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Innovation Scorecard

— Theoretical Background and Principles —

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The concept of Innovation Scorecard was introduced and further developed within an original primary research project conducted in the Czech Republic during the period 2013-2015. This conceptual performance measurement and management control framework was specifically designed for innovation work activities. In its current form, the scorecard system has a user-friendly interface and supports go/no-go decision making within innovation projects. It provides guidelines how to focus attention on what is important to be done and how to measure in-and outputs. Resource optimisation forms an essential part of an innovation scorecard. It appears that the informed use of evaluation metrics as guideposts for increased managerial attention. The identification of problems may assist management in their efforts to prevent 'drop-and- go-errors' during innovation activities. This paper is the result of a number of core Innovation Scorecard implementation practices. The initiative is supported by the Czech Agency in the Czech Republic and consists of a three-year roll-out project that commenced in 2019 and will finish at the end of 2021. The purpose of this paper is to present the theoretical background and principles of the Innovation Scorecard as well as the adoption of fit for intended purpose modifications to make it suitable for alignment for use within the IT industry. Agile management practices have become a de facto standard within the IT industry in recent years. The biggest advantage of the agile approach is its flexibility and ability to react fast to changes. This approach is dynamic and provides quick access to solutions, especially in software development environments. At first glance it appears that the immeasurable can actually be measured. A combination of a dynamic change process such as innovation scorecard and a significant project management control system such as agile can achieve things that are greater than their combined parts. Innovation Scorecard implementation will make a significant contribution to improve the efficiency, economies of scale capabilities (at operational level) and the ultimate competitiveness of organizations across the IT industry.The current innovation scorecard team has presently developed two sub-projects. The first project is known as Red Hat Enterprise Linux (RHEL) Atomic Host ®. It serves as a pilot implementation project. The initial results from the project roll-out are outlined and described in this paper. The capturing of essential knowledge, in particular lessons learned, will ensure that future projects can be implemented with improved levels of time, cost and quality parameters.

Keywords and Phrases: Innovation Project, Management Control, Software Development, Agile

1. Introduction

It appears that many companies across the industries are driven by ever-increasing demands to come up with new products and services to satisfy their customer needs and demands. To stay competitive, they need to respond positively and adopt new approaches how to become and stay innovative in their outlook. Innovation Management is not a new concept. It has been around since the 1960s. The value added by innovation has not always been measured regularly and consistently. Kaplan and Norton (1996) introduced a so-called Balanced Scorecard concept that measured business performance data of an organization in both financial as well as non-financial terms. A Balanced Scorecard, on its own, was not an appropriate tool for measuring the value added by innovation. Gama et al. (2007) developed a new innovation scorecard that was based on combining innovation metrics with the standard Balanced Scorecard. Their approach, for the first time, aligned innovation metrics with organizational strategic objectives. Today, the core question for any organization is not whether "to innovate or not" but "how to innovate efficiently and effectively". This drives the need to innovate wisely and with focus. This requires organizations to be capable of conducting continuous evaluations of their current innovation projects and of using this data to make decisions on whether to continue with their projects or not. Establishing effective forms of innovation efficiency measurement and management control as an information support for decision making undertaken at either the business or academic level is a very challenging task. The authors adopted the following practical approach to apply an appropriate innovation scorecard concept for practical use and application within a Red Hat Czech s.r.o. Project, a Software Development and IT company within the Czech Republic. This included the utilization of traditional techniques of 'measurement of returns' focusing on the cost control combined with strategic measurements over the long - term together with financial objectives set by the project team. Selected relevant indicators were tailored to the organization as each innovation is

considered to be unique, specific and intended to bring competitive advantage to an organisation' s growth. This approach resulted in a fit for purpose Innovation Scorecard design that provides conceptual efficiency measurements and acts as a management control framework for innovations specific for, but not limited to, software development and IT industries, including other countries (Zizlavsky 2016). The IT industry was chosen as a pilot study. It is one of the most innovative and dynamic industries in the Czech Republic. It appears that agile management practices, including SCRUM, have become a de facto standard in this industry in recent years. The biggest advantage of the agile approach is its flexibility and ability to react fast to changes. This approach is dynamic and provides quick access to solutions, especially in software development environments. At first glance it appears that the immeasurable can actually be measured. A combination of a dynamic change process such as Innovation Scorecard and a significant project management control system such as agile can achieve things that are greater than their combined parts. Innovation Scorecard implementation will make a significant contribution to improve the efficiency, economies of scale capabilities (at operational level) and the ultimate competitiveness of organizations across the IT industry not just in the Czech Republic. Section 2 provides a brief overview of the authors' chosen research approach. Section 3 describes the theory behind the Czech Innovation Scorecard Project and Section 4 presents the practical applications of the theoretical framework in a real life agile and SCRUM working environment within Red Hat Czech s.r.o. The final Section summarises and concludes the Czech Innovation Scorecard implementation project story so far.

2. Methodology

2.1 Method

The Innovation Scorecard itself is designed as a hybrid of quantitative and qualitative methods. It means it combines financial (hard) and non-financial (soft) metrics. The quantitative approach was based on statistical available data, numbers of occurrences of events. The qualitative research was based on a constructivist interpretivist research approach within a phenomenological research paradigm. This qualitative research approach was considered most appropriate as the researchers wanted to get close to the subject matter under investigation within what they consider to be a socially constructed world. Table 1 is a summary of questions asked during early face to face meetings with research participants. This operational group was made up of ten technical subject matter experts from Red Hat. All answers were recorded in writing, with the full approval/consent of participants. Respondents were members of two groups; (a) Container team and (b) Container owners. Participants were mostly male and female in minor, age range between 25 and 43 years, with an average employment history with the company of 3 to 7 years within the area of software development/IT. Majority of participants have master level education, then bachelor and secondary level education at least. They provided valuable insights for this research.

Table 1: Interview questions

What is your role and responsibilities in Red Hat? What are you currently working on? Which of these are priority tasks? – *input metric I01*
How much time do you currently spend on each of these activities? Measured by % of time (based on an 8-hour day/40-hour week Monday to Friday). How do you make time to manage unsolved tasks? – *input metric I02*
Are you satisfied with distribution of your working activities? On a scale of 1 (very dissatisfied) to 10 (very satisfied), how satisfied are you with the changes made? – *result metric R01*
What difference has the introduction of the automation tool made to how you work and your work area? – *result metric R02*
Imagine that the priority tasks could be completed in less time and you now have more time available to you: what would you do with this extra time? Which areas would you devote this time to? – *output metric O02 and result metric R02*

2.2 Data Collection and Interpretation

The researchers considered two methods to collect relevant research data: a literature review and face to face interviews, within the context of a phenomenological research paradigm and an associated constructivist interpretivist research approach. The outcome of each research method such as literature review and face to face interviews increased the contributions of relevant research data that was based on what is already known about the subject matter under investigation (literature review) and the contemporary views of the community of practice. The findings from each of the research methods such as literature review and face to face interviews were based on an evidential analysis and interpretation of all collected research data. This was enriched by the contemporary view contributions from the interviewees and allowed for a balanced view to be presented. All interviews were conducted in a consistent and methodical manner. The researchers probed further from time to time when interviewees were not forthcoming with sufficient supportive evidence. The result was a high level of data reliability and validity.

3. Czech Innovation Scorecard Project: Theory

The adopted Innovation Scorecard concept is a conceptual project management control framework specifically designed for working environments that thrive on innovation and/or change management, especially within the IT and Software Development industries in the Czech Republic. Its origin lies in the outcomes of a primary research project that was supported by the Czech Scientific Foundation during 2013-2015. This research' s primary objective was to ascertain whether organizations in the Czech Republic measure the efficiency of their innovations and what metrics they applied to measure these. Results confirmed that organizations who constantly managed innovation were engaged in identifying performance measurements to determine the level of value and benefits associated with innovation. When applied appropriately and in accordance with existing company strategy, marketing drives and HR/corporate policies, processes and procedures, innovation metrics provide managers and employees with opportunities to plan, organize, monitor and control all innovation activities for the benefit of the organization they work for.

The Innovation Scorecard was proposed as a solution to support these activities and to create the basis for improved business decision making. It aligns and integrates popular innovation management and management control approaches (Table 2).

Table 2: Innovation Scorecard theoretical background

Method	What (Author)
Balanced Scorecard	Balance between financial/non-financial metrics, short/long-term goals (Kaplan and Norton, 1996) Sequence 'Aim–Cause&effect–Metric–Target Value' (Horváth, 2011) Scorecard design (Niven, 2014) Number of metrics (Kaplan and Norton, 1996) Casual links – strategy maps (Cokins, 2009) Balanced Scorecard and Innovation (Gama et al., 2007; Garcia-Valderrama et al., 2008)
Innovation management	Innovation pipeline (e.g. Bessant and Tidd, 2011; Davila et al., 2013) Input–Process–Output–Outcome Model (Brown, 1996) Stage Gate Model (Cooper, 2008) Open innovation (Chesbrough, 2003)
Project management	Wingate (2015), APM Body of Knowledge (2019)
KPI design	Niven (2014), Parmenter (2015)
Performance measurement systems design	Bourne et al. (2003), Horvath (2011), Kaplan and Norton (1996)

The Czech business environment is idiosyncratic due to its prevailing cultural differences in term of modus operandi (Zizlavsky, 2016). The developed Innovation Scorecard, specifically designed for this unique working environment, is based on 'the needs led' considerations by Kaplan and Norton (1996), the 'audit led' procedures considered by Dixon et al. (1990) and the 'consultant or facilitator led' approach suggested by Niven (2014). It is based on a Balanced Scorecard approach where balance is considered to be the equilibrium between operative and strategic (short-term and long-term) goals, required inputs and outputs, internal and external performance factors and lagging/leading indicators. This includes the financial and non-financial performance indicators. Each measurement is an inherent part of a chain of 'cause-and-effect' links.

The theoretical background, structure (including processes) and methodology of the suggested Innovation Scorecard can be divided into a number of distinct stages including some management decision gates to aid control. The suggested Innovation Scorecard approach incorporates the core functions of leading innovative teams such as defining tasks, planning, controlling, evaluating/reviewing and

supporting. This effective and efficient approach to introduce the concept of Innovation Scorecard into organization is vital for moving innovations from the idea to launch phase in a systematic, managed and controlled way. The proposed Innovation Scorecard (Figure 1) suggests six distinct stages controlled by gates where Go/No Go decisions are made whether to proceed to the next gate: Gate 1 Concept/Idea; Gate 2 Feasibility and verification (including pilot studies/testing); Gate 3 Planning and implementation; Gate 4 Deployment (Roll-out or Going Live); Gate 5 Closed Down (Post Implementation Review including Lessons Learned/Knowledge Management).

Such a stage gate system is designed to work as a 'funnel' that begins with screening the ideas or projects in the early stages of the project when fewer resources are utilized and continues throughout the life of the project. An innovation project leader is in charge in each stage to ensure that the innovation project meets all the required criteria to pass the gate and moves forward to the next stage. Besides, the stage gate system can also improve the effectiveness, efficiency and productivity in the execution of key project tasks.

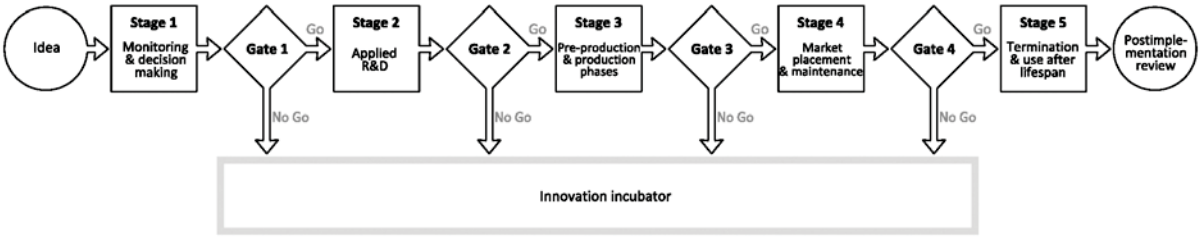

Figure 1: Innovation Scorecard framework (Zizlavsky, 2016)

The design of an Innovation Scorecard must happen in an orderly, structured and logical sequence. Only a strictly logical approach can ensure that all the characteristics and essentials of such an exceptional activity as innovation will be respected. In this way the effectiveness of the Innovation Scorecard is guaranteed.

The basic structure of the Innovation Scorecard implementation process involves the following phases and is presented in Figure 2. First step is to set the goals of any project and how to achieve these. The Innovation Scorecard cannot contain a large number of goals. That would go against the concept of targeting, maintaining clarity and concentrating on what is important. The quality of the goals is the main quality criterion for the Innovation Scorecard as a whole and has a significant influence on its successful launch and implementation. Then, relevant and appropriate critical success factors (CSFs) are developed for each goal set. These are high level goals that focus on what needs to be done (and not the how). At the level below CSFs, Key Performance Indicators (KPIs) are created and their task is to inform how the organization will deliver the CSFs (the how). An innovation strategy map can help any organization how to implement and apply the CSF/KPI strategy in practice. Effective communication forms a very important element of the Innovation Scorecard process. Those involved in developing and implementing the process need to communicate and be communicated regularly to keep everyone informed of progress. Metrics need to be developed and rolled out and managed. They form an essential part of any Innovation Scorecard process. A proper target value to each metric has to be set. It should be demanding and ambitious, but at the same time credible and achievable. By setting target values the responsibility of the relevant person for the goal is achieved and their adoption by the Innovation Scorecard and the goal negotiation system is made possible. Goals should be SMART (specific, measurable, attainable, relevant and time-based). Goals need to be considered and prepared at the start of any project and their details are often presented and agreed during a project definition workshop that is usually run at the end of the feasibility phase of a project. Goals must have target performance values and these values must be realistic to achieve.

In content these six phases collectively form an integrated whole. This gives rise to a sample

approach, conceived in the form of concrete instructions for the process of implementing the Innovation Scorecard.

Figure 2: Innovation Scorecard design process (Zizlavsky, 2016)

4. Czech Innovation Scorecard Project: Practice

From a managerial viewpoint, the Innovation Scorecard may provide useful guidelines for focusing attention and expending resources during the entire innovation process. It is argued that the informed use of evaluation metrics as guideposts for increased managerial attention and the identification of problems may help management to prevent drop-and-go-errors in their innovation efforts.

Hence, the next logical step Innovation Scorecard initiative was to implement the concept of Innovation Scorecard in a particular organization in order to verify its suitability and functionality. A project for the practical roll-out of an Innovation Scorecard system within an existing organization in the Czech Republic was submitted and supported by the Technology Agency of the Czech Republic. The duration of the project is 3 years during which best practices in the IT industry will be identified and several associated case studies will be developed accordingly.

Red Hat Czech s.r.o. has been chosen as a partner of the Innovation Scorecard roll-out project. It is a R&D subsidiary of Red Hat, settled in the Czech Republic. Red Hat Czech s.r.o. was formed in 2006 and has around 1,200 employees. It is intended to be Red Hat' s major and largest development center in the world. Here the Innovation Scorecard initial roll-out will be applied and tested.

The implementation of the Innovation Scorecard will contribute to improving the efficiency, modus operandi, economies of scale (operational level) and the ultimate competitiveness of Red Hat in a number of ways:

a) Improved informed decision making by empowering staff more (staff becoming more independent)

b) A significant reduction in software development rework time due to agile and innovative process improvements (having a positive effect on the company' s Return on Investment (ROI)

c) Time savings can be used to deploy the same staff on other tasks thus improving operational efficiency by being able to deliver more in less time to the same or higher quality parameters (higher productivity)

d) An increase in dynamic response approaches in relation to business changes due to attitudinal changes in staff driven by innovative idea generation and process improvements (staff viewing changes as something positive)

In summary, the researchers consider that the following benefit realizations can be achieved through the roll-out and implementation of an Innovation Scorecard concept within Red Hat:

e) Higher profitability through the overall value of innovation from a market and product perspective

f) Maximize Return on Investment (ROI)

g) Higher staff productivity levels through business change including improved organizational alignment and modus operandi

h) Improved streamlining of software development processes through the roll-out of an Innovation Scorecard System across a number of associated projects

i) Improved timely internal and external communications

4.1 Czech Innovation Scorecard Adjustment for Software Development

Agile management is used extensively within the IT industry, especially in software development in Red Hat. It is an umbrella term for a set of frameworks and practices based on the values and principles expressed in the Manifesto for Agile Software Development and the twelve principles behind it (www.agilealliance.org). When software development is approached in a particular manner, it is generally advisable to follow these values and principles and to use them to work out the right things to do in particular contexts. One thing that separates Agile from other approaches to software development is the focus on how people work and how they co-operate with each other. Solutions evolve through collaboration between self-organizing cross-functional teams using appropriate practices for their context.

A system that is fast and flexible at the same time and a system that can respond to changes swiftly adds value to users of an Agile approach. Focusing on results rather than adhering to a rigid and strict process is of paramount importance to the successful delivery of so-called Agile projects or work.

4.2 Czech Innovation Scorecard in a Scrum Environment

Scrum is one of many agile approaches to software development. It is based on a paper written by Takeuchi and Nonaka (1986) where they introduced new possibilities for project team management on examples from the automotive industry. In this paper, the authors used the sport of rugby as a metaphor to describe the benefits of self-organizing teams in innovative product development and delivery. Schwaber and Beedle (2001) took the ideas from this paper, including the metaphor, and applied it to their field of software development. They called their new method Scrum, after the rugby term that describes how teams form a circle and go for the ball to get it back into play again.

Scrum provides a lightweight process framework that embraces iterative and incremental product delivery and uses frequent feedback and collaborative decision making. The series of iterations are known as 'Sprints' (typically lasting from one to four weeks and are driven by goals set at the beginning of each sprint). At the end of each sprint the team presents the work they have completed to the stakeholders and gathers feedback that will affect what they work on in the next sprint. They also hold a retrospective to learn how to improve. This meeting is critical, as its focus is on the three pillars of Scrum: transparency, inspection, and adaptation. A potentially shippable product is produced by the team at the end (Sliger, 2011).

Typical Scrum activities are Sprint Planning Meeting, Daily Scrum or daily Stand-up, Sprint Review, and Sprint Retrospective. In terms of Scrum team roles, a typical Scrum team needs three specific roles: product owner, Scrum master and the development team. Scrum teams are cross-functional and this is the reason why the development team includes testers, designers, so-called UX specialists and operational engineers in addition to developers (Sliger, 2011). For Innovation Scorecard application it is required to add management control role to the team or to involve controller (person who is responsible for delivering correct data in the required range and within the deadline to manager for further decision making).

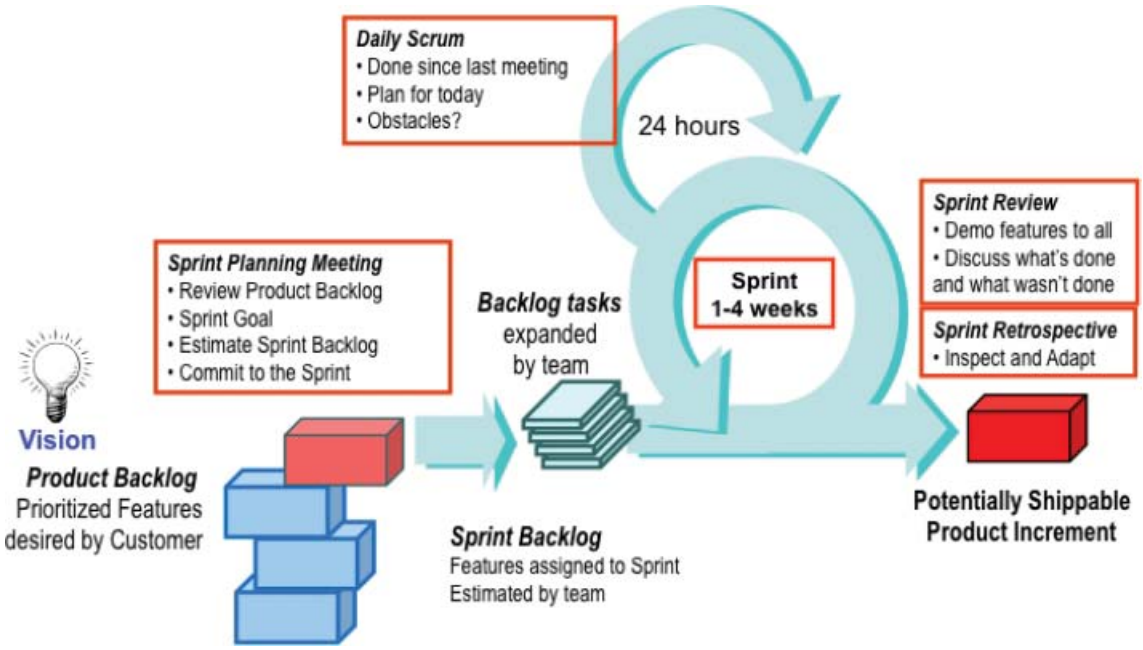

Figure 3: The original Scrum framework (Sliger, 2011)

The biggest advantage of Agile/Scrum access is flexibility and ability to react fast to changes. This approach is dynamic and provides quick access to solutions within software development environments. The Innovation Scorecard works on same logical steps process of implementation within organizations. Therefore, the combination of concepts of the Innovation Scorecard and Agile Methodology is vital. Thus, a pilot case study of Innovation Scorecard implementation in Agile software development has been developed in Red Hat Czech s.r.o. Namely Innovation Scorecard is implemented in process innovation within one Red Hat project known as 'Red Hat Enterprise Linux (RHEL) Atomic Host'.

4.3 Agile Innovation Scorecard Case Study-First Project: Atomic Host

RHEL Atomic Host is a secure, lightweight, and minimal-footprint operating system optimized to run Linux containers. By choosing Red Hat Enterprise Linux Atomic Host, customers can take advantage of the fast pace of innovation from open source community projects like the Docker project and Project Atomic while maintaining a stable platform for production deployment. Customers can concentrate on customizing and developing containerized applications while Red Hat maintains the underlying Linux platform on which these depend (www.redhat.com). RHEL Atomic Host process runs as follows (see Figure 4).

Each updating batch was planned, developed, tested and released over a period of 6 weeks. Work started with a planning phase. It was based on the outputs from Sprint Planning Meeting(s), which the Product Owner, Product Manager and team members attended. Then the development phase followed. It consisted of two sprints. It included a third optional sprint if this was needed (this decision was made during the planning phase). In the development phase, everything was based on the plan (backlog(s)) coming from preceding planning phase. At the end of the development phase, there was a development freeze. It meant that the development was closed for any further work to be undertaken. Developers confirmed and provided relevant information that all packages were ready and available to proceed to the testing stage which consisted of two steps. First, Early Build and Testing was performed. The building process purpose was to put together all bits and associated packages. Early testing followed which was deployed to identify any issues/problems as early as possible and then take corrective action. When early testing was completed successfully, Final Build and Testing (also referred to as launch) followed. The process of this launch was the same as Early Build and Testing. If passed successfully then an Atomic Host was created and released.

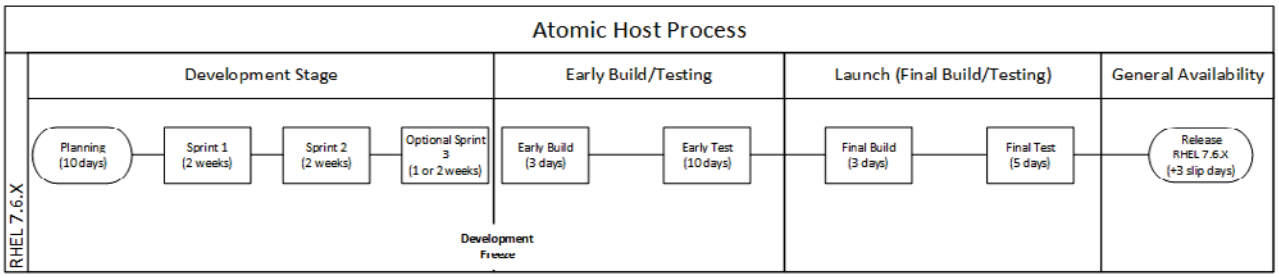

Figure 4: RHEL Atomic Host process

Our pilot case study focused on 'containers rebuild' in support of the required process innovation automation tool, to provide support in terms of information, to provide metrics and to show impact/ improvements of the automation system. The Innovation Scorecard methodology described in section 2 had to be modified for Agile software development working environment in following way. First, authors consider that the application of a 'gate process' to manage this each small project is not justified as it does not add any value to the overall process. The measurement was performed after each evolution cycle (2-week lasting sprint) and for some metrics 'before and after' innovation project. Second, inputs lead to outputs. Processes are used to get from input to output. Therefore, the goal/purpose was to improve the management of inputs and outputs through innovative approaches to improve areas such as job satisfaction, staff motivation and morale, customer perception and associated outcomes such as improving productivity, reduce business overheads and generate new/repeat business for Red Hat. Third, it was not the number of metrics we used, what really mattered was the quality of these metrics and their overall contribution to the success of introducing an innovation scorecard design. Then, metrics presented in Table 3 were applied in the container rebuild process innovation. Red Hat imposed a restriction on the iScorecard Team how much project data can be published due to commercial implications. This is why the data shared in this paper is limited.

Table 3: Innovation Scorecard metrics

	Metric number/name	Target value
Inputs	I01 - Working activities structure	Reduce manual repetitive work
	I02 - Blocked time	Minimize
Process	P01 - Number/weight of errors during implementation	Minimize
Outputs	O01 - Number of requests for automation tool changes	Max. 1 radical/10 incremental
	O02 - Number of due (priority) activities	Minimize
Results	R01 - Job Satisfaction	Increase
	R02 - Saved resources	Maximum of Time

5. Summary and Initial Conclusions

The Innovation Scorecard theoretical background and application in a software development project in the Czech Republic have been presented in this paper. Its original concept was introduced and further developed within an original primary research project conducted in the Czech Republic during the period 2013-2015. This conceptual performance measurement and management control framework was specifically designed for innovation work activities. In its current form, the scorecard system has a user-friendly interface and supports go/no-go decision making within innovation projects. It provides guidelines how to focus attention on what is important to be done and how to measure in-and outputs. Resource optimization forms an essential part of an innovation scorecard. It appears that the informed use of evaluation metrics as guideposts for increased managerial attention. The identification of problems may assist management in their efforts to prevent 'drop-and- go-errors' during innovation activities.

The Innovation Scorecard is implemented and rolled-out in an IT organization Red Hat Czech s.r.o within 3-years lasting project granted by Technology Agency of the Czech Republic. For this purpose, it has been necessary to research the theory of what was already known about the subject matter under investigation and to modify the Innovation Scorecard system and approach to make it fit for the intended purpose and use within an Agile Software Development work environment. This includes modifications relating to the existing Agile Methodology in operation within Red Hat in addition to further adjustments as far as the innovation approach is concerned. This approach ensures that the concept of an Innovation Scorecard is aligned with the day to day operations of Red Hat' s Agile Methodology. It is thus possible to implement the proposal for the introduction of an Innovation Scorecard system into the live working environment of Red Hat without disrupting the 'business as usual' work activities.

Authors have presently developed two sub-projects of Innovation Scorecard implementation. The first project is known as RHEL Atomic Host and serves as a pilot implementation project. The initial results from the project roll-out are outlined and described in this paper. Continuous Integration is the next project that forms part of our Innovation Scorecard roll-out and has just started. Here, authors are developing a hybrid model of original Innovation Scorecard and Agile Scrum methods.

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