hammersley, M., 2013. Systematic or Unsystematic, Is That the Question? Some Reflections on the Science, Art and Politics of Reviewing. In: M. Hammersley, ed. The Myth of Research-Based Policy & Practice. London: SAGE Publications, Inc., pp. 110-119.
Hammerstrøm, K., Wade, A., Hanz, K. & Jørgensen, A.-M. K., 2009. Searching for studies: Information retrieval methods group policy brief, Oslo, Norway: The Campbell Collaboration.
Hart, C., 1998. Doing a literature review: releasing the social science research imagination. London: Sage.
Hausler, P. A., Linger, R. & Rrammen, C., 1994. Adopting Cleanroom Software Engineering with a Phased Approach. IBM Systems Journal, 33(1), pp. 89-109.
Highsmith, J., 2001. History: The Agile Manifesto. [Online] Available at: http://agilemanifesto.org/history.html [Accessed 31 July 2017].
Holmstrom, H., Fitzgerald, B., Agerfalk, P. J. & Conchuir, E. O., 2006. Agile practices reduce distance in global software development. Information Systems Management, 23(3), pp. 7-18.
Hosier, W. A., 1961. Pitfalls and Safeguards in Real-Time Digital Systems with Emphasis on Programming. IRE Transactions on Engineering Management, EM-8(2), pp. 99 - 115.
Hunter, J., Schmidt, F. & Jackson, G., 1982. Meta-Analysis: Cumulating research findings across studies. Beverly Hills, Ca.: Sage.
Iacocca Institute. 1991. 21st Century Manufacturing Enterprise Strategy: An Industry Led View of Agile Manufacturing. Iacocca Institute, Lehigh University: Bethlehem, USA.
Ishikawa, K., 1985. What is Total Quality Control?. Englewood Cliffs, NJ: Prentice-Hall Inc..
Ishikawa, K. & Loftus, J. H., 1990. Introduction to quality control. English : 3rd ed ed. Tokyo: 3A Corporation.
Janes, A. & Succi, H., 2012. The dark side of agile software development. Tucson, Arizona, Association for Computing Machinery, pp. 19-26.
Johnson, C. L. & Smith, M., 1989. Kelly : More Than My Share of It All. 1 ed. Washington, D.C.: Smithsonian Institution Press.
Jordan, J. A. & Frederick, J. M., 2001. The lean company; making the right choices. Hardcover ed. Portland: Society of Mfganufacturing Engineers.
Juran, J. M., 1999. Juran's Quality Handbook. Fifth Edition ed. New York: McGraw-Hill.
Kahneman, D., 2011. Thinking, fast and slow. New York: Farrar, Straus and Giroux.
Kasarda, J. D. & Rondinelli, D. A., 1998. Innovative Infrastructure for Agile Manufacturers. Sloan Management Review, 39(2), pp. 73-82.
Kidd, P. T., 1995. Agile manufacturing: a strategy for the 21st century. Agile Manufacturing (Digest No.1995/179), IEE Colloquium on, 1995(179), pp. 1-6.
Klefsjö, B., Håkan, W. & Edgeman, R., 2001. Six sigma seen as a methodology for total quality management. Measuring Business Excellence, 5(1), pp. 31-35.
Knight, J. C., 1981. Production of Reliable Flight-Crucial Software: Validation Methods Research for Fault-Tolerant Avionics and Control Systems Sub-Working-Group Meeting. Research Triangle Institute Research Triangle Park, NASA, p. 30.
Ko, D. & Kirsch, L. 2017. The hybrid IT project manager: One foot each in the IT and business domains. International Journal of Project Management, 35, 307-319.
Larman, C. & Basili, V. R., 2003. Iterative and Incremental Development: A Brief History. Computer, 01 06, 36(6), pp. 47-56.
Leong, T. W. & Robertson, T., 2016. Voicing values: laying foundations for ageing people to participate in design. Aarhus, Denmark, s.n., pp. 31-40.
Light, R. J., 1980. Synthesis methods: Some judgement calls that must be made. Evaluation in Education, 4(1), pp. 13-17.
Liker, K. J., 2004. The Toyota Way: 14 management principles from the world's greatest manufacturer. New York: McGraw-Hill.
Lindberg, S., Thomsen, M. & Åkesson, M., 2014. Ethics in health promoting PD: designing digital peer support with children cured from cancer. Windhoek, Namibia, s.n., pp. 91-100.
Locander, W. B., Napier, H. A. & Scamell, R. W., 1979. A team approach to managing the development of a decision support system. MIS Quarterly, March, 3(1), pp. 53-63.
Lockheed Martin Corporation, 2017. Kelly's 14 Rules & Practices. [Online] Available at: http://www.lockheedmartin.com.au/us/aeronautics/skunkworks/14rules.html [Accessed 10 4 2017].
Lutz, M. J., 2001. Software engineering on internet time. Computer, 34(5), p. 36.
Maital, S., 1994. A 'Made in America' system.. Across the Board, 31(4), p. 45.
Makhaeva, J., Frauenberger, C. & Spiel, K., 2016. Creating creative spaces for co-designing with autistic children: the concept of a "Handlungsspielraum". Aarhus, Denmark, ACM New York, NY, USA, pp. 51-60.
Maldonado Branco, R., Quental, J. & Ribeiro, Ó., 2016. Playing with personalisation and openness in a codesign project involving people with dementia. Aarhus, Denmark, ACM New York, NY, USA, pp. 61-70.
Mcauley, L., Pham, B., Tugwell, P. & Moher, D., 2000. Does the inclusion of grey literature influence estimates of intervention effectiveness reported in meta-analyses?. The Lancet, 356(9237), pp. 1228-1231.
McDonald, C., 2010. Art form to engineering discipline?: A history of US Military software development standards, 1974–1998. IEEE Annals of the History of Computing, 32(4), pp. 32-47.
McDonnell Douglas Aerospace, 1995. Report of survey conducted at McDonnell Douglas Aerospace (MDA) (St. Louis), St. Louis, MO: Center of Excellence for best Manufacturing Practices.
McGarry, P., Sopel, J., Caira, M. & McDonald, B., 1996. Self–Directed Work: A Strategy for Continuous Improvement. Journal of Innovative Management, pp. 61-71.
Mead, L. M. & Gavin, J. G. J., 1970. Proposal to Accomplish Phase B Space Shuttle Program, Bethpage, Long Island, New York ll714: Grumman Aerospace Corp..
Microsoft, 2015. Using stubs to isolate parts of your application from each other for unit testing. [Online] Available at: https://msdn.microsoft.com/en-us/library/hh549174.aspx [Accessed 11 4 2017].
Mills, H., Dyer, R. & Linger, R., 1987. Cleanroom Software Engineering. IEEE Software, 4(5), pp. 19-25.
Moczar, L., 2013. Why agile isn't working: bringing common sense to agile principles, 2013: CIO.
Moore, J. W. & Rada, R., 1996. Organizational badge collecting. Communications of the ACM, 39(8), pp. 17-21.
Morris, J. M., 1987. A theoretical basis for Stepwise Refinement and the programming calculus. Science of Computer Programming, 9(3), pp. 287-306.
Mulrow, C. D., 1994. Rationale For Systematic Reviews. British Medical Journal, 309(6954), pp. 597-599.
NATO, 2008. RTO Technical Report: Evolutionary Software Development. s.l.:North Atlantic Treaty Organisation.
Nelson, A. & Harvey, F. A., 1995. Technologies for Training and Supporting your Agile Work Force, Proceedings of the 4th Agility Forum Annual Conference. Bethlehem, PA, Agility Forum.
Nerur, S., Mahapatra, R. & Mangalaraj, G., 2005. Challenges of migrating to agile methodologies. Communications of the ACM, 48(5), pp. 73-78.
Noblit, G. W. & Hare, R. D., 1988. Meta-ethnography: synthesizing qualitative studies. Newbury Park, Calif;London: SAGE.
Ohno, T., 1988. Toyota production system: beyond large-scale production. Cambridge, Mass.: Productivity Press.
Papaioannou, D. et al., 2010. Literature searching for social science systematic reviews: consideration of a range of search techniques. Health Information and Libraries Journal, 27(2), pp. 114-122.
Pariser, E., 2011. The filter bubble: what the Internet is hiding from you. 18th ed. London: Viking/Penguin Press.
Parolo, P. D. B. et al., 2015. Attention decay in science. Journal of Informetrics, 9(4), pp. 734-745.
Parris, D. L. & Peachey, J. W., 2013. A Systematic Literature Review of Servant Leadership Theory in Organizational Contexts. Journal of Business Ethics, 113(3), pp. 377-393.
Pdworld, 2017. Pdworld -- List of the Participatory Design Community. [Online] Available at: https://listserv.uni-siegen.de/mailman/listinfo/pdworld [Accessed 1 8 2017].
Pentagon, 1987. Report of the Defense Science Board Task Force on Military Software, Unclassified, s.l.: Pentagon, The.
Perry, W. J., 1994. Specifications & Standards - A New Way of Doing Business, Washington DC: Department of Defense.
Pihkala, S. & Karasti, H., 2016. Reflexive engagement: enacting reflexivity in design and for 'participation in plural'. Aarhus, Denmark, s.n., pp. 21-30.
Pope, C., Mays, N. & Popay, J., 2007. Synthesizing qualitative and quantitative health evidence: a guide to methods. Maidenhead, England ; New York, NY: Open University Press, McGraw Hill Education.
Porter, M. E., 1980. Competitive strategy: Techniques for analyzing industries and competitors. New York: Free Press.
Port, O., 1991. This is what the U.S. must do to stay competitive. Business Week, p. 92.
Presley, A., Mills, J. & Liles, D., 1995. Agile Aerospace Manufacturing, Nepcon East: The University of Texas at Arlington.
Presley, A., Sarkis, J., Liles, D. & Barnett, W., 1998. Participative Design Using Soft Systems Methodology. Baltimore, MD, Association for Information Systems (AIS'98).
Project Management Institute, 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide). 5th ed. Newtown Square, Pa.: Project Management Institute.
Ramer, S. L., 2005. Site-ation pearl growing: methods and librarianship history and theory. Journal of the Medical Library Association. 93(3), pp. 397-400.
Royce, W. W., 1970. Managing the development of large software systems: concepts and techniques. Monterey, California, USA, Originally published by TRW. Reprinted by IEEE Computer Society Press, pp. 328-338.
Saraph, J. V., Benson, P. G. & Schroeder, R. G., 1989. An Instrument for Measuring the Critical Factors of Quality Management. Decision Sciences, 20(4), p. 810–829.
Schroedera, R. G., Linderman, K., Liedtkeb, C. & Choo, A. S., 2008. Six Sigma: Definition and underlying theory. Journal of Operations Management, 26(4), pp. 536-554.
SCRUM Alliance®, Inc., 2016. SCRUM Alliance. [Online] Available at: https://www.scrumalliance.org/why-scrum#why-its-called-scrum [Accessed 17 April 2017].
Scrum Inc®, 2017. Scrum Inc. [Online] Available at: https://www.scruminc.com/ [Accessed 17 April 2017].
Selby, R. W., Basili, V. R. & Baker, T. F., 1987. Cleanroom Software Development: An Empirical Evaluation. IEEE TRANSACTIONS ON SOFTWARE ENGINEERING, 13(9), pp. 1027-1037.
Sharp, H. et al., 2006. Agile development: opportunity or fad?. Montreal, Canada, 22–27 April Association for Computing Machinery.
Sheridan, J. H., 1993. Agile manufacturing: Stepping beyond lean production. Industry Week, 242(8), p. 30.
Shewhart, W. A., 1939. Statistical method from the viewpoint of quality control. Washington, D.C.: Graduate School of the Department of Agriculture.
Takeuchi, H. & Nonaka, I., 1986. The new new product development game. Harvard Business Review, January-February, 64(1), pp. 137-146.
Temple, L. P. I., 2005. Shades of gray: national security and the evolution of space reconnaissance. Reston(Va.): American Institute of Aeronautics and Astronautics.
The Cochrane Collaboration, 2017. About Us. [Online] Available at: http://www.cochrane.org/about-us [Accessed 20 08 2016].
Union of Japanese Scientists and Engineers, 2015. 日科技連について. [Online] Available at: http://www.juse.or.jp/aboutus/history/ [Accessed 10 11 2017].
US Department of Defence, 1988. DOD-STD-2167A. Washington DC: US Department of Defence.
VersionOne Inc., 2017. 11th Annual State of Agile Survey, Alpharetta: VersionOne Inc..
Ward, C., 1994. What is agility?. Industrial Engineering, 26(11), p. 14.
Webster, G., 2013. Sun in the Way Will Affect Mars Missions in April. [Online] Available at: https://mars.jpl.nasa.gov/mars2020/news/whatsnew/index.cfm?FuseAction=ShowNews&NewsID=1449 [Accessed 20 4 2017].
Wirth, N., 1971. Program Development by Stepwise Refinement. Reprinted from Communications of the ACM, 1 April, 14(4), pp. 221-227.
Wirth, N., 2008. A Brief History of Software Engineering. IEEE Annals of the History of Computing, 30(3), pp. 32-39.
Yeo, K. T., 1993. Systems thinking and project management – time to reunite. International Journal of Project Management, 11(2), pp. 111-117.
Yin, R. K., 1994. Applied social research methods series Case study research: Design and methods. 2nd ed. London: Sage.
Youssef, M. A., 1992. Agile manufacturing: A necessary condition for competing in. Industrial Engineering, 24(12), p. 18.

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