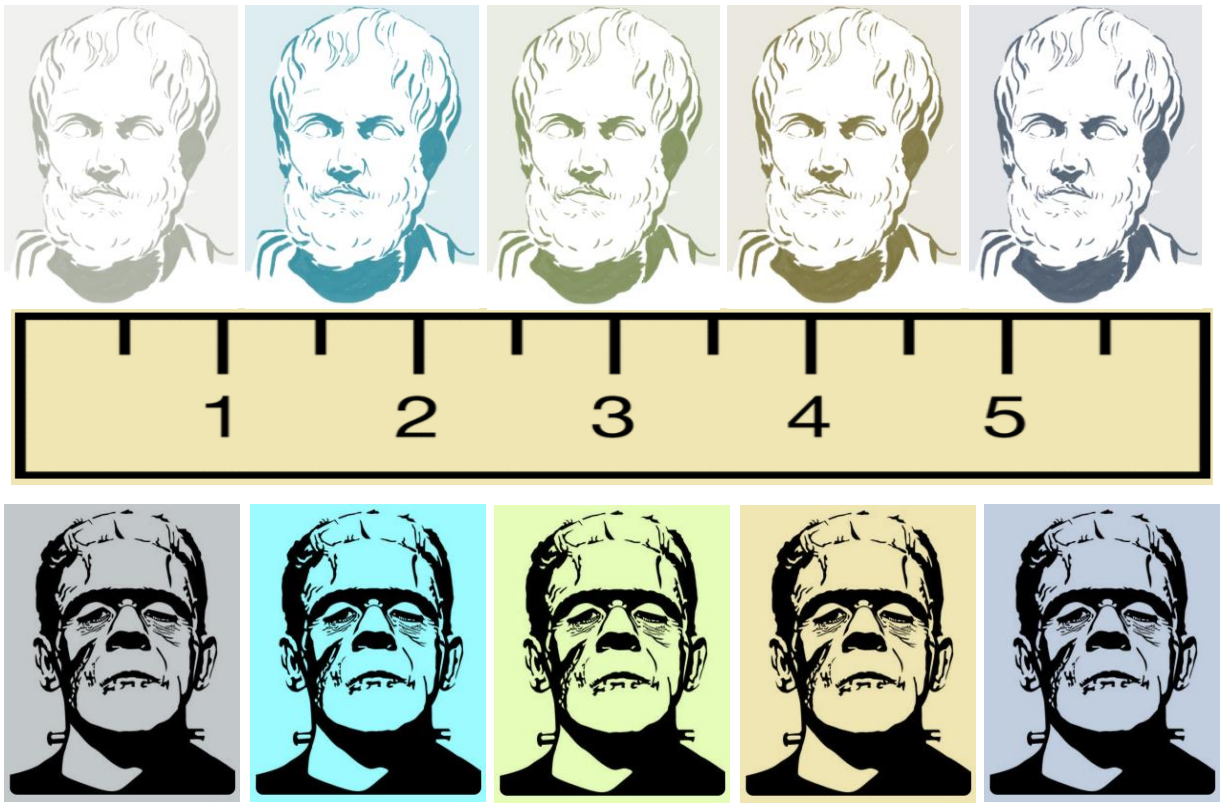

Toward a Scale to Measure a Level of Individual Behavior in Regards to Responsible Innovation Concept in a Business Context

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Toward a Scale to Measure a Level of Individual Behavior in Regards to Responsible Innovation Concept in a Business Context

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PREFACE

It was in the middle of December 2014 when I received an email from TU Delft showing a letter of acceptance of my admission process. Time flies and brings me today, the very day when I have to end up writing this thesis report before I can officially graduate from TU Delft. Lots of things have encouraged me to finally reach this point. I would like to use this opportunity to thank many great people behind this journey.

First and foremost, I would like to thank to the Indonesian Endowment Fund for Education (LPDP) for providing me a full financial support during my study in TU Delft. Without this support, it would be almost impossible for me to accomplish my study in TU Delft

I would also like to express my gratitude to the graduation committee in this thesis project. Special thanks go to Dr. Robert Verburg. For me, you are more than a chair of this committee. You are the one who have given me a chance to be involved in this research, and you are also the one who had provided valuable motivation and care in many occasions, no matter what happened. My gratitude also goes to Dr. Laurens Rook for providing me a full support and valuable feedback. Be it academic topic or personal stuff, I have enjoyed every single discussion with you. Having a meeting in your room would definitely be missed. I would also like to thank Dr. Udo Pesch for giving me an understanding to see the innovation concept from different perspective. It was really a good experience to work with a responsible innovation scholar like you. All in all, I have been really satisfied with this great opportunity to work together with you. It has been great interacting and working each one of you. I do wish you and TU Delft every success in all future endeavors

I also want to send a word of thanks to my family in Jakarta. Miles away from Delft, Bayahs, Bumas, Bades have given an endless support to motivate me to elevate higher.

Last, let me also send a final word of thanks to all my friends, especially my fellow students in MoT 2015 class and in the Indonesian Student Association in Delft. I have enjoyed my study period here and I do appreciate having had such pleasant experience with you.

Delft, 28 August 2017

Hakim Agung Ramadhan

EXECUTIVE SUMMARY

In doing their jobs, innovators are writing history. Time has witnessed that various innovations bring a groundbreaking advance for human development (Geels, 2002, 2005; Jensen, 1993; Van den Ende & Kemp, 1999). However, despite a lot of contribution that innovators have given in the human history, one should note that innovation is not invulnerable to a harmful effect. This is evident in the case of nuclear power plant (Blowers, 2011; Van de Poel, 2011), information and communication technology (ICT) (W. S. Brown, 2000; Jenkins & McCauley, 2006; Berndt C. Stahl, Eden, & Jirotka, 2013; Bernd Carsten Stahl, Eden, Jirotka, & Coeckelbergh, 2014; Tavani, 2008; Van den Hoven, 1997, 2007), energy technology (Cuppen, Brunsting, Pesch, & Feenstra, 2015; Dignum, Correljé, Cuppen, Pesch, & Taebi, 2016). The evidence also presents in new emerging science and technology area (e.g., synthetic biology) in which "the boundaries between 'research' and 'development', between 'science' and 'technology' have blurred" (Steven M. Flipse, van der Sanden, & Osseweijer, 2013, p. 706).

Cases above show that innovations have largely overlooked its consequences to the complex sociotechnical dynamics (Moor, 1985; Van den Hoven, 1997). Building on this view, seeing innovation as a passive tool to serve our necessities is not only irrelevant but also "illusory" (Guston et al., 2014, p. 1). Thus, Doorn and van de Poel (2012) have explained that innovation influences the context of human responsibility. The interrelatedness between innovation and society needs an articulation of ethical perspective in the innovation process (Van den Hoven, 2014). According to Von Schomberg (2014, p. 32), innovators and society need "an innovation-governance far beyond the means of solely market-driven innovations". After decades of waiting, finally, this necessity comes into reality. The notions of "responsible innovation", "responsible research and innovation" and "responsible development" have started becoming an important discussion in the beginning of 2000s (Guston et al., 2014, p. 2).

Unwelcome Problems (and the Ultimate Challenges?)

As a concept, responsible innovation allows innovators to take into account ethical perspective while they are doing their tasks. However, the current responsible innovation conception suffers from one common issue: lack of clarity to implement the concept (Bos, Walhout, Peine, & van Lente, 2014; M. de Jong, Kupper, Roelofsen, & Broerse, 2015; Owen et al., 2013). This issue especially takes place in the business context (Foley, Bernstein, & Wiek, 2016; Lubberink, Blok, van Ophem, & Omta, 2017; Pavie, Scholten, & Carthy, 2014; Scholten & Blok, 2015). In this case, innovators find a difficulty to implement the responsible innovation concept in their daily activities. In fact, scholars argue that they are the forefront actors that could determine the consequences of innovation for the well-being of people, be it the positive or negative consequence (Roeser, 2012). Innovators have different behaviors that could affect the way they implement the concept of responsibility in the innovative tasks that they perform.

Building on this foundation, this study argue that what is vital now is a readily assessed scale that can measure individual behavior in regards to responsible innovation concept in the business context. Therefore, this study has two objectives: (1) to review the responsible innovation literatures and (2) to develop and validating a scale that can measure the level of individual behaviors in regards to responsible innovation concept in the business context. These dual objectives is achieved by answering the central research question as follows.

> *Main RQ: What is the validated scale that can be used to measure a level of individual behavior in regards to responsible innovation concept in a business context?*

Theoretical Framework and Scale Development

Responsible innovation emphasizes an involvement of society ethical perspective in the innovation process (Owen et al., 2013; Stilgoe, Owen, & Macnaghten, 2013; Van den Hoven, 2014; von Schomberg, 2011b). Scholars have made an attempt to conceptualize and accordingly offer several dimensions: anticipation, reflexivity, inclusiveness, deliberative, and responsiveness. Recently, Lubberink et al. (2017) link these responsible innovation dimensions into the application in the business context.

Nevertheless, the present study argues that, in order to build and validate a readily assessed measure, a clearer insight is needed. Therefore, the discussion in current responsible innovation literatures is, indeed, needed, but not sufficient to address the aforementioned problem. In order to develop an individual behavior measure, this study then propose an alternative approach by taking into account the study about individual behavior.

According to this view, the present study develops a measurement tool that can satisfy individual behavior characteristics in regards to the concept of responsible innovation. It implies that, in the business or organization setting, the concept of responsible innovation is reflected in the belief, attitudes, or intentions of organization's individual members. Combining the insight from responsible innovation literatures and individual behavior literatures, this study propose that responsible innovation behavior consists of four factors: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization. Building on this foundation, this study develops the initial responsible innovation scale with 12 items (questions) as follows.

- Responsible Idea Generation (Originality)
  - I am good at coming up with ideas that are novel, but in the right way
  - I find it easy to generate original solutions that reflect how the problem at hand ought to be solved
  - The ethical side of an idea does not interest me as much as the originality of that idea
- Responsible Fluency
  - I have a knack for coming up with many ethical solutions to a problem
  - Producing large numbers of solutions for a better future comes natural to me
  - I am good at generating many ideas that capture the responsible side of innovation
- Responsible Flexibility
  - I find it easy to explore a wide range of politically correct alternatives in idea generation
  - It is important to me to explore the various ethical aspects of my ideas
- Responsible Idea Realization
  - Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me
  - I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements
  - I have no interest in evaluating the moral aspects of my new ideas
  - I like to contribute to the implementation of new ideas when these are appropriate to solving a meaningful problem

Note.
In order to measure the items, this scale applies a 7-item Likert scale:

Research Finding

In order to test this scale, a survey to 244 students from Erasmus University Rotterdam is administered. The data from this survey is then analyzed using exploratory factor analysis in a large number of random half samples (Field, 2009; Hair, Black, Babin, Anderson, & Tatham, 2014; Peter, 1979). This study applies coefficient comparability to ensure the stability of the factor structure (John E. Everett, 1983; James E. Everett & Entrekin, 1980; Nunnally, 1978). The finding shows that the four hypothesized responsible innovation factors still hold. However, several items need to be eliminated because they do not contribute to the stable factor structure. In this case, the final responsible innovation scale consists of 8 questions as follows.

- Responsible Idea Generation (Originality)
  - I am good at coming up with ideas that are novel, but in the right way
  - I find it easy to generate original solutions that reflect how the problem at hand ought to be solved
- Responsible Fluency
  - Producing large numbers of solutions for a better future comes natural to me
  - I am good at generating many ideas that capture the responsible side of innovation
- Responsible Flexibility
  - I have a knack for coming up with many ethical solutions to a problem
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In order to measure the items, this scale applies a 7-item Likert scale:

The present study applies various statistical methods to assess the validity of this finalized responsible innovation scale. First, the final responsible innovation scale is tested using multiple combinations of factor extraction and factor rotation method in the full sample mode. The result indicates that the items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample.

Next, the present study finds that the final responsible innovation scale has an acceptable reliability in both half sample (Cronbach's Alpha = .841) and full sample mode (average Cronbach's Alpha = .837). In addition, using confirmatory factor analysis, correlation analysis, and multi regression analysis, the present study also observes that the final responsible innovation scale has satisfied convergent validity, discriminant validity, and nomological validity. In regards to the latter, this study identifies that the responsible innovation behavior has a positive correlation with basic individual personalities: openness, agreeableness, and extraversion; and has negative correlation with neuroticism (McCrae, 1987; McCrae & Costa Jr, 1999). This study notices no relationship between responsible innovation behavior and conscientiousness. This study also identifies positive association between responsible innovation behavior and other relevant behaviors that relate to ethical climate (Cullen, Victor, & Bronson, 1993; Victor & Cullen, 1988), sustainable development goals (Voegtlin & Scherer, 2017), creative self-efficacy (Bandura, 1997; Tierney & Farmer, 2002), and innovative working (Janssen, 2000; S. G. Scott & Bruce, 1994). However, the present

study shows no correlation between responsible innovation behavior and the Fraedrich's (1993) ethical behavior concept as these two behaviors see ethical perspective from different angels.

Contribution, Limitations, and Future Research Suggestions

In the research leading to responsible innovation domain, this study has gone a long way toward doing what responsible innovation scholars, like Bessant (2013), M. de Jong et al. (2015), Doorn and van de Poel (2012), Fisher (2016), Foley et al. (2016), J. Hankins (2015b), S. Kaplan (2000), (B. G. F. Tabachnick, L.S., 2007), Pesch (2015), Ribeiro, Smith, and Millar (2016), Roeser (2012), and Van den Hoven (2014), set out to do: develop a scale that can help innovators to operationalize responsible innovation concept in the business domain.

In the academic domain, the present study does not only extend the discussion in the responsible innovation literatures, but also has provided a solid emerging evidence to personality and social psychology literatures, managerial literatures, and business ethics literatures in such a way that has opened the possibility to a broader understanding of society ethical perspective in the innovation process.

Likewise, this study has also made two important practical contributions. At the most basic, the present study offers a readily assessed scale that is useful for the line managers and human resource department to, for example, assess the job seekers during the job application processes. In addition, the present study has provided a checklist for a company and industry to reduce the level of uncertainty in which the innovation deviates from society ethical perspective. In this fashion, the present study has given a contribution to society by minimalizing the adverse impact of innovation.

However, this study is bounded to several limitations: insufficient factor components, lack of expert interview, the debate about factor extraction method, and possibility of response bias. In addition, several questions remain unanswered at present. In future investigations, it might be possible to replicate this study in different innovation context (i.e., radical vs. incremental innovation) and different department settings (i.e., explorative, like RnD department vs. exploitative, like sales department).

ABSTRACT

In a traditional view, innovation is seen as a silver bullet to bring well-being to society. However, various reports seem to prove that this assumption is no longer valid. Almost always, the adverse impacts of innovation endorse that innovation is no longer a sole province of innovators. In many areas, innovations interact with stakeholders from multiple backgrounds. In order to allow a 'better society with a better innovation', scholars then raise a concern to take into account an ethical perspective in the innovation processes. Several frameworks have been offered to fulfil such demands. However, it seems that these prior concepts find little fit with the current challenges that society faces. This then drives the emergence of a new innovation approach, namely responsible innovation.

However, current conceptions of responsible innovation suffer from a failure to take a quantitative assessment into account. Regrettably, this failure becomes a shortcoming of current rationale in the responsible innovation arena. Of particular concern is the absence of a scale to measure a level of individual behavior in regards to the responsible innovation concept, namely a responsible innovation scale. At this moment, this scale is arguably a necessity in the business context because it allows the innovators to measure how responsible they are while undertaking their jobs.

In order to develop such a scale, a survey was firstly administered to 244 respondents. Subsequently, the response was examined using Exploratory Factor Analysis (EFA). Stability of factor structure that was derived from EFA was then assessed using coefficient comparability in a large amount of random half sample. The most stable factor structure was subsequently validated using multiple statistical analytic methods. The finding showed that such measurement tool can be operationalized using eight questions. Finally, study limitations and fruitful future studies were offered to improve the scale in certain contexts.

Keyword: responsibility, innovation, responsible innovation, responsible innovation scale, business, individual behavior, factor analysis

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CHAPTER 1
INTRODUCTION

"Invention, it must be humbly admitted, does not consist in creating out of void, but out of chaos; the materials must, in the first place, be afforded: it can give form to dark, shapeless substances, but cannot bring into being the substance itself. […] Invention consists in the capacity of seizing on the capabilities of a subject, and in the power of moulding and fashioning ideas suggested to it." - Mary Shelley

Next year will be the 200th anniversary of Frankenstein completion. Mary Shelley, the author of Frankenstein, describes Victor Frankenstein as a Modern Prometheus who has the ability to create "innovation" in an unorthodox approach. This novel has become popular literature publication that symbolizes an expression of science and ethics. As I would argue in the rest of this report, this celebration should not only jog the memory about the reputation of this novel. Rather, it should also remind us on how Mary Shelley had already keenly created an awareness about the ultimate allegory of scientific hubris.

Be it in the pre or post-modern era of science, innovation is associated with story about a great and influential event in the human history (Von Schomberg, 2013). However, not all innovations have been smooth sailing in the society. Many cases in current era show that innovations have also stark controversies. These controversy stem from innovations that present an impact at the levels beyond society's ethical acceptance. Just to name a few, this impact is exemplified in nuclear technology (Blowers, 2011; Van de Poel, 2011), shale gas (Dignum et al., 2016), carbon capture storage (CCS) (Cuppen et al., 2015), and even in information and communication technology (ICT) (Tavani, 2008; Van den Hoven, 1997, 2007) and personal digital device (Savov, 2017; Zachary, 2017).

More often than not, the controversy around innovation has brought a heated public debate running for years, such as risks, autonomy, and privacy. This finding suggests that innovation can have both positive and negative implications toward the society. Therefore, innovators have a responsibility in regards with the impacts of the products and processes they introduce to the society. The interrelatedness between innovation and society then raises awareness that innovation should not be seen as a bare physical structure that is value neutral. Quite the opposite, innovation could have a moral agency and is value laden (Correljé, Cuppen, Dignum, Pesch, & Taebi, 2015; Friedman & Kahn Jr, 2003; Van de Poel & Verbeek, 2006). Consequently, technological advancement per se should no longer prevail the dominant discussion of innovation.

Building on this perspective, scholars start to think that there should be something more to do to improve the interaction between innovators, their innovations, and society. In this fashion, society ethical perspective should be used to drive the direction of innovation. As explained by Van den Hoven (2014, p. 5), "If ethics could make contributions to the improvement of society and human wellbeing anywhere, then technology, engineering and applied science would be a promising place to start". This approach requires the innovators to bear in mind the ethical perspective in their tasks as early as possible (Schuurbiers, Doorn, van de Poel,

& Gorman, 2013). Prompt ethical consideration would not only lead the innovators to acquire business benefit, but also hinder them from problematic consequences that might appear (Collingridge, 1982).

The inherent ethical and value-ladenness aspect of innovation also indicates that it would be a grave mistake to take innovation for granted. The fact that there is a systematic technology-society interaction suggests that individual innovators should incorporate responsibility in their works (Doorn & van de Poel, 2012; Pesch, 2015). A universal accepted explanation for this rationale is that who else is better equipped with the effect of innovation than the innovators themselves (J. Hankins, 2015a). In other words, innovators are standing at a foundation of innovation. For that reason, they can bring both the benefits and risks more directly than anybody else (Roeser, 2012). It is in the hand of innovators where the innovation is created. Thus, the way they undertake their jobs determines the consequences for the well-being of people, either for better or for worse.

The responsibility of innovators is especially relevant in emerging technology, such as nanotechnology (Grunwald, 2005), artificial intelligence (AI) (Bostrom & Yudkowsky, 2014), and genetically modified organism (GMO) (Wynne, 2001). It is widely believed that the promised benefits of these technologies are controversial and, therefore, peril cannot be predicted. As a consequence, scholars start to ponder upon the attempt to incorporate a value to an innovation so that it can be more responsible. According to Owen et al. (2013), responsibility has evolved over time because the norms in society has also changed. Thus, they pointed out that "responsibility in the context of science and innovation now needs to change again, reflecting the modern context in which innovation occurs" (Owen et al., 2013, p. 30). For this purpose, a new framework that would guide the innovators to make better innovations for a better society arises: responsible innovation (Hellström, 2003; Stilgoe et al., 2013; Von Schomberg, 2013).

These explanations above, by a large extent, seem to prove that innovation could weirdly foreshadow the future and become another Frankenstein Monster that is disgraceful. However, it is important to note that the proponent of responsible innovation is not a Luddite to an innovation. Rather, responsible innovation provides a new concept to the innovators regarding to their responsibility towards the society. Like Frankenstein, innovators do not have an unlimited power to drive the future of society. It is unlikely that innovators' arrogant thinking would make a value conflict by chance. By this bicentennial anniversary, Mary Shelley of Frankenstein tries to provide an opportunity for the innovators to reflect their very nature, roles, and responsibilities towards society.

1. THE PROBLEM IN RESPONSIBLE INNOVATION CONCEPT

Although still a relatively new concept, the compelling concept of responsible innovation has started attracting scholars' attention and becomes an important discussion since the beginning of the 2000s (Guston, 2014; Guston et al., 2014; Hellström, 2003; Lubberink et al., 2017). Unlike its earlier approaches (see for example, the work of Van de Poel (2013), Van den Hoven (2007), Schot and Rip (1997)), responsible innovation is seen as a promising concept of 'innovation for society, with society' (M. de Jong et al., 2015; Owen, Macnaghten, & Stilgoe, 2012; Owen et al., 2013). Subsequently, there is an increasing effort to conceptualize responsible innovation, be it from policy makers or academic scholars (Burget, Bardone, & Pedaste, 2016).

Notwithstanding to the fact that responsible innovation is gaining interest from multiple disciplines and, indeed, there seems to be a need for it, several scholars have pointed out that responsible innovation concept is still at an embryonic stage. As a consequence, Sutcliffe and Director (2011, p. 3) have stated that the "definitions are evolving" and, according to Lubberink et al. (2017, p. 1), it needs more than an "empirical exploration and description". This fact implies that there are some problems in the current responsible

innovation concept. In general, such problems can be classified into two categories: theoretical and practical (Table 1).

Table 1. Scholars' argument about theoretical and practical problem in responsible innovation

Responsible Innovation Problems		Scholars' Arguments
Theoretical	Practical	
Lack of conceptual definition and clarity	Lack of practical definition and clarity	Responsible innovation is "lacks definition and clarity, both in concept and practice" (Owen et al., 2013, p. 27).
Lack of clarity in terms of definition and motivation	Lack of definition and clarity in practice and at policy level	Responsible innovation is "lack of clarity in terms of definition, practice and, at a policy level, motivation" (Owen et al., 2012, p. 752).
Un"stabilized" term in policy domain	Un"stabilized" term in empirical phenomenon	Although there is a growing concern about the responsible innovation, "the term has not yet been "stabilized" in the policy domain as an empirical phenomenon" (de Jong et al., 2015, p. 58)
Definitions are not much elaborated	Lack of empirical basis	"The results of the study indicated that while administrative definitions were widely quoted in the reviewed literature, they were not substantially further elaborated. Academic definitions were mostly derived from the institutional definitions; however, more empirical studies should be conducted in order to give a broader empirical basis to the development of the concept" (Burget, M., Bardone, E., & Pedaste, M., 2017, p. 1)
Theoretically under-investigated	The concept lacks of normative dimension	"Although this approach shifts the focus from an explicit ethical enquiry towards the idea of responsibility, the concept has remained surprisingly under-investigated in RRI literature from a theoretical point of view." (Pelle, S., & Reber, B., 2015, p. 108)
		"And yet, the concept has remained surprisingly under-theoretically developed by RI advocates, who appear to be more interested in investigating the 'ingredients' or 'pillars' of responsibility than the normative dimension of it." (Pelle, S., & Reber, B., 2015, p. 107)
Theoretically opaque	Practically opaque	"Our analysis focuses on three key dimensions of RRI (motivations, theoretical conceptualisations and translations into practice) that remain particularly opaque" (Ribeiro, B. E., Smith, R. D., & Millar, K., 2017, p. 81)

1.1.1 Theoretical Problem

As a concept, responsible innovation allows innovators to take into account ethical perspectives while they are doing their tasks. However, current conception suffers from several theoretical problems. Many scholars have challenged the current concept on the grounds that responsible innovation lacks of common conception about the definition. For example, Bos et al. (2014) have taken a contention that responsible innovation leads to a multi-interpretation issue. Rip (2016) observes a support for this argument in Expert Advisory Group (EAG) of Responsible Research and Innovation in the European Commission. The multi-interpretation issue has also been expressed by Koops (2015). According to him, "it is by no means clear what exactly the term refers to, nor how Responsible Innovation, once we know what is meant by this, can or should be approached" (Koops, 2015, p. 2). De Jong et al., (2015) even have highlighted that the most

cited definition of responsible innovation from Von Schomberg (2011a) is a merely "working definition". Furthermore, a recent study from Lubberink et al. (2017) have explained that current responsible innovation literatures have not set a clarity between research, development, and commercialization domain.

Spurred by these critics, Blok and Lemmens (2015) have attempted to draw an intensive argument which discusses the theoretical limitation in responsible innovation. They have pointed out that "the concept of responsible innovation is highly problematic and that a more thorough inquiry of the concept is required" (Blok & Lemmens, 2015, p. 19). They provide three arguments why the current concept of responsible innovation is naïve and questionable. First, an input of responsible innovation processes comes from the grand challenge issues, such as global warming and sustainable development. According to them, these issues can be categorized as a wicked problem in which the problem and the respective solution are hardly defined. As a consequence, there could be a power imbalance among stakeholders that potentially brings the "responsiveness towards stakeholders is highly questionable" (Blok & Lemmens, 2015, p. 23). Second, they point out that responsible innovation is dubious from a throughput aspect. In regards to this aspect, they state that, in the real world, transparency and mutual understanding among stakeholders are practically limited by information asymmetries. Third, responsible innovation lacks in an output aspect. Considering the input aspect as a wicked problem, Blok and Lemmens (2015) stress that there seems to be a limitation in the human ability to predict the unintended consequences of innovation.

1.1.2 Practical Problem

Scholars have pointed out that current conception of responsible innovation bring a difficulty for the innovators to implement such concept. This issue especially emerges in the business context. This section explains that this issue can be categorized into two groups: common issue and emerging issue.

Common Issue: Unfamiliarity and Difficulty to Implement Responsible Innovation Concept

Irrespective of the fact that responsible innovation could be a suitable concept in the innovation process and indeed there is a growing dissemination of this concept, scholars argue that the multi-interpretation meaning of responsible innovation has brought the little use of the concept (Pavie & Egal, 2014). Related to this, I find that the lack of clarity in the responsible innovation concept brings about two consequences.

The first consequence is a lack of familiarity and awareness of responsible innovation concept for actors outside responsible innovation academia. M. de Jong et al. (2015, p. 69) have found that most of the scientists working in R&D laboratory and technological innovation "had trouble elaborating on what RI means to them as a concept". A similar finding is also found by Davies and Horst (2015). Examining the phenomena in governmental bodies, they observe that "it easier to identify discussion of the principles of RI than examples of it being carried out in practice" (Davies & Horst, 2015, p. 46).

Second, the unfamiliarity of responsible innovation concept brings a difficulty for the innovators to implement such concept. According to Blok and Lemmens (2015), the lack of practicability issues stems from critical issues, like decreasing competitive advantage, power imbalances, and diverse vision among different actors. This argument is supported by De Hoop, Pols, and Romijn (2016). Using a case study, they have recognized practical barriers that hamper the implementation of responsible innovation concept. Based on their observation, the value of inclusiveness and responsiveness are hard to realize in the actual practice because there is a power difference and strategic behavior issue. In addition, Pandza and Ellwood (2013) find that this difficulty especially happen if the innovators have to deal with the technologies with high-impact uncertainty. Recently, Wiek, Foley, Guston, and Bernstein (2016) have identified a similar evidence in nanotechnology industry. They then stress that "it would be premature to conclude from these modest

advances that the current state of nanotechnology innovation delivers on the grand promise of responsible and sustainable innovation" (Wiek et al., 2016, p. 640).

Emerging Issue: the Practical Problem in the Business Context

However, one should note that the practical difficulty in applying responsible innovation concept is especially felt in a business context (Blok & Lemmens, 2015; Lubberink et al., 2017). Scholten and Blok (2015, p. 2) have highlighted that "It is precisely responsible innovation in the private sector, which is underrepresented in current research". Lubberink et al. (2017, p. 2) support this idea by stating that "the question still remains as to how the current concept of responsible innovation can be implemented in the business context". Scholars observe that this problem stems from the fact that existing responsible innovation literatures has been mainly focused at the 'why' (Van den Hoven, Lokhorst, & Van de Poel, 2012) and the 'what' (Stilgoe et al., 2013) questions. As a consequence, the business context has been unfortunately ignored in current responsible innovation discussion (Pavie et al., 2014).

Practical problems in the business context are somehow striking for two reasons. First, the unfamiliarity of responsible innovation concept for the actors outside the responsible innovation scholars could hinder the penetration of responsible innovation theory itself. Related to this, M. de Jong et al. (2015, p. 78) argue that "Just as technologies can fail when the solutions they provide do not match the problems experienced by society, hyped concepts can fail as well, thereby losing its (potential) power to mobilize concerted action". In the same vein, Foley et al. (2016) state that "conceptual framework would benefit from more work to explore the current practices of industry to innovate responsibly".

In addition, I argue that a shortage of discussion toward responsible innovation in the business context is regrettable. First, the business context is the environment where the innovations grow (Baregheh, Rowley, & Sambrook, 2009). Having said that, Scholten and Blok (2015) have identified that current responsible innovation literatures are still emphasizing a discussion in "a policy or socio-ethical perspective and focusing on academic R&D environments, while most innovations take place in the private sector". Thus, it could be the case that the concept of responsible innovation that is developed by responsible innovation scholars is not necessarily in line with the actual condition in the business domain. Closely related to this, second, there is a chance that the concept of responsible innovation cannot satisfy the objective of business practitioners (Lubberink et al., 2017). Third, according to Schroeder and Iatridis (2016), by nature, the actors in business field deserve the clear concept on how to involve society ethical perspectives in the innovation process. Having a clear understanding about such concept would make the managers and innovators aware about the responsibility that they have toward society. In other words, responsible innovation concept could enrich the business actors to not only produce an innovation from a "do no harm" perspective, but also from a "do good" perspective.

1.2 KNOWLEDGE GAP

In order to address the practical problem in the business context, scholars have examined several studies. In general, the study can be classified into two parts: qualitative and quantitative part. An example of the former is the study carried out by Shelley-Egan and Davies (2013). Using a case study approach, they find that nanotechnology industry in European and U.S. have different discourse in regards to the responsible innovation concept. Another qualitative research has also been examined by Iatridis and Schroeder (2016). Based on existing corporate responsibility tools (e.g., ISO, OHSAS, UN's human right initiative), they develop a tool that could assist the company to implement responsible innovation concept. Blok, Hoffmans, and Wubben (2015) have also provided another qualitative study that identify the barriers (e.g., power imbalances and losing competitive advantage) that hamper the implementation of responsible innovation in the business domain. Recently, another qualitative study also comes from Lubberink et al. (2017). Based

on five responsible innovation dimensions that are offered by Stilgoe et al. (2013), they propose an operationalization of responsible innovation concept in the business context.

In the quantitative domain, one study from Scholten and Van der Duin (2015), for example, has examined the relationship between responsible innovation practice and company's absorptive capacity. Another quantitative study is also provided by S. M. Flipse, Van Dam, Stragier, Oude Vrielink, and Van der Sanden (2015). In their research, they identify a relation between responsible innovation and a project success.

Several efforts above should be appreciated in a view that they have opened up a dialogue about the responsible innovation in the business context. Nevertheless, the prior studies seem makes no attempt given an answer to the current needs: a scale to measure individual behavior in regards to responsible innovation concept (Bessant, 2013; S. Kaplan, 2000; Sternberg & Arndt, 2001; Zollo & Winter, 2002). It is the innovators in the business contexts, as the forefront actors of innovation, who need the guidelines on how to articulate ethical perspective in their work (Roeser, 2012; Schroeder & Iatridis, 2016). Thus, the way they carry out their jobs determines the consequences for the well-being of people, be it the positive or negative consequences. Based on this view, a knowledge gap exists between the current state of responsible innovation research and a tool that can measure individual behaviors in regards to responsible innovation in the business context.

1.3 RESEARCH OBJECTIVE (RO)

Based on explanation in previous sections, the goal of the present study is twofold. First, the multi-interpretation issue in responsible innovation concept, in my view, requires an extensive review of literatures to arrive at a comprehensive insight about this concept in the business context. Existing responsible innovation literatures have primarily focused on the theory development. As a consequence, innovators find a difficulty to implement such theory in their daily works. For that reason, the second objective of this study is to develop a scale that can measure a level of individual behavior in regards to the responsible innovation concept in the business context.

1.3.1 Review of Literatures about Responsible Innovation in the Business Context

While acknowledging previous studies as a frontier to discuss responsible innovation in the business domain, I argue that those studies seem to have little relevance with current needs. I believe that what is important here is a tool for business practitioners to operationalize the concept of responsible innovation in their daily activities. However, existing responsible innovation literatures fail to resolve such challenge.

The needs to operationalize responsible innovation has increasingly gained interest amongst scholars. As expressed by Ribeiro et al. (2016, p. 13), "RRI is a concept that is currently subject to experimentation; no single approach to practice dominates and operationalization of the concept is still under development". Thus, M. de Jong et al. (2015, p. 78) have explained that "To avoid RI ending up as a void concept, or mere "manager's language" as one scientist put it, there is a need for practicing RI, measuring and evaluating RI and for the development of (policy) instruments to do so". Fisher (2016) has also raised a similar awareness. According to him, in order to widen the acceptance of responsible innovation concept, "scholars and practitioners alike must not shy away from the challenges that its more ambitious normative commitments unavoidably entail" (Fisher, 2016, p. 89). In a similar vein, Foley et al. (2016, p. 18) have also argued that "one of the main areas for further attention is to specify the general concepts" in order to get "more tangible guidelines". In line with M. de Jong et al. (2015), the lack of operationalization issue would only bring the concept of responsible innovation into a disappointment.

1.3.2 The Need of Responsible Innovation Scale in the Business Context

It is common to see that, by nature, innovators have different behaviors (e.g., personalities, innovative and ethical behavior) (Bessant, 2013; S. Kaplan, 2000). In the business context, they work in different socioeconomic settings (e.g., company rules, government regulation, societal culture) and interact with different level of stakeholders (Sternberg & Arndt, 2001; Zollo & Winter, 2002). These different behaviors and contexts are likely to affect the innovators to apply the concept of responsibility in the innovative tasks that they perform. None is better equipped with the effect of such innovative tasks than the innovators themselves. However, irrespective that there are some efforts to examine the concept of responsible innovation in the business context, little is known about a tool that can quantitatively measure the level of innovator's responsible innovation behavior. For that reason, scholars have expressed that it is vital to develop a tool that can measure individual behavior in regards to responsible innovation concept.

1.3.3 Dual Objectives: Review of Literatures and Development of Responsible Innovation Scale

I believe that what becomes an essential progress in any activity is a standard measure to assess if conditions are getting better or worse. Therefore, I follow this call to develop a responsible innovation scale: a scale that can measure the level of individual behaviors in regards to responsible innovation concept in the business context. In order to meet this call, firstly, this study conducts a literature review from previous findings to give a clear picture about theoretical underpinning that relates to responsible innovation in the business context. Building on this foundation, this study will develop and, subsequently, validate the responsible innovation scale.

Therefore, this study is aimed at (1) reviewing the responsible innovation literatures and (2) to developing and validating a scale that can measure the level of individual behaviors in regards to responsible innovation concept in the business context.

1.4 RESEARCH QUESTION (RQ)

To fulfill the aforementioned ROs, the central RQ of this study is arranged as follows.

> *Main RQ: What is the validated scale that can be used to measure a level of individual behavior in regards to responsible innovation concept in a business context?*

In order to answer the main RQ, I formulate several sub-RQs. First, I need to understand the concept of responsible innovation from existing literatures in regards to a measure of individual level behavior. Sub-RQ1 is then arranged as follows.

> *Sub-RQ1: What is a scale that is suggested by existing responsible innovation literatures to measure a level of individual behavior in regards to responsible innovation concept in the business context?*

Based on the insight in the existing literatures, I propose a measurement tool to measure such individual behavior. Sub-RQ2 is then proposed as follows.

> *Sub-RQ2: What is the scale that is proposed by this study that can measure a level of individual behavior based on the current concept of responsible innovation concept in the business context?*

Next, I test the proposed scale to see if there is modification that should be applied. In order to answer such demand, Sub-RQ3 is then proposed as follows.

SubRQ3: Based on empirical data that is acquired from the proposed measurement scale, what is the finalized scale that can measure a level of individual behavior based on the current concept of responsible innovation concept in the business context?

Subsequently, I need to assess the validity of the proposed measurement tool. Sub-RQ4 is designed as follows.

Sub-RQ4: What is the result of validity testing of the proposed measurement scale?

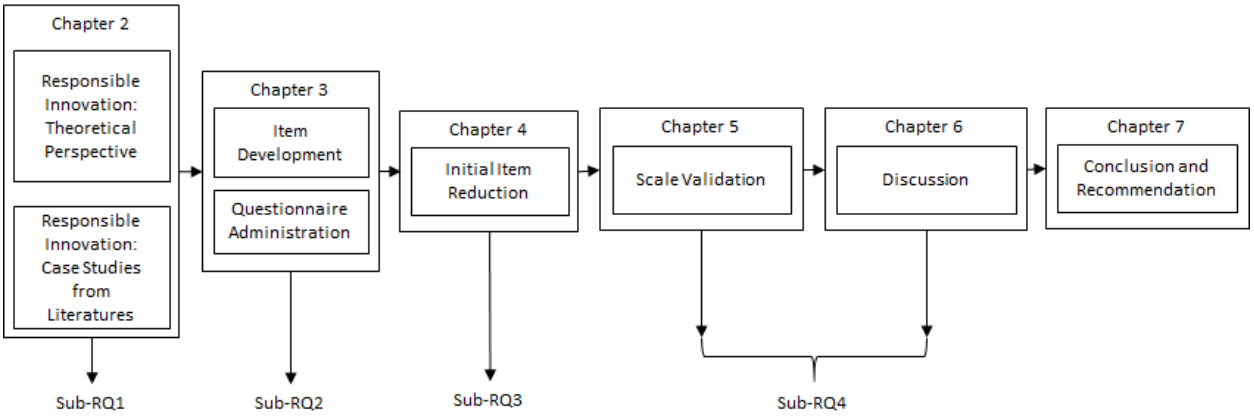
1.5 RESEARCH APPROACH

In order to bridge the research objective and the research questions, I developed a research framework as shown in Figure 1. Subsequently, I have also arranged a set of research strategy that describes the research methodology to answer the research questions (Table 2).

Table 2. Research Strategy

Sub RQ	Research Strategy	Description		
1	Literature Review	Responsible Innovation Theory	Exploring literature about responsible innovation concept	
		Responsible Innovation in Business Context	Exploring literature to find case studies that are related with responsible innovation in the business context	
2	Literature Review	Research Method	Exploring literature about methodology to develop measurement tool	
		Reviews of journals about statistical tools	Exploring literature on journal reviews, editorial papers, or special issue articles that talk about statistical approach to develop measurement tool	
			Exploring literature on journal reviews, editorial papers, or special issue articles that talk about statistical approach to validate measurement tool	
		Individual behavior	Exploring literature about individual behavior that is related to responsible innovation	
3	Survey	Data gathering by administering survey to respondents		
	Statistical Analysis	General	Exploring literature about multivariate data analysis	
		Specific	EFA and CFA	Exploring literature about Exploratory Factor Analysis
				Exploring literature about Confirmatory Factor Analysis
			Software	Exploring literature about SPSS
4	Literature Review	General	Exploring literature about personality and social psychology, management (applied psychology and organizational behavior), business ethics, and responsible innovation	
		Concept	Exploring literature about existing scales that can be used to validate responsible innovation scale	
	Statistical Analysis	Specific	Concept	Exploring literature about Exploratory Factor Analysis
				Exploring literature about Confirmatory Factor Analysis
			Tools	Exploring literature about SPSS
				Exploring literature about Amos
	Discussion of between empirical finding and theoretical perspective			

Figure 1. Research Framework



1.6 SCIENTIFIC AND PRACTICAL RELEVANCE

As explained in previous sections, numerous studies have attempted to explain that there is a need to develop a scale that can measure individual behavior in regards to responsible innovation concept in the business context. However, research on the subject of responsible innovation has been mostly restricted to descriptive in nature. Thus, the present study is relevant to make a contribution for both academia and business practitioners.

Using a quantitative approach, the present study provides an appropriate supplement for scientific domain in certain circumstances. At first, this study gives a contribution in the topic of responsible innovation, especially in the business context. In addition, this quantitative study allows an accumulative evidence from different cases. For example, it may encourage future studies on the relations between variables in different contexts (e.g., different company size (SME vs. MNC) or different innovation type (emerging vs. radical innovation). Besides, this quantitative study would enable to process a large number of data. It is especially important for the theory that is still in the infant phase like responsible innovation. A large number of data then could be used to refine the responsible innovation concept.

In certain settings, this study also offers unique advantages for business practitioners, especially managers and organizational development consultants. For example, considering the fact that the quantitative study can be conducted in a short time period, managers can conduct an efficient research from a large quantitative assessment to garner a related information. In particular, it would help them develop a focused and targeted measurable effort in doing an innovation using an ethical perspective. Thus, it would allow managers and innovators to a better understanding of the nature and determinants of responsible innovation. As a result, this quantitative study would give a valuable insight for innovators and managers to do a careful planning in the innovation products and processes. As highlighted by Pavie and Egal (2014, p. 53): "we must consider responsibility as a major determinant to innovation, and from a managerial point of view, integrate forecasting and anticipation in the decision-making process". Furthermore, this study would enable innovators to have a more understanding about an interwoven between society and innovation. It implies that this study would give a certain advantage to the public at large.

1.7 OUTLINE OF THESIS REPORT

This report consists of seven chapters (Figure 1). The aforementioned discussion in this chapter describes the introduction related to this research. Next, Chapter 2 provides a theoretical underpinning of responsible innovation, especially in the business context. It is followed by Chapter 3 that explains the methodology used to achieve the research objectives. Subsequently, Chapter 4 and Chapter 5 respectively examine the

data analysis and data validation. The discussion about the theoretical aspect (Chapter 2) and the empirical finding (Chapter 4 and Chapter 5) is given in Chapter 6. Last, Chapter 7 offers a conclusion that covers summary of the findings, scientific and practical contribution, study limitation, and suggestion for future studies. The report ends with references and appendices section.

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CHAPTER 2
LITERATURE REVIEW

"You cannot escape the responsibility of tomorrow by evading it today" - Abraham Lincoln

Using a literature review, this chapter is intended to give a clearer picture about the current state of responsible innovation concept. It starts with a discussion about the definition of responsible innovation. Next, it provides an explanation about the concept of responsible innovation in the business context. In the last part, this chapter wants to see what scale is suggested by existing responsible innovation literatures that can be used measure a level of individual behavior in regards to responsible innovation concept in the business context.

2.1 WHAT IS RESPONSIBLE INNOVATION?

Innovation can no longer be seen as a value neutral. Thus, innovation should be understood as an appropriate subject of responsibility (Grunwald, 2011). The notion of responsible innovation can be comprehended in the form of two separate terminologies: responsible and innovation. However, it is likely that the definition of 'innovation' is not much elaborated (Koops, 2015). Related to this, Koops (2015) has explained that responsible innovation is a sub-field of innovation, and therefore "It does not primarily aim a understanding or improving innovation as such, but rather at understanding how innovation, whatever it means in different contexts, can be made 'responsible'" (Koops, 2015, p. 4).

The concept of responsible innovation –also usually called responsible research and innovation- is still at the infancy stage and therefore there are numerous definitions from the literatures (Davies & Horst, 2015). Davies and Horst (2015) divide the definition of responsible innovation based on two areas: policy domain and the applied domain. According to Davies and Horst (2015, p. 47), the "influential" definition of the former comes from von Schomberg.

> Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (von Schomberg, 2011b, p. 9)

This definition referenced in several European Commission documents and is one of the most cited definitions of responsible innovation. Davies and Horst (2015) explain that this definition shows four characteristics. First, it indicates that responsible innovation is a "process". Second, it implies that responsible innovation is characterized by a transparent, interactive, and mutual responsiveness between the societal actors and innovators. Third, it shows that responsible innovation emphasizes both the "innovation process and its marketable products". Thus, it describes the association between these products (as the output of innovation) and the society. Last, this definition could bring a debate in regards to the 'mutual responsiveness' and common 'view' of the ethical acceptability. According to them, the consensus on ethical acceptability is "at best difficult and at worst impossible" (Davies & Horst, 2015, p. 47).

Another definition of responsible innovation comes from the UK's Technology Strategy Board.

> Responsible innovation requires careful consideration of ethical, societal and regulatory issues and appropriate response throughout the process, including (i) during the process of carrying out the R&D, and (ii) for commercial use of the findings. (Board, 2012, p. 1)

Similar with the concept from von Schomberg, this definition also describes the "ethical, societal and regulatory issues" (Davies & Horst, 2015). It also specifies the "commercial use" and "the process of carrying out the R&D" that respectively reflect the product (output of scientific research) and the process innovation.

In a similar nuance, Berndt C. Stahl et al. (2013) have eloquently proposed the definition of responsible innovation as follows.

> RRI is a social construct or ascription that defines entities and relationships between them in such a way that the outcomes of research and innovation processes lead to socially desirable consequences. (Berndt C. Stahl et al., 2013, p. 214)

In addition, in a broader definition, (Stilgoe et al., 2013, p. 1570) explain that:

> "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present" (Stilgoe et al., 2013, p. 1570).

Besides the policy domain, there are also the definitions of responsible innovation that come from the applied domain. For example, Unilever remarks that:

> We believe our products should make a real contribution to an individual's wellbeing and that of their community, while having the least possible adverse impact on the environment at every stage in the product lifecycle.[1]

Considering the fact that this definition appears in the corporate website, this definition is rather simple because it wants to give an easy-to-understand concept to the public (Davies & Horst, 2015). Similar with the previous definitions, this definition also emphasizes the "products" -as the output of scientific research- and how these products can deliver the "contribution" to both "individual's wellbeing" and "community". This definition also tells that the outcome of the innovation process should have the minimum harmful impact to "the environment".

2.2 DIMENSIONS OF RESPONSIBLE INNOVATION

In order to give a clearer insight about the concept of responsible innovation, scholars have proposed several dimensions. This study summaries the dimensions of responsible innovation as follows.

2.2.1 Anticipation

Anticipation refers to an effort to foresee the consequences of innovation (Asante, Owen, & Williamson, 2014; Owen et al., 2013; Stilgoe et al., 2013). Anticipation is looking forward to both the desired and undesired impacts of innovation in regards to aspects like societal, technical, political, and environmental. In other words, anticipatory governance takes into account the advantage of the technology and at the same time avoid the potentially harmful consequences (Robinson, 2009). Anticipation does not only articulate promising narratives of expectation, but it also prompts scientists and innovators to think "what if …" and

[1] See https://www.unilever.pk/about/innovation/innovation-in-unilever/responsible-innovation/

”what else might it do?” questions. Therefore, anticipation is needed to "articulate and assess expectations in science and technology" and see "the difference between looking into the future and looking at the future" (Borup, Brown, Konrad, & Van Lente, 2006).

The goal of anticipation is to make a desirable application (Edelenbosch, Kupper, & Broerse, 2013). This goal is especially applicable in the emerging technology, like nanotechnology (Robinson, 2009; Roco, Harthorn, Guston, & Shapira, 2011), human-brain technology (Rose, 2014). By making a desirable outcome, anticipation does not only come from predicting, but also from richly imagining the shape of future innovation trajectories (Barben, Fisher, Selin, & Guston, 2008). In other words, when the innovators acknowledge new opportunities, anticipation is aimed to make the innovation socially-robust by doing the systematic considerations to increase the resilience (Stilgoe et al., 2013).

Stirling (2010) argues that an overly narrow focus on risk has made the science vulnerable to the dynamics in the social group, like the manipulation due to political pressure. Therefore, he suggests to move from a narrow focus on risk to a broader understanding of incomplete knowledge. In this case, anticipation would make the innovators understand about the dynamics of expectation regarding to the innovation consequences (Selin, 2011). In addition, Rose (2014) argues that anticipation is aimed to reflect the motivations and consequences of innovation, clearly understand the uncertainties and dilemma, open up vision to broader public, and use these outcomes to shape the innovation agenda.

Scholars have also pointed out that the anticipation should be put in the early stage of innovation processes. For example, Stirling (2010) argues that there is a need to recognize the sources of harm as the possible risks in the early stage of innovation processes. Stilgoe et al. (2013) also highlight that anticipatory process needs to be early enough to be constructed. According to them, the early anticipatory governance is needed because there is a significant time lag between the beginning of technical innovation and the beginning of commercialization processes. Thus, this recognition of the potential negative impacts of innovation should be considered in a transparent way to reduce the uncertainties and other possible surprises (Van den Hove, McGlade, Mottet, & Depledge, 2012).

Based on the explanation above, Lubberink et al. (2017, p. 11) define anticipation in the business context as follows:

> “the act of determining the desired impact(s) and outcomes of the innovation process to address societal and/or environmental needs (1), the negative impacts to be prevented or mitigated (2), and the uncovering of the different pathways through which this can be achieved (3) while being aware of the inevitable uncertainty of forecasting.”

Following this view, I explored case studies from existing literatures that can explain this concept. A detail explanation about this finding and its resume are respectively given in Appendix 1 and Table 38.

2.2.2 Reflexivity

Stilgoe et al. (2013, p. 1571) define reflexivity as ‘‘holding a mirror up to one’s activities commitments and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held.’’ Thus, reflexivity is aimed to reflect the values and beliefs in the innovation processes. In this case, reflexivity requires the innovators to blur their role responsibilities into the wider moral responsibilities. In other words, reflexivity obstructs the scientific amorality and agnosticism assumption.

Based on this idea, reflexivity requires collaboration approaches and involvement from public (Asante et al., 2014; Steven M. Flipse et al., 2013; Macnaghten & Chilvers, 2014). In this case, the responsibilities

make the reflexivity into a public matter (Wynne, 2011). Stilgoe et al. (2013) have pointed out that reflexivity can be performed by involving the social scientists and philosophers in laboratory processes. In addition, reflexivity also emphasizes the learning processes of the feedback mechanisms that are obtained from the collective experimentations (Chilvers, 2013). In the similar vein, Fisher, Mahajan, and Mitcham (2006) have expressed that the reflexive awareness comes from the capacity building of the actors "to become attentive to the nested processes, structures, interactions, and interdependencies, both immediate and more removed, within which they operate" Fisher et al. (2006, p. 492).

In the business context, Lubberink et al. (2017, p. 12) define reflexivity dimension as follows.

> "critically thinking about one's own actions and responsibilities (1), values and motivations (2) knowledge and perceived realities (3), and how each of these have an effect on the management of the innovation process for the desired outcome."

Based on this definition, I explored case studies from existing literatures that can explain this concept. A detail discussion about this finding and its summary are respectively given in Appendix 2 and Table 39.

2.2.3 Inclusion

The diminishing effect the experts' authority and top-down policy making have raised a concern of inclusiveness (Stilgoe et al., 2013). Stilgoe et al. (2013, p. 1572) have argued that "inclusion inevitably force consideration of questions of power." Therefore, inclusion aims to engage different stakeholders in the early stage of innovation processes (Asante et al., 2014). Related to this, Von Schomberg (2007, p. 12) point out that "upon everyone's shoulders rests a particular moral obligation to engage in the collective debate that shapes the context for collective decision making" This moral obligation can be achieved by identifying the socially desirable outcomes from the involvement of public (Owen et al., 2012; Berndt C. Stahl et al., 2013).

Bozeman, Rimes, and Youtie (2015) explain that there are three reasons why innovation needs a greater involvement of public values. First, public values would encompass the outcomes that are important to the public at large. For example, most of the people would value safety more than the economic advantage. Second, scientific and technological innovation is supported by public funding: tax. Regarding to this, Grimpe, Hartswood, and Jirotka (2014) have found that many responsible innovation proponents envisage inclusion of society involvement in innovation processes without wasting taxpayers' money and time. Third, the public involvement is likely to improve the acceptability of innovation. Related to this, scholars argued that public involvement is important to find the solution of the technical issues. Mejlgaard, Bloch, Degn, Nielsen, and Ravn (2012) identify that three are significant differences between countries in regards to the role and location of science in society. In this case, they find that the countries with low public involvement has low public pleasure toward science. In addition, Barben et al. (2008) propose that the public involvement should be placed in the early phase of innovation processes.

Based on the explanation above, Lubberink et al. (2017, p. 14) define inclusion dimension in the business context as follows:

> "the involvement of a diversity of stakeholders during different stages of the innovation process (1) who comprise a quality innovation network providing different resources necessary for responsible governance of the innovation process and the achievement of the desired outcomes (2). Raising commitment and contribution by multiple stakeholders benefits network performance and can be achieved by creating and maintaining relationships that satisfy stakeholders (3)."

Following this view, I explored case studies from existing literatures that can explain this concept. A detail explanation about this finding and its resume are respectively given in Appendix 3 and Table 40.

2.2.4 Deliberation

Stilgoe et al. (2013) and Owen et al. (2013) have used the inclusion and deliberation interchangeably. However, Pelle and Reber (2015) have argued that, in the context of responsible innovation, inclusion should be separated from deliberation. In this case, stakeholder inclusion can have conflicting goals with stakeholder deliberation (Papadopoulos & Warin, 2007). van de Kerkhof (2006, p. 282) defines deliberation to "a process of argumentation and communication in which the participants engage into an open process in which they exchange opinions and viewpoints, weigh and balance arguments, and offer reflections and associations". This idea implies that, while stakeholder inclusion emphasizes question like, what actor should be involved, when to involve them, and whether the actors represent the relevant stakeholders, deliberation should focus on the ideal dialogue situation that brings to the decision making (Lubberink et al., 2017). In other words, deliberation does not take much attention about the challenges of inclusivity and stakeholders' representativeness. Being deliberative means that there is a sustained interaction between stakeholders in the whole innovation processes (Jasanoff, 2003; Parkhill, Pidgeon, Corner, & Vaughan, 2013).

Building on this foundation, Lubberink et al. (2017, p. 14) define deliberation in the business context as follows:

> "a commonly agreed two-way exchange of views and opinions between stakeholders (1) based on shared information and evaluation criteria (2) that could support decision-making with regard to the innovation that is under consideration (3). This can be complemented with actual decision-making power of stakeholders regarding the innovation process and/or outcomes (4). Satisfying contributors is achieved by providing feedback regarding the dialogue and explaining how the results are integrated into the innovation (5), which can facilitate innovation adoption."

Following this view, I explored case studies from existing literatures that can explain this concept. A detail explanation about this finding and its resume are respectively given in Appendix 4 and Table 41.

2.2.5 Responsiveness

Responsiveness concerns the response to the new knowledge to address the circumstances due to different emerging perspectives, views, and norms (Stilgoe et al., 2013). Responsiveness is needed because there is a limitation in the effort to do involve the public in the innovation processes. This limitation makes a condition in which there might be a risk that the innovation may bring about. Therefore, innovators should consider how the innovation should respond to undesired impacts that it carries.

Based on this view, Von Schomberg (2013) argues that the challenge of responsible innovation is to improve the responsiveness to the societal challenges. Related to this, Maynard (2015) explains that innovators are likely to be blinkered by their optimism. In this case, the way the innovators give a response to the "seemingly speculative future health, environmental and other societal impacts look like an ill-affordable luxury" (Maynard, 2015, p. 199). Pellizzoni (2004) argues that responsiveness can be used to understand "the extent to which voluntary regimes rearrange social relations in such a way that assimilative or exclusionary outcomes are reproduced".

According to this perspective, Lubberink et al. (2017, p. 14) have defined responsiveness in the business context as follows:

> "making sure that the organisation is able to, and actually does, adjust the innovation process in accordance with events and changing circumstances that take place during the innovation process (1) within and outside the organisation (2), in order to safeguard the achievement of the desired innovation outcomes which address grand challenges and/or prevent detrimental effects (3). This can imply that the innovation project will be adjusted or even withdrawn from market launch. Stakeholders can be mutually responsive to each other by recalibrating their roles and responsibilities during the innovation process (4)."

Following this view, I explored case studies from existing literatures that can explain this concept. A detail explanation about this finding and its resume are respectively given in Appendix 5 and Table 42.

2.3 DISCUSSION OF THE LITERATURE REVIEW

This chapter shows that innovation in the contemporary era has brought a huge transformation in the way people live. In many cases, this transformation brings undesired consequences. This then raised a concern to embroil ethical perspective in the innovation processes. Several approaches have been proposed to come across that issue. However, these approaches are no longer applicable in current context. In order to address the issues in present era, scholars offer a new concept that can reflect a responsibility aspect in the innovation processes. This new concept is called responsible innovation.

Responsible innovation emphasizes an involvement of ethical perspective in the innovation processes. Scholars had tried to conceptualize and accordingly offered several dimensions. From a theoretical perspective, however, it is still considered as an unattached concept. In addition, this concept also suffers from practical problem, especially in the business context. Literature review shows that, currently, only Lubberink et al. (2017) who had discussed operationalization of responsible innovation in a business context. Based on their study, responsible innovation in the business context can be applied using following key activities (Table 3).

As a promising concept, the multi-interpretation issue in responsible innovation is somehow regrettable. However, the inconsistency in the current concept cannot be overlooked. In order to build and validate a readily assessed measure, a clearer insight is needed. Based on this view, before finishing the discussion in this chapter, I argue that there is a promising approach that can be used to develop such measurement tool: individual behavior.

Literature review shows that the measure of individual behavior is missing in the responsible innovation discussion. This fact is striking because the understanding of individual's behavior could bring an advantage in to develop a measurement tool. Behavioral study is especially relevant for responsible innovation because it emphasizes an individual behavior towards society. Study from Carlo, Okun, Knight, and de Guzman (2005) and Graziano and Eisenberg (1997), for example, have highlighted that individual behavior plays an important role in explaining societal-related motives. The evidences havee also been observed in other literatures, be it a voluntary-oriented behavior (Erdle, Sansom, Cole, & Heapy, 1992; Okun, Pugliese, & Rook, 2007; Omoto & Snyder, 1995) or pro-environment behavior literatures (Karp, 1996; Kollmuss & Agyeman, 2002; Little, 1983; Turaga, Howarth, & Borsuk, 2010).

According to this view, in this study, I propose to develop a measurement tool that can satisfy individual behavior characteristics in regards to the concept of responsible innovation. In the business (organization) context, it implies that the concept of responsible innovation is reflected in the belief, attitudes, or intentions of organization's individual members. However, it is important to note that what has been explained in this chapter has not necessarily been of no use. Rather, the discussion in this chapter has brought a significant contribution to determine appropriate behaviors that could represent the concept of responsible innovation.

Table 3. Responsible dimensions and key activities in the business context (Lubberink et al., 2017)

Dimension	Key Activities
Anticipation	Determining desired impacts and outcomes of innovation
	Preventing or mitigating negative impacts
	Development of roadmaps for impact
Reflexivity	Actions and responsibilities
	Values and motivations
	Knowledge and perceived realities
Inclusion	Involvement of stakeholders at different stages
	Provision of resources and capital
	Raised commitment and contribution
Deliberation	Two-way exchange of views and opinions
	Shared information and value criteria
	Support decision-making with regard to the innovation that is under consideration
	Decision-making power of stakeholders regarding the innovation process and/or outcome
	Feedback regarding the dialogue and explaining how the results are integrated in the innovation
Responsiveness	Making sure that one can respond to changes in the environment
	Actual response to changing environments
	Addressing grand challenges
	Mutual responsiveness

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CHAPTER 3
METHODOLOGY

"We must revisit the idea that science is a methodology and not an ontology." - Deepak Chopra

Based on the theoretical foundation in Chapter 2, the present chapter describes a methodology to develop a scale that can measure individual behavior in regards to responsible innovation in the business context. In order to develop such scale, I followed suggestion from (Hinkin, 1998); Hinkin, Tracey, and Enz (1997). According to him, scale development process consists of five parts: item development, questionnaire administration, initial item reduction, and scale validation.

3.1 ITEM DEVELOPMENT

As the first step in scale development, item development is used to assess the examined construct (Hinkin, 1998; Hinkin et al., 1997). Therefore, solid theoretical understanding about the measured construct is needed. It is here that the extensive literature review in Chapter 2 plays a role.

In the item development process, two methods are commonly applied: inductive approach and deductive approach (Hinkin et al., 1997). Hinkin et al. (1997) explains that the inductive approach is likely to be used "when exploring an unfamiliar phenomenon where little theory may exist" (p. 3). According to him, this approach is usually conducted by asking a sample of respondents "to provide descriptions of their feelings about their organizations or to describe some aspect of behavior" (Hinkin et al., 1997).

Based on this view, however, I argue that this approach is not suitable to develop a measure that is proposed in this study. To the extent of my knowledge, currently there has been no discussion about relevant behaviors that are associated with the responsible innovation concept. As explained in previous chapters, discussion about the concept of responsible innovation is still in an explorative stage. To date, scholars are still focusing on conceptualizing responsible innovation. As a consequence, studies that are related to behaviors are less attractive in current responsible innovation literatures. This being said, it is unlikely that the consensus about the behavior can be found.

Based on this background, this study used a deductive approach in the item development process. According to Hinkin et al. (1997), the deductive approach "requires an understanding of the phenomenon to be investigated and a thorough review of the literature to develop the theoretical definition of the construct under examination". Following this view, Schwab (1980, 2013) suggests that the items should be developed closely from the definitions.

Although scholars have different concept about responsible innovation, extensive literature review in Chapter 2 allows me to conclude that there are two aspects that characterize the definition of responsible innovation: innovative and ethical aspect (Barron & Harrington, 1981; King, Walker, & Broyles, 1996). This idea, for example, follows the most frequently cited responsible innovation definition from von Schomberg (2011b).

> "Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)" (von Schomberg, 2011b, p. 9).

As this study uses individual behavior as the basis for the measurement tool, I argue that the definition from (Von Schomberg, 2011a) above can be associated into individual behavior based on following perspectives:

- "…the innovation process and its marketable products …"(von Schomberg, 2011b, p. 9) represents the innovative behavior.
- "…societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability …"(von Schomberg, 2011b, p. 9) indicates the ethical behavior.

This view also follows an argument from Koops (2015) who states that responsible innovation consists of two aspects: responsible and innovation: "It does not primarily aim a understanding or improving innovation as such, but rather at understanding how innovation, whatever it means in different contexts, can be made 'responsible'" (Koops, 2015, p. 4). Thus, responsible innovation can be seen as a cognitive precursor to the innovative and ethical behaviors in the innovation processes.

Following the argument from Koops (2015), the theoretical discussion about responsible innovation (Chapter 2) can give an insight about the ethical behavior that individual should have. Thus, what I have not presented in the item development process is the discussion about the innovative behavior. In the following discussion, I explain about the innovative (creativity) behavior from existing relevant literatures.

At first, I referred to a creative behavioral study that was reported by Runco and Jaeger (2012). In their research, they examine that creativity is constructed by two interrelated aspects. The first one is originality. According to Runco and Jaeger (2012, p. 92), "It is not original, and therefore not creative." Originality is also called novelty or uniqueness. However, Runco and Jaeger (2012) explain that originality alone is not sufficient to shape creativity. Merely novel ideas might be useless if they do not consider the functional aspect.

Following this view, Runco and Jaeger (2012, p. 92) explain that creativity needs an effective action, like "usefulness, fit, or appropriateness". Runco and Jaeger (2012, p. 92). Related to the study from Runco and Jaeger (2012), West (2002) linked creativity to innovation processes: idea generation and idea realization. West (2002) has explored on how originality in idea generation can be effectively implemented in idea realization. In particular, he studied on how an innovator can effectively implement their idea with other parties. It is here that the concept of responsible innovation plays a role. As explained in Chapter 2, in order to incorporate the ethical perspective in the innovation processes, innovators need an integrative work from different stakeholders. In this case, West (2002) have found that there are four factors that make the innovation work effectively in multi stakeholders environments: group task characteristics, group knowledge, diversity, and skills, external demands, and group creativity and innovation implementation. Further, these factors can be integrated into eight group processes. It is important for the innovators to understand these processes while doing a collaboration work with other parties. These group processes are: clarifying and ensuring commitment to group objectives, participation in decision making, managing conflict effectively, supporting innovation, minority influences, developing intra-group safety, reflexivity, and developing group members' integration skills.

Next, I followed a study from Baas, De Dreu, and Nijstad (2008). Their study is particularly important in order to understand specific behaviors that innovators have in the idea generation process. They have pointed out that while doing an idea generation, innovators need several creativity characteristics: originality, fluency, and flexibility. They defined these facets as follow:

- Fluency: "the number of unique, non-redundant ideas or problem solutions that are generated." (Baas et al., 2008, p. 781)
- Flexibility: "the breadth and number of distinct semantic categories that a person accesses, and it reflects the capacity to switch approaches, goals, and sets" (Baas et al., 2008, p. 781)
- Originality: "the uncommonness and infrequency of an idea and reflects the ability to approach a problem or situation in a new way, without relying on routine or habitual thought" (Baas et al., 2008, p. 781)

Drawing from these studies, a hypothesized Responsible Innovation Scale (RIS) was developed. This scale contains a total of 12 questions that represent the idea of responsible innovation in the business context (Table 43 in Appendix 6). This study calls this initial items as Ris_Original. Unless otherwise mentioned, this study defines responsible innovation behavior as an individual behavior that shows psychometric properties that take into account responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization.

- Responsible Idea Generation (Originality)
  - Ris01: I am good at coming up with ideas that are novel, but in the right way
  - Ris02: I find it easy to generate original solutions that reflect how the problem at hand ought to be solved
  - (Ris03_Reencoded): The ethical side of an idea does not interest me as much as the originality of that idea (reverse scored)
- Responsible Fluency
  - Ris04: I have a knack for coming up with many ethical solutions to a problem
  - Ris05: Producing large numbers of solutions for a better future comes natural to me
  - Ris06: I am good at generating many ideas that capture the responsible side of innovation
- Responsible Flexibility
  - Ris07: I find it easy to explore a wide range of politically correct alternatives in idea generation
  - Ris08: It is important to me to explore the various ethical aspects of my ideas
- Responsible Idea Realization
  - Ris09: Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me
  - Ris10: I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements
  - Ris11_Reencoded: I have no interest in evaluating the moral aspects of my new ideas (reverse scored)
  - Ris12: I like to contribute to the implementation of new ideas when these are appropriate to solving a meaningful problem

    Note.
    - In order to measure the items, this scale applies a 7-item Likert scale: 1 = very strongly disagree, . . . , 7 = very strongly agree.

- A 7-point Likert scale is has been observed to create necessary variance in explaining the relationship between items and provide adequate Cronbach's Alpha value (Hinkin et al., 1997; Lissitz & Green, 1975)

3.2 QUESTIONNAIRE ADMINISTRATION

Once the item development is completed, the items need to be tested by administering a questionnaire (Hinkin, 1998; Hinkin et al., 1997). Questionnaire is the most frequently data collection method in the field research setting, especially for social science studies (Sekaran & Bougie, 2009). The questionnaire contains a set of questions to measure individual behaviors based on psychometric properties (Schwab, 2013). Questionnaire administration consists of three aspects: sample size, respondents, and procedures.

3.2.1 Sample Size

In order to determine the sample size, two perspectives are taken into account. The first aspect is the understanding of the nature of this study. As explained in the opening section, the primary objective of this study is to develop a scale to measure the responsible innovation behavior. To the best of my knowledge, this study is the first that develops such measure. Thus, it is reasonable to consider this study as a preliminary (pilot-testing) research (L. A. Clark & Watson, 1995). This view implies that the outcome obtained from this study should be seen as an initial result to understand an individual behavior in regards to responsible innovation in the business context. A consideration to see this study as a pilot testing research is useful to determine the required sample size. According to L. A. Clark and Watson (1995), a preliminary pilot testing research should have a sample size of 100 – 200 respondents.

Another aspect to determine the sample size is by taking into account the data analysis methodology that is used. In this study, the data is analyzed using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In this regards, both EFA and CFA require a sample size of 200 at the minimum (DeCoster, 1998; Fabrigar, Wegener, MacCallum, & Strahan, 1999; Hair et al., 2014; Hoelter, 1983).

3.2.2 Respondents

Another important factor in questionnaire administration is selecting respondents (Reise, Waller, & Comrey, 2000). In this case, I have considered the heterogeneity of the respondents themselves. Heterogeneity is important to ensure replicable factors. Related to this, Reise et al. (2000, p. 290) explain that "the standard pool of undergraduates may be suitable when undergraduates manifest sufficient heterogeneity with respect to trait standing". The trait that would be identified in this study is innovative and ethical behavior. For the former one, Rodgers (1995) stated that innovativeness are bell-shaped across population. Thus, Goldsmith and Foxall (2003) have explained that innovativeness is the global personality traits. The association between student and innovative behavior can be found, for example, in the work of Chye Koh (1996). This idea indicates that the use of university students as an object of this study would not break the heterogeneity effect.

Another behavior that is associated in this study is the ethical behavior. However, little is known about the heterogeneity of respondents in regards to ethical behavior. Related to this, Randall and Fernandes (1991) has explained that the ethics research has a greater threat of response bias. It implies that, regardless of the type of respondents (university students or non-university students), respondents are likely to express the social desirability behavior.

In addition, the use of university students is also suitable for two other reasons. First, according to L. A. Clark and Watson (1995), university students are considered to be acceptable for a pilot testing research. Next, the use of students could bring a practical advantage. Druckman and Kam (2009) explained that students were relatively common to survey experiment than non-student participants.

3.2.3 Procedures

Based on the explanation above, a survey were administered to 244 students from Erasmus University of Rotterdam (EUR). Of all respondents, 36.885% was male, while 63.115% was female. They were invited to take part in this study in class. The survey was an online survey, i.e., they were given a link associated to a website to fill in the survey. The response rate was 100%. In order to ensure natural response from respondents, participation was voluntary. Before doing a survey, the participants were firstly debriefed. This study asked no name of respondent to promote the closure of ethical conduct in research activity. Participant's answers were confidentially assured.

3.3 INITIAL ITEM REDUCTION

After collecting the data from the survey, the next step is initial item reduction. This step is applied using factor analysis (Hinkin et al., 1997). In the scale development process, item reduction is used to get the stable structure that can best represent the measured construct. In order to derive the factor structure, factor analysis is applied in a large number of random half sample method (Field, 2009; Hair et al., 2014; Peter, 1979). The stability of the factor structure is then assessed using coefficient comparability (John E. Everett, 1983; James E. Everett & Entrekin, 1980; Nunnally, 1978).

3.3.1 Deriving Factor Structure

The factor structure derivation contains two methods. First, a random split half sampling method is applied as an initial structure assessment. Subsequently, the structure is assessed using a coefficient comparability. Figure 2 outlines these methods in detail.

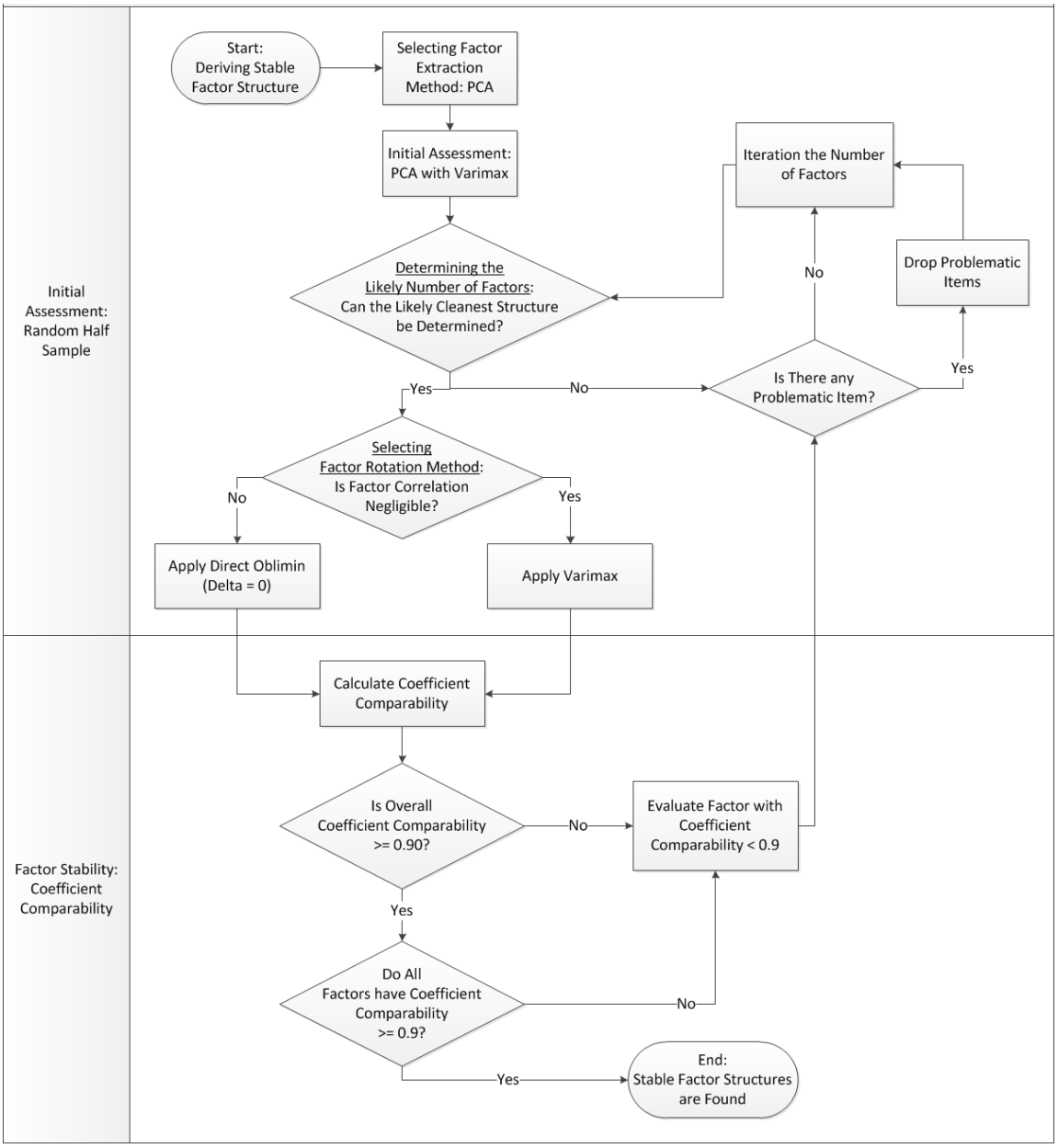

Figure 2. Deriving a stable factor structure

Random Split Half Sampling

In order to determine the factor structure, firstly, a random split half sampling method is applied. Random-half sampling method assesses internal consistency reliability of the construct (Field, 2009; Hair et al., 2014; Peter, 1979). Based on this method, a full sample is divided into two random groups: the first and the second group of random half sample. Each group consists about a half (50%) of the total sample.

Exploratory Factor Analysis (EFA) is applied to each random half samples (L. A. Clark & Watson, 1995). EFA is the most frequent method in the field of scale development (L. A. Clark & Watson, 1995; Hinkin et al., 1997; Worthington & Whittaker, 2006). In this case, EFA gives a benefit to determine how many reliable factors that can be interpreted from the data (B. G. Tabachnick, Fidell, & Osterlind, 2001). EFA

has “a rich tradition producing psychometrically sound instruments for applications in research, training, and practice” (Worthington & Whittaker, 2006, p. 806).

In both groups of random half sample, an identical factor extraction method is performed. For example, if Principal Component Analysis (PCA) with Varimax Rotation is applied in the first half group, PCA with Varimax Rotation will also be applied in the second half group.

It is important to note that the random half sampling method can be applied with many stratums (stratified random half sampling) (Allahbakhsh, Ignjatovic, Benatallah, Bertino, & Foo; McCarthy, 1969; Rao & Shao, 1996). One stratified sample indicates a division of the full sample, t, into two random half samples: t_1 and t_2. Subsequently, two stratified sample means a separation of t_1 and t_2 into another two random half samples: t_{11}, t_{12}, t_{21}, and t_{22}. And so on, and so forth.

Based on this concept, every random half stratum will reduces the size of the random half sample. Many scholars, like Hair et al. (2014) and Field (2009), have explained that the shrink of the sample size affects to the suitability use of factor analysis. In order to assess the sample size suitability, I use a parameter called the KMO value. As I will explain later in Appendix 12 (part The Measure of Sampling Adequacy (MSA)), the KMO value is used to determine if the data has sufficient sample size to perform factor analysis. Kaiser (1974) has indicated that the KMO = .80s is meritorious, while the KMO = .70s is middling (please see Appendix 12). Therefore, before determining how many stratum that could be applied, the KMO value is assessed in every stratum of the random half sampling.

- One stratified random half sampling
  In this case, the full sample is divided into two groups. Each group consists of nearly 50% of the total sample. After checking 50 random half samples, the mean KMO value is .802 and the standard deviation is .026.
- Two stratified random half sampling
  In this case, the full sample is divided into four groups. Every group consists of nearly 25% of the total sample. After checking 50 random half samples, the mean KMO value is .753 and the standard deviation is .051.

The result above shows that one stratified random half sampling has an average KMO value of .802, while two stratified random half sampling has an average KMO value of .753. It is very certain that if the number of stratum is increased, the KMO value will drop. Thus, following Kaiser’s suggestion, this study only applies one stratified random half sampling.

Selecting Factor Extraction Method

As explained before, Exploratory Factor Analysis (EFA) is applied in the random half sample. EFA consists of a number factor extraction methods (Costello & Osborne, 2005; Field, 2009; Hair et al., 2014; B. Williams, Onsman, & Brown, 2010). EFA works based on the composition of a variable’s variance. Based on the method on how the variance is classified, two EFA methods are widely used: Principal Component Analysis (PCA) and Principal Factor Analysis (PFA) (Field, 2009; Hair et al., 2014). Hair et al. (2014, p. 106) state that PFA is “often viewed as more theoretically based”, while PCA has more practical benefit. As a consequence, PCA becomes the most frequently method to do exploratory factor analysis (L. A. Clark & Watson, 1995; Hinkin et al., 1997; Worthington & Whittaker, 2006). There have been continuing debates about the suitability use of PCA and PFA in EFA, for which many believe that these debates will always remain (Gorsuch, 1990). However, some scholars have been reporting that these two methods produce a similar solution (Guadagnoli & Velicer, 1988; Velicer & Jackson, 1990).

This study applies PCA as the factor extraction method because of two reasons. First, according to B. G. F. Tabachnick, L.S. (2007), PCA is important for an initial analysis B. G. F. Tabachnick, L.S. (2007, p. 642) explains that "Most researchers begin their FA by using principal components extraction and varimax rotation". Second, the objective of the factor derivation in this study is initial item reduction. Regarding to this, Hair et al. (2014, p. 105) have explain that PCA is suitable if the "Data reduction is a primary concern".

Nevertheless, this study also conducts an assessment to check the suitability use of PCA as the factor analysis method. In order to do so, this study follows the argument from Gorsuch (1983). As mentioned by Hair et al. (2014), Gorsuch (1983) explains that both PCA and PFA will generate a similar result if the number of variables is more than 30 or the communalities are above .60 for most variables. Because this study has less than 30 variables, this study uses the communality to assess the suitability use of PCA as a factor analysis method.

Initial Assessment (PCA with Varimax)

In the factor derivation process, the initial assessment has two objectives: predicting "the likely number of factors" (B. G. F. Tabachnick, L.S., 2007, p. 642) and predicting the cleanest structure (Costello & Osborne, 2005). These predictions require a factor extraction and factor rotation processes. In order to determine the type of factor extraction and factor rotation method, this study follows a suggestion from B. G. F. Tabachnick, L.S. (2007, p. 642) who explains that "Most researchers begin their FA by using principal components extraction and varimax rotation". Building on this view, this study uses PCA with Varimax for this initial assessment.

Determining the likely number of factors

B. G. F. Tabachnick, L.S. (2007, p. 644) explains that "Selection of the number of factors is probably more critical than selection of extraction and rotational techniques or communality values". There are several ways to determine the number of factors. The common methods are Kaiser's criteria (Eigen value >= 1) and Scree Plot criteria. However, these criteria are not suitable in this study.

- This study uses the random half sample method. It is found that, in many cases, Kaiser's criteria cannot extract the same factor's structure between the two random half samples. In other words, the factor extraction cannot generate the same number of factors and cannot generate the same factors' component in the first and the second random half sample.
- In addition, it is also very likely that the two random half samples produce different Scree Plots. As a consequence, these two Scree Plots do not give the clarity about how many factors that should be retained.

As an alternative to Kaiser and Scree Plot criteria, this study determines the number of factors based on an iteration approach as suggested by scholars like Costello and Osborne (2005); Lorenzo-Seva and Ferrando (2006); Preacher and MacCallum (2003); B. Williams et al. (2010), and Yong and Pearce (2013). In general, this approach is based on the Eigen value and the Scree Plot criteria. Iteration approach is suitable for this study because it allows to manually set multiple number of factors to retain. Several scholars have also used the manual approach to determine the number of factors to be retained. For example, while creating the new personality scale, Donnellan, Oswald, Baird, and Lucas (2006, p. 194) use factor analysis and "forced a five-factor solution and exported the factor-loading matrix".

It is important to note that the iteration approach seems to be exhaustive because factor extraction have to be applied manually based on different number of factor settings. In order to address such issue, Costello and Osborne (2005) gives a practical guidance to predict the number of iteration that I should have. In this case, Costello and Osborne (2005, p. 3) have explained to run "once at the projected number based on the

a priori factor structure, again at the number of factors suggested by the Scree Test if it is different from the predicted number, and then at numbers above and below those numbers"

Determining the likely cleanest structure

In order to determine the likely number of factors, it is important to predict the likely cleanest structure. In order to do so, this study defines the cleanest structure if it has: "item loadings above .30, no or few item crossloadings, no factors with fewer than three items" (Costello & Osborne, 2005, p. 3).

In addition, Costello and Osborne (2005) have also recognized that there are conditions in which the structure is messy or uninterpretable. In such situation, they give the following advice.

> "Sometimes dropping problematic items (ones that are low-loading, crossloading or freestanding) and rerunning the analysis can solve the problem, but the researcher has to consider if doing so compromises the integrity of the data. If the factor structure still fails to clarify after multiple test runs, there is a problem with item construction, scale design, or the hypothesis itself, and the researcher may need to throw out the data as unusable and start from scratch" (Costello & Osborne, 2005, p. 3).

Selecting Factor Rotation Method

The previous section explains about the use of factor extraction method. In most cases, factor extraction alone is not enough to derive the factor structure (Hair et al., 2014). It is very common to apply a factor rotation after extracting the factors. Factor rotation is needed to "redistribute the variance from earlier factors to later ones to achieve a simpler, theoretically more meaningful factor pattern" (Hair et al., 2014, p. 111).

Generally, factor rotation can be classified into two types: orthogonal and oblique (Costello & Osborne, 2005; Field, 2009; Hair et al., 2014; B. Williams et al., 2010). Orthogonal and oblique rotations have several derivatives. By far, Varimax and Direct Oblimin are the most frequently used method respectively for orthogonal and oblique rotation (L. A. Clark & Watson, 1995; Hinkin et al., 1997; Worthington & Whittaker, 2006). Regarding to other oblique rotation methods, Costello and Osborne (2005, p. 3) have highlighted that "There is no widely preferred method of oblique rotation; all tend to produce similar results". In addition, it is important to know how these oblique methods allow the correlation between factors. In order to allow the correlation between factors, Direct Oblimin requires a setting of Delta value. Delta has a default value of 0. In addition, Costello and Osborne (2005, p. 3) also explains that the use of Delta = 0 is preferable.

Before determining what factor rotation method that will be used, this study takes into account following consideration. As the name suggests, orthogonal rotation does not allow any correlation between factors, while oblique rotation does. Orthogonal rotation is widely used because the result is easily interpreted. However, in social science, such uncorrelated thing rarely exists because "behavior is rarely partitioned into neatly packaged units that function independently of one another" (Costello & Osborne, 2005, p. 3). Thus, the conventional wisdom to use orthogonal rotation is considered as a weak argument. In a similar vein, Hair et al. (2014, p. 114) explain that Oblique Rotation "Are best suited to the goal of obtaining several theoretically meaningful factors or constructs, because, realistically, few constructs in the real world are uncorrelated".

Regarding the differences between the orthogonal and the oblique rotation method, Costello and Osborne (2005, pp. 6-7) have found that "Oblique rotation produced results nearly identical to the orthogonal rotation when using the same extraction method". However, they have pointed out an important point: "Since

oblique rotation will reproduce an orthogonal solution but not vice versa, we recommend oblique rotation" Costello and Osborne (2005, p. 7).

In regards to determining the factor rotation method, several scholars have proposed practical suggestions. For example, B. G. F. Tabachnick, L.S. (2007) suggests to look at the factor correlation that exceeds .320. In addition, as mentioned by Hair et al. (2014), Pedhazur and Schmelkin (1991) explain that the orthogonal rotation may be used if the correlation is negligible. Regarding to this, Hinkle, Wiersma, and Jurs (2003) (as cited by Mukaka (2012)) explain that the negligible correlation has an absolute value between .000 and .300. In addition, they consider that the correlation value of .300 and .500 as a low correlation; .500 and .700 as a moderate correlation; .700 and .900 as a high correlation; and .900 and 1.000 as a very high correlation.

Based on this guidance, this study firstly assesses the factor correlation to see if the orthogonal rotation is acceptable. In other words, this study checks the correlation between factors before determining the factor rotation method.

3.3.2 Coefficient Comparability

After determining the factor structures from two random half samples, this study calculates a coefficient comparability to assess the structure stability (John E. Everett, 1983; James E. Everett & Entrekin, 1980; Nunnally, 1978). Regarding to this Briggs and Cheek (1986, p. 119) have pointed out that "one of the chief considerations should always be the replicate of the factor structure. Factors that do not replicate are of little value". Coefficient comparability has been widely used to test the stability of the factor structure (Fabrigar et al., 1999; Zwick & Velicer, 1986). For example, Aaker (1997); McCrae and Costa (1987); and Conners, Sitarenios, Parker, and Epstein (1998) apply coefficient comparability while developing the personality and behavioral scale.

The factor extraction (and rotation) in the two random half samples produces two factor structures. Each of them yields its own factor score coefficient matrix. The cross-correlation of these factor score coefficient matrix will be used to determine the stability of the factor structures (John E. Everett, 1983). John E. Everett (1983) calls the cross-correlation of these factor score coefficient matrix as the coefficient comparability. John E. Everett (1983) recommends the coefficient comparability is acceptable if it is at least .90.

As mentioned in his paper, following steps are the method to obtain coefficient comparability (John E. Everett, 1983):

1. Split the total number of sample (t) into two groups: t_1 and t_2
2. Apply the (exploratory) factor analysis in the two groups. This factor analysis will extract the factors structure in every group

$$F_t = S_t \cdot V_t \quad \text{Equation 1}$$

$$F_1 = S_1 \cdot V_1 \quad \text{Equation 2}$$

$$F_2 = S_2 \cdot V_2 \quad \text{Equation 3}$$

F: factor scores of variables V

V: variables

S: factor score coefficent

3. Apply S_1 and S_2 in the total sample, t. It will produce factors scores F_{1t} and F_{2t} for the total sample.
4. The cross-correlation between F_{1t} and F_{2t} is called coefficient comparability.

3.4 SCALE VALIDATION

After carefully following initial item reduction process in the previous section, it is needed to assess the validity of the new scale (Hinkin et al., 1997). Several statistical methods are applied to assess the validity of the scale. At first, the structure is tested using several factor extraction and factor rotation methods in a full sample mode. Next, Confirmatory Factor Analysis (CFA) and Multi-regression Analysis (MRA) are applied to assess the convergent and discriminant validity. MRA is also used to assess nomological validity. The internal consistency assessment (Cronbach's Alpha) is discussed in CFA section.

3.4.1 Factor Extraction and Rotation in Full Sample Mode

After the factor structure is obtained from the random half sampling method, it is tested in the full sample to see if this factor structure could hold in the full sample. Four combination of factor extraction and factor rotation methods were applied: Principal Component Analysis (PCA) with Varimax Rotation, PCA with Direct Oblimin Rotation, Principal Axis Factoring (PAF) with Varimax Rotation, and PAF with Direct Oblimin Rotation. These factor extraction and factor rotation methods are among the common methods that is used by scholars while developing a new scale (L. A. Clark & Watson, 1995; Hinkin et al., 1997; Worthington & Whittaker, 2006).

3.4.2 Confirmatory Factor Analysis

Second, the factor structure is tested using Confirmatory Factor Analysis (CFA). The role of CFA to validate EFA can be explained as follows. As explained in previous section, EFA is useful to generate the factor structure. This factor structure is useful to generate a theory or to develop a model. In this point, CFA can be used as to assess the theory and the model that are generated from EFA (L. A. Clark & Watson, 1995; Hinkin et al., 1997; Jöreskog & Sörbom, 1993; B. G. Tabachnick et al., 2001; Worthington & Whittaker, 2006). In other words, CFA "can be used to confirm the measurement model developed using EFA." (Hair et al., 2014, p. 617). CFA is important to assess the convergent validity and discriminant validity (Hair et al., 2014).

3.4.3 Multi-Regression Analysis

Another method to assess the construct validity of the new scale is by comparing it with the existing scales (L. A. Clark & Watson, 1995). As argued by L. A. Clark and Watson (1995, p. 318) "Correlations of a test with theoretically relevant criteria still constitute crucial evidence of validity, and there is no reason to avoid examining these correlations even in the early stages of scale development". Comparison between the new scale and the existing scales can be applied using Multi-Regression Analysis (MRA). In this case, MRA is useful to assess the convergent, discriminant, and nomological validity (Gatignon, Tushman, Smith, & Anderson, 2002; Hair et al., 2014; Hinkin et al., 1997). This study uses several existing scales that are related with the responsible innovation concept (see Section 5.5).

3.5 STATISTICAL SOFTWARES

In order to perform statistical analysis, this study uses two softwares: SPSS and AMOS. The former is mainly used for exploratory factor analysis and multi-regression analysis, while the latter is used for confirmatory factor analysis (Barbara, 2001; Field, 2009).

3.6 CONCLUSION OF THE METHODOLOGY

This chapter have explained a methodology to develop a scale that can measure individual behavior in regards to responsible innovation in the business context. From the responsible innovation and creativity literatures, four behaviors are hypothesized: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization. These behaviors are measured using a questionnaire that consists of 12 questions and are assessed using a 7-Likert Scale. In the data gathering process, this questionnaire is administered to 244 students from Erasmus University Rotterdam.

Subsequently, the survey result is analyzed using several statistical methods. Firstly, this study applies EFA to derive the factor structure. This method is conducted in a large number of random half samples. Next, the coefficient comparability is used to measure the stability of factor structure.

In order to validate the finding from factor derivation, the acquired stable structure is validated using multiple statistical approaches in a full sample mode: PCA with Varimax, PCA with Direct Oblimin, PAF with Varimax, PAF with Direct Oblimin, Confirmatory Factor Analysis (CFA), and Multi-Regression Analysis (MRA).

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CHAPTER 4
INITIAL ITEM REDUCTION

"In much of society, research means to investigate something you do not know or understand" - Neil Armstrong

Following the methodology in previous chapter, this chapter talks over the initial item reduction to derive a stable factor structure. This chapter starts with a data examination. After that, statistical assumptions are checked before applying EFA to derive the factor structure. It is followed by a discussion about the general discussion about data analysis process.

4.1 EXAMINING THE DATA

In this study, the data was analyzed based on several multivariate data analysis techniques. It is important to note that these techniques may not be started without carefully examining the data. Data examination is essential to make sure that the researcher gain critical insight about the data characteristics (Hair et al., 2014). In the context of multivariate data analysis, these characteristics allows the researcher (1) to understand relationship between the data and (2) to ensure that the data satisfy with all the multivariate data analysis requirements. According to this view, data examination is seen as "investments" to certify that "the results obtained from the multivariate analysis are truly valid and accurate" (Hair et al., 2014, p. 35).

Data examination consists of three steps: evaluation of missing data, identification of outliers, and testing the assumptions underlying the most multivariate techniques. A careful analysis in Appendix 7, Appendix 8, and Appendix 11 respectively conclude that the missing data, outliers, and statistical assumptions are not issue in this study.

4.2 EXPLORATORY FACTOR ANALYSIS 1: ASSUMPTION CHECKING

Besides general data examination in the previous section, EFA requires an initial checking to assess if the variables meet the statistical assumptions to perform EFA. These assumptions are needed to ensure that representative factors can be extracted from the data (Hair et al., 2014). The discussion in Appendix 12 finds that all Ris variables meet the statistical assumptions to apply EFA. However, it is interesting to note that two variables are "suspicious" and are needed to be aware of. The summary of EFA assumptions checking is shown in Table 4.

Table 4. Resume of factor analysis assumptions in Ris variables

Assessment		Aggregate	Individual Variables
Correlation		Most of the correlation values is above .300	Ris03_Reencoded has nine correlation values that are less than |.300|
			Ris11_Reencoded has ten correlation values that are less than |.300|
Significance of Correlation Value		Most of the correlation values is significant	Ris03_Reencoded has three correlation values that are not significant
			Ris11_Reencoded has nine correlation values that are not significant
			Ris04_Reencoded has two correlation values that are not significant
			Ris07_Reencoded has two correlation values that are not significant
The Measure of Sampling Adequacy		KMO value is great (.830)	Ris03_Reencoded and Ris11_Reencoded have miserable KMO values: .601 and .552 respectively
The Bartlett' Test		R-matrix is significantly different with the identity matrix	-
Multicollinearity	Correlation	-	Data is not a subject of multicollinearity: none of the variables have correlation > |.800|
	Haitovsky	The determinant value is not subject of multicollinearity	-

4.3 EXPLORATORY FACTOR ANALYSIS 2: DERIVING THE FACTOR STRUCTURE

As the data have met all statistical assumptions to apply factor analysis, this section provides a data analysis to derive the factor structure in Ris variables. This factor derivation follows a flow chart in Figure 2.

4.3.1 Step 1

This step starts by analyzing all Ris' variables.

Determining the Likely Number of Factors

Following the scheme in Figure 2, I firstly needed to determine the likely number of factors. PCA with Varimax was manually applied in different number of factors. In order to predict the range in which the number of factors is likely to occur, I followed a suggestion from Costello and Osborne (2005) (please also see Section 3.3.1): try once based on a priori factor structure, once based on the Scree Test, and each at numbers above and below those numbers.

A priory theory (Section 3.1) reveals that the structure consists of four factors, while the Scree Test shows that there is three factors. Based on this insight, PCA with Varimax was applied and manually setting the number of factors ranging from 2 to 5. In every number of factor setting, I run a 50-pair random half sample was applied. Interestingly, the result shows that none of these settings could give a hint the likely number of factors that should be retained. It implies that the current factor structure is really not stable. Nevertheless, after a thorough inspection, I found that two factors already had relatively constant components. In this case:

- Factor 1: Ris01 and Ris02
- Factor 2: Ris03_Reencoded and Ris11_Reencoded

Besides these two factors, other factors do not have stable components. Therefore, in Step 1, I did not check coefficient comparability of the overall structure. Instead, Cronbachs' Alpha was used as an assessment to check these factors. In a 50-pair random half sample, the Cronbachs' Alpha of Factor 1 is good (mean = .758; Standard Deviation = .404), while the Cronbachs' Alpha of Factor 2 is not acceptable (mean = .580; Standard Deviation = .068). This finding allowed me to eliminate, Ris03_Reencoded and Ris11_Reencoded in the upcoming steps.

It is important to note that the decision to eliminate Ris03_Reencoded and Ris11_Reencoded follows the flow chart in Figure 2. In this case, Costello and Osborne (2005) suggest to drop the problematic items if the loading tables are uninterpretable (see Section 3.3.1).

4.3.2 Step 2

This step starts with ten remained factors: Ris01, Ris02, Ris04, Ris05, Ris06, Ris07, Ris08, Ris09, Ris10, and Ris12.

Determining the Likely Number of Factors

Following a scheme in Figure 2, I needed to determine the likely number of factors. A priory theory says that the structure consists of four factors, while the Scree Test using PCA with Varimax predicts that the structure consists of two until three factors.

Based on this information, PCA with Varimax was manually applied by setting the number of factors manually between 2 and 5. In every number of factor settings, a 50-pair random half sample was applied. However, the results showed that none of the number factor settings could predict the likely number of factors. Therefore, PCA with Varimax was applied by manually setting the number of factors = 6. The result showed that the number of factors = 6 gave the cleanest structure. These factor structures are:

Factor 1 = Ris01 and Ris02
Factor 2 = Ris09 and Ris10
Factor 3 = Ris05 and Ris06
Factor 4 = Ris04 and Ris08
Factor 5 = Ris07
Factor 6 = Ris12

Selecting the Factor Rotation Method

In order to determine the factor rotation method, I needed to check the correlation between factors. The result showed several correlation values of more than |.30|. This finding implies that factor inter-correlation is not negligible. Therefore, Direct Oblimin (Delta = 0) was applied as the factor rotation method.

Calculate Coefficient Comparability

Next, the coefficient comparability was checked in a 50-pair random half sample. The descriptive statistics of this assessment is provided in Table 5. I allow interested readers to check the detailed findings in Table 58 (Appendix 13).

Table 5. Descriptive statistics of coefficient comparability in Step 2

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Average	.965	.907	.926	.912	.881	.867
Std. Dev.	.039	.117	.052	.065	.120	.099
Max	.997	.995	.990	.995	.980	.983
Min	.776	.381	.768	.662	.446	.530
Total*	3	12	11	16	19	26
Percentage*	6.00%	24.00%	22.00%	32.00%	38.00%	52.00%

Note.
Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris07
Factor 6: Ris12
* Coefficient Comparability <= .90

Evaluating Factor with Coefficient Comparability < .90

Table 5 shows that two factors (Factor 5 and Factor 6) have coefficient comparability less than .90. However, since these factors only consist of one item (Factor 5 only consists of Ris07; Factor 6 only consists of Ris12), I could not check the Cronbach's Alpha of these factors. Therefore, these factors were analyzed separately in the next analysis.

Assessing the Suitability of PCA

Before continuing to the next step, the use of PCA in this step needed to be assessed for suitability. According to Hair et al. (2014), PCA will give a similar result with PFA if the number of variables is more than 30 or the communality is at least .60 for most variables. Since the Ris contains less than 30 variables, then the communality needed to be measured.

In order to check the communality in the random half samples, data from 100 random half samples that was used in this step were collected and the average and standard deviation value of communality in every variables were measured. The result in Table 59 (Appendix 13) shows that all variables have communality above .60.Therefore, it can be safely assumed that the use of PCA in this random half sample would give a similar result with the use of PFA.

4.3.3 Step 3

This step starts with nine remained factors: Ris01, Ris02, Ris04, Ris05, Ris06, Ris07, Ris08, Ris09, and Ris10.

Determining the Likely Number of Factors

Following the scheme in Figure 2, I firstly needed to determine the likely number of factors. A priory theory says that the structure consists of four factors, while the Scree Test using PCA with Varimax implies that the structure consists of two factors.

Based on this information, PCA with Varimax was applied by setting the number of factors manually from 2 until 5. In every number of factor settings, a 50-pair random half sample was applied. The result indicated that the number of factors = 5 gave the cleanest structure. This factor structure contains:

Factor 1 = Ris01 and Ris02
Factor 2 = Ris09 and Ris10
Factor 3 = Ris05 and Ris06
Factor 4 = Ris04 and Ris08
Factor 5 = Ris07

Selecting the Factor Rotation Method

In order to determine the factor rotation method, I needed to check the correlation between factors. The result showed several correlation values of more than |.30|. This result implies that the inter-correlation between factors is not negligible. Therefore, Direct Oblimin (Delta = 0) was applied as the factor rotation method.

Calculate Coefficient Comparability

Next, I checked the coefficient comparability in a 50-pair random half sample. Table 6 provides the descriptive statistics of this assessment. Interested reader is referred to Table 60 (Appendix 13) to find the detailed findings.

Table 6. Descriptive statistics of coefficient comparability in Step 3

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Average	.962	.953	.938	.919	.908
Std. Dev.	.089	.062	.055	.095	.077
Max	.998	.995	.990	.996	.993
Min	.354	.688	.722	.496	.545
Total*	1	6	8	10	15
Percentage*	2.00%	12.00%	16.00%	20.00%	30.00%

Note.
Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris07
* Coefficient Comparability <= .90

Evaluating Factor with Coefficient Comparability < .90

Table 6 shows that Factor 5 is vulnerable to create a stable structure. However, since this factor only consists of one item (Ris07), the Cronbach's Alpha of these factors could not be checked. Therefore, Ris07 was dropped in the next analysis.

Assessing the Suitability of PCA

Before continuing to the next step, the use of PCA needed to be assessed for suitability. Following the discussion in Step 2, data from 100 random half samples that was used in this step was collected and the average and standard deviation value of communality in every variables was measured. The result Table 61 (Appendix 13) reveals that all variables have communality above .60. Therefore, I can safely assume that the use of PCA in this random half sample will give similar result with the use of PFA.

4.3.4 Step 4

This step starts with eight factors: Ris01, Ris02, Ris04, Ris05, Ris06, Ris08, Ris09, and Ris10.

Determining the Likely Number of Factors

Following the scheme in Figure 2, I firstly needed to determine the likely number of factors. I manually applied PCA with Varimax in different number of factors. A priory theory says that the structure consists of four factors, while the Scree Test using PCA with Varimax implies that the structure consists of two and three factors.

Based on this information, PCA with Varimax was applied by setting the number of factors manually from 2 until 5. In every number of factor settings, a 50-pair of random half sample was applied. The result indicated that the number of factors = 5 gave the cleanest structure. This factor structure is:

Factor 1 = Ris01 and Ris02
Factor 2 = Ris09 and Ris10
Factor 3 = Ris05 and Ris06
Factor 4 = Ris04 and Ris08
Factor 5 = Ris12

Selecting the Factor Rotation Method

In order to determine the factor rotation method, the correlation between factors needed to be checked. The result showed several correlation values of more than |.30|. This finding implies that the inter-correlation between factors is not negligible. Therefore, Direct Oblimin (Delta = 0) was applied as the factor rotation method.

Calculate Coefficient Comparability

Next, the coefficient comparability in 50 pairs of random half samples was checked. The detail descriptive of this assessment is provided in Table 7. Interested readers may find the detailed findings in Table 62 (Appendix 13).

Table 7. Descriptive statistics of coefficient comparability in Step 4

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Average	.973	.882	.931	.951	.847
Std. Dev.	.024	.131	.099	.044	.156
Max	.998	.996	.992	.994	.973
Min	.864	.409	.389	.797	.147
Total*	2	20	3	6	27
Percentage*	4.00%	40.00%	6.00%	12.00%	54.00%

Note.
Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris12
* Coefficient Comparability <= .90

Evaluating Factor with Coefficient Comparability < .90

Table 7 shows that Factor 5 does not have an acceptable coefficient comparability. However, since this factor only consists of one item (Ris07), the Cronbach's Alpha of these factors could not be checked. Therefore, Ris07 was dropped in the next analysis.

Assessing the Suitability of PCA

Before continuing to the next step, the use of PCA in this step needed to be assessed for suitability. In order to check the communality in the random half samples, data from 100 random half samples that was used in this step was collected and the average and standard deviation value of communality in every variables was measured. The result in Table 63 (Appendix 13) shows that all variables have communality more than .60.Therefore, I can safely assume that the use of PCA in this random half sample will give similar result with the use of PFA.

4.3.5 Step 5

This step starts with eight factors: Ris01, Ris02, Ris04, Ris05, Ris06, Ris08, Ris09, and Ris10.

Determining the Likely Number of Factors

Following the scheme in Figure 2, I firstly needed to determine the likely number of factors. A priory theory says that the structure consists of four factors, while the Scree Test using PCA with Varimax implies that the structure consists of two and three factors.

Based on this information, PCA and Varimax was applied by setting the number of factors manually from 2 until 5. In every number of factor settings, a 50-pair random half sample was applied. The result indicated that he number of factors = 4 gives the cleanest number of factors. This factor structure contains:

Factor 1 = Ris01 and Ris02
Factor 2 = Ris09 and Ris10
Factor 3 = Ris05 and Ris06
Factor 4 = Ris04 and Ris08

Selecting the Factor Rotation Method

In order to determine the factor rotation method, the correlation between factors needed to be checked. The result showed several correlation values of more than |.30|. This result implies that the factor correlations is not negligible. Therefore, Direct Oblimin (Delta = 0) was applied as the factor rotation method.

Calculate Coefficient Comparability

Next, the coefficient comparability in 50 pairs of random half samples was checked. The detail descriptive of this assessment is provided in Table 8. Interested readers may find the detailed findings in Table 64 (Appendix 13).

Table 8. Descriptive statistics of coefficient comparability in Step 5

	Factor 1	Factor 2	Factor 3	Factor 4
Average	.984	.970	.949	.966
Std. Dev.	.012	.023	.046	.040
Max	.997	.994	.993	.996
Min	.922	.890	.719	.820
Total*	0	2	5	4
Percentage*	.000%	4.00%	10.00%	8.00%

Note.
Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
* Coefficient Comparability <= .90

Evaluating Factor with Coefficient Comparability < .90

Table 8 shows that all factors have an acceptable coefficient comparability. Therefore, this factor structure will be retained.

Assessing the Suitability of PCA

Before continuing to the next step, the use of PCA needed to be assessed for suitability. In order to check the communality in the random half samples, data from 100 random half samples that was used in this step was collected and the average and standard deviation value of communality in every variables was measured. The result in Table 65 (Appendix 13) shows that all variables have communality more than .60.Therefore, I can assume say that the use of PCA in this random half sample will give similar result with the use of PFA.

4.4 DISCUSSION OF FACTOR DERIVATION

The factor derivation in this chapter shows that four variables are eliminated from the preliminary responsible innovation scale. In order to give a clear understanding, the section that follows offers a discussion about this elimination.

4.4.1 Elimination of Ris03_Reencoded and Ris11_Reencoded

Ris03_Reencoded and Ris11_Reencoded were eliminated from Ris scale since Step-1 (Section 4.3.1). I notice that there are some reasons behind this elimination. First, these variables seems to ignore basic principles of item writing (L. A. Clark & Watson, 1995). In this case, these variables contain the term that virtually everyone (or no one) will endorse. Ris03_Reencoded and Ris11_Reencoded respectively contain 'much more interest' and 'no particular interest'. The content of 'no particular' in Ris11_Reencoded implies an absolute expression. Schwab (2013) have explained that the use of absolute wordings (e.g., always, never) should be avoided because it would make a logical problem. Thus, such expressions is likely to make the sentence that includes them to be false. Besides, it is found that Ris03_Reencoded has a poor psychometric properties because it contains double-barreled items. In this case, Ris03_Reencoded compares "originality" and "ethical side". Scholars have argued that idea originality is an example on how ethical perspective is applied (Anderson & Obenshain, 1994; Buckley, Wiese, & Harvey, 1998; Lawson, 2004; Taylor, 1992). Therefore, the concept of idea originality is associated with ethical perspective. As a consequence, it is likely that Ris03_Reencoded creates a heterogeneity of respondents' interpretation.

Second, it is also found that negative wording in these variables is problematic from descriptive statistics perspective. Table 55 shows that these negatively worded items have a standard deviation that is larger (average SD = 1.405) than the positively worded items (average SD = 1.119). Statistical finding in the negatively worded items has also observed by Benson and Hocevar (1985); M. Hankins (2008); Parasuraman, Berry, and Zeithaml (1991). The wider variation (SD) in negative worded items implies that the respondents might relatively be more confused with such items than what they feel to the positively worded items (Parasuraman et al., 1991). It somehow indicates a response bias (M. Hankins, 2008). In this case, the differences in sematic complexity leads the respondents to be more straightforward in the positively worded item (McKay, Boduszek, & Harvey, 2014).

Third, empirical finding displays that Cronbach's Alpha value of the original scale can be improved if these variables are eliminated (see Table 66 in Appendix 14). Low Cronbach's Alpha value indicates that the respondents think as if these variables are related to the same construct. This finding is in line with a study from Barnette (1999, 2000). He have observed that the use of certain patterns (negative worded items in this case) "have strong effects on Cronbach's alpha coefficient" (Barnette, 2000, p. 367). In addition, scholars like Schriesheim and Hill (1981), Chamberlain and Cummings (1984), and Schriesheim, Eisenbach, and Hill (1991) point out that the Cronbach's Alpha value would be higher if the survey uses positively worded items.

The fourth argument is more of "a philosophical" argument. Several scholars argue that negatively worded items are useful to get the respondents focus on the survey (Nunnally, 1978; Rossi, Wright, & Anderson, 2013). However, other scholars have also pointed out that this condition is not necessarily needed. In this respect, Barnette (2000, p. 362) explains that in a circumstance where the respondents are considered as a willing participants, "the need for such a practice would seem to be minimal and may actually be detrimental to the validity and reliability of survey scores". Building on this view, it can be argued that there is little chance that the student did not willing to participate in the survey because the respondents consisted of students who were taking statistical class.

Next, scholars have found that negatively worded items could have a detrimental effect in the factor analysis (Barnette, 2000; Schmitt & Stuits, 1985). Schmitt and Stuits (1985), for example, find that "when only 10% of the respondents are careless in this fashion, a clearly definable negative factor is generated" (Schmitt & Stuits, 1985, p. 367). Related to this, Benson and Hocevar (1985) and Benson (1987) have highlighted that negatively worded items usually create a factor structure that is different with the positive worded items. In

other words, it is very likely that the positive and negatively worded items are loaded into different factors (Knight, Chisholm, Marsh, & Godfrey, 1988; Pilotte & Gable, 1990). Such finding implies that the respondents think as if these items are related to the same construct. It could then explain why Ris03_Reencoded and Ris11_Reencoded are loaded into the same factor.

In addition, it might be the case that during the item development, it was not expected that university students could be a subject to response bias due to the negatively worded items. In fact, using a sample of 757 students from two universities, a study from DiStefano and Motl (2006) have observed the presence of this bias. Similar result has also found in the work of Sheasby, Barlow, Cullen, and Wright (2000) and Greenberger, Chen, Dmitrieva, and Farruggia (2003).

4.4.2 Elimination of Ris07 and Ris12

Factor derivation process also eliminated Ris07 and Ris12. Either Ris07 or Ris12 cannot make a stable structure with other variables. There are many cross-loadings caused by these variables. It indicates that these variables do not share the common variance with other variables (Hair et al., 2014).

4.4.3 Stable Factor Structure

Using coefficient comparability to assess the factor stability in a large number of random half sample, it was found that four factors form a stable structure in responsible innovation scale. Based on the similarity in the item's content, I offer a name of every factor as follows:

- Factor 1: Responsible Idea Generation
  - Ris01: I am good at coming up with ideas that are novel, but also right
  - Ris02: I find it easy to generate original solutions that reflect how the problem at hand ought to be solved
- Factor 2: Responsible Idea Realization
  - Ris09: Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me
  - Ris10: I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements
- Factor 3: Responsible Fluency
  - Ris05: Producing large numbers of solutions for a better future comes natural to me
  - Ris06: I am good at generating many ideas that capture the responsible side of innovation
- Factor 4: Responsible Flexibility
  - Ris04: I have a knack for coming up with many ethical solutions to a problem
  - Ris08: It is important to me to explore the various ethical aspects of my ideas

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CHAPTER 5
SCALE VALIDATION

"If we knew what it was we were doing, it would not be called research, would it?" - Albert Einstein

The structure derivation in Chapter 4 shows that the responsible innovation scale consists of eight items (questions) that represent four factors. Unless stated otherwise, this factor structure is called Ris_Model1. In order to assess the validation of this structure, this study applies several statistical methods.

5.1 DESCRIPTIVE STATISTICS

Table 9 and Table 10 show that the mean value of Ris_Model1 in in the single variable level, factor level, and aggregate level. This finding indicates that respondents have a relatively high responsible innovation behavior (the neutral value is 4.0). It is in line with findings from several ethical and creativity measures (Fraedrich, 1993; Lu & Lin, 2014; Tierney & Farmer, 2002). The correlation between variables also indicates a good value (> .30) (Hair et al., 2014).

Table 9. Descriptive statistics of Ris_Model1 per variables (N = 244)

	Mean	Std. Deviation	1.	2.	3.	4.	5.	6.	7.	8.
1. Ris01	4.709	0.974	-							
2. Ris02	4.553	1.039	.615**	-						
3. Ris04	4.201	1.157	.264**	.246**	-					
4. Ris05	4.246	1.153	.405**	.274**	.475**	-				
5. Ris06	4.434	1.118	.430**	.426**	.470**	.670**	-			
6. Ris08	4.537	1.238	.239**	.197**	.542**	.362**	.437**	-		
7. Ris09	4.582	1.209	.344**	.267**	.293**	.343**	.442**	.357**	-	
8. Ris10	4.623	1.076	.433**	.360**	.359**	.470**	.568**	.381**	.539**	-
Ris_Model1	4.486	.773								

Note. ** Correlation is significant at the .01 level (2-tailed).

Table 10. Descriptive statistics of Ris_Model1 per factors (N = 244)

	Mean	Std. Deviation	1.	2.	3.	4.
1. Responsible Idea Generation	4.631	.905	-			
2. Responsible Idea Realization	4.603	1.002	.440**	-		
3. Responsible Idea Fluency	4.340	1.038	.465**	.562**	-	
4. Responsible Idea Flexibility	4.369	1.052	.298**	.450**	.541**	-

Note. ** Correlation is significant at the .01 level (2-tailed).

5.2 RELIABILITY ANALYSIS

Reliability is a measure to assess the consistency of the questionnaire (Field, 2009). This study assesses reliability using Cronbach's Alpha value in both full sample and half sample mode (Cronbach, 1951). Table 11 shows that the Ris_Model1 has an acceptable reliability value (Cronbach's Alpha > .700).

Table 11. Reliability statistics of Ris_Model1

		Responsible Idea Generation	Responsible Idea Realization	Responsible Fluency	Responsible Flexibility	Ris_Model1
Full sample		.761	.698	.802	.702	.841
Half-sample*	Average	.758	.696	.801	.702	.837
	Std. Dev.	.040	.039	.029	.042	.024

Note. * Half-sample in 50 random-half samples

5.3 VALIDITY 1: FACTOR EXTRACTIONS WITH ROTATIONS IN FULL SAMPLE

5.3.1 Validity 1.1: PCA with Varimax in Full Sample

In this assessment, PCA with Varimax is applied to check the factor structure in the full sample. Table 12 shows communality before and after the factor extraction. Communality indicates the proportion of common variance in a variable. PCA works based on the assumption that the total variance only consists of common variance (the specific or error variance is neglected). Therefore, before factor extraction, every variable has communality = 1. The column 'Extraction' provides a better insight about the percentage of common variance in every variable after factor extraction. The result shows that every variable has communality above .700, which is good (Hair et al., 2014).

Table 12. Communality using PCA with Varimax in full sample

	Initial	Extraction
I am good at coming up with ideas that are novel, but also right	1.000	.779
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	1.000	.848
I have a knack for coming up with many ethical solutions to a problem	1.000	.778
Producing large numbers of solutions for a better future comes natural to me	1.000	.876
I am good at generating many ideas that capture the responsible side of innovation	1.000	.779
It is important to me to explore the various ethical aspects of my ideas	1.000	.830
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	1.000	.853
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	1.000	.720

Table 13 shows that the factor extraction and rotation method have improved the factor structure. In column 'Extraction Sums of Squared Loadings', the biggest percentage of variance are loaded into Factor 1. However, after the rotation, the factor structure are being optimized. In this case, the relative importance of four factors (percentage of total variance) is distributed relative equally.

Table 13. Total variance explained using PCA with Varimax in full sample

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.836	47.950	47.950	3.836	47.95	47.95	1.704	21.296	21.296
2	1.126	14.076	62.025	1.126	14.076	62.025	1.685	21.062	42.358
3	.802	10.027	72.052	.802	10.027	72.052	1.548	19.354	61.712
4	.698	8.719	80.771	.698	8.719	80.771	1.525	19.059	80.771
5	.442	5.526	86.297						
6	.423	5.284	91.581						
7	.407	5.083	96.664						
8	.267	3.336	100.000						

Table 14 shows the rotated factor (component matrix). This matrix provides the information about the factor loadings: association between variables and their associated factor. The substantive factor loadings in this structure shows that the items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007).

Table 14. Rotated component matrix using PCA with Varimax in full sample

	Component			
	1	2	3	4
Producing large numbers of solutions for a better future comes natural to me	**.887**	.145	.209	.152
I am good at generating many ideas that capture the responsible side of innovation	**.726**	.280	.266	.321
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	.109	**.901**	.114	.107
I am good at coming up with ideas that are novel, but also right	.239	**.818**	.079	.215
It is important to me to explore the various ethical aspects of my ideas	.095	.080	**.858**	.279
I have a knack for coming up with many ethical solutions to a problem	.370	.129	**.789**	.040
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.115	.134	.175	**.889**
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	**.401**	.252	.158	**.686**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007)

5.3.2 Validity 1.2: PCA with Direct Oblimin (Delta = 0) in Full Sample

Table 15 shows the same value with Table 12 because communality is not affected by rotation method.

Table 15. Communality using PCA with Direct Oblimin (Delta = 0) in full sample

	Initial	Extraction
I am good at coming up with ideas that are novel, but also right	1.000	.779
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	1.000	.848
I have a knack for coming up with many ethical solutions to a problem	1.000	.778
Producing large numbers of solutions for a better future comes natural to me	1.000	.876
I am good at generating many ideas that capture the responsible side of innovation	1.000	.779
It is important to me to explore the various ethical aspects of my ideas	1.000	.830
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	1.000	.853
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	1.000	.720

Like other oblique rotation methods, Direct Oblimin generates a pattern matrix (Table 16) and a structure matrix (Table 17). The substantive factor loadings in the pattern matrix and the structure matrix show that the items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample. The cross-loading between factors might be ignored in this case. This view follows Costello and Osborne (2005, p. 4) who define cross-loading item as "an item that loads at .32 or higher on two or more factors".

Table 16. Pattern matrix using PCA with Direct Oblimin (Delta = 0) in full sample

	Component			
	1	2	3	4
Producing large numbers of solutions for a better future comes natural to me	**.936**	-.026	.005	.027
I am good at generating many ideas that capture the responsible side of innovation	**.690**	.124	-.175	.093
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	-.079	**.960**	.054	.033
I am good at coming up with ideas that are novel, but also right	.080	**.830**	-.067	-.040
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	-.050	-.011	**-.926**	.054
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	.290	.101	**-.645**	-.005
It is important to me to explore the various ethical aspects of my ideas	-.122	-.005	-.157	**.896**
I have a knack for coming up with many ethical solutions to a problem	.234	.039	.142	**.791**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007)

Table 17. Structure matrix using PCA with Direct Oblimin (Delta = 0) in full sample

	Component			
	1	2	3	4
Producing large numbers of solutions for a better future comes natural to me	**.935**	.361	-.347	.423
I am good at generating many ideas that capture the responsible side of innovation	**.846**	.494	-.512	.485
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	.306	**.917**	-.282	.233
I am good at coming up with ideas that are novel, but also right	.426	**.877**	-.389	.236
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.317	.324	**-.922**	.351
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	**.572**	.456	**-.790**	.372
It is important to me to explore the various ethical aspects of my ideas	.322	.239	-.421	**.897**
I have a knack for coming up with many ethical solutions to a problem	**.538**	.290	-.235	**.853**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007)

Table 18 shows the correlation between factors. This table shows that the correlation between factors are not orthogonal. However, these inter-correlation values indicate that the correlation is negligible (absolute value of .000 until .300) and low (absolute value of .300 until .500) (Hinkle et al., 2003).

Table 18. Component correlation matrix using PCA with Direct Oblimin (Delta = 0) in full sample

Component	1.	2.	3.	4.
1.	-			
2.	.407	-		
3.	-.376	-.369	-	
4.	.432	.263	-.348	-

5.3.3 Validity 1.3: PAF with Varimax in Full Sample

Table 19 shows the communality before and after the factor extraction was applied. Different with PCA, PAF assumes that the total variance does not only consist of common variance, but also contains specific or error variance. Thus, the initial communality in PAF is different with the initial communality in PCA (Table 12). The column 'Extraction' provides a better insight about the percentage of common variance in every variable after factor extraction.

Table 20 shows that the factor extraction and rotation method have improved the factor structure. In column 'Extraction Sums of Squared Loadings', the biggest percentage of variance are loaded into Factor 1. However, after the rotation, the factor structure are being optimized. In this case, the relative importance of four factors (percentage of total variance) is distributed relative equally.

Table 21 shows the rotated factor (component matrix). The substantive factor loadings in this structure shows that the items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample (Stevens, 2012); B. G. F. Tabachnick, L.S. (2007).

Table 19. Communality using PAF with Varimax in full sample

	Initial	Extraction
I am good at coming up with ideas that are novel, but also right	.463	.553
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	.424	.741
I have a knack for coming up with many ethical solutions to a problem	.395	.571
Producing large numbers of solutions for a better future comes natural to me	.509	.814
I am good at generating many ideas that capture the responsible side of innovation	.590	.646
It is important to me to explore the various ethical aspects of my ideas	.362	.562
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.340	.498
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	.461	.613

Table 20. Total variance explained using PAF with Varimax in full sample

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.836	47.950	47.950	3.468	43.349	43.349	1.369	17.111	17.111
2	1.126	14.076	62.025	.765	9.568	52.917	1.227	15.343	32.454
3	.802	10.027	72.052	.395	4.937	57.854	1.212	15.152	47.606
4	.698	8.719	80.771	.368	4.606	62.460	1.188	14.854	62.460
5	.442	5.526	86.297						
6	.423	5.284	91.581						
7	.407	5.083	96.664						
8	.267	3.336	100.000						

Table 21. Rotated component matrix using PAF with Varimax in full sample

	Factor			
	1	2	3	4
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	**.836**	.119	.141	.093
I am good at coming up with ideas that are novel, but also right	**.646**	.110	.270	.225
It is important to me to explore the various ethical aspects of my ideas	.085	**.680**	.277	.125
I have a knack for coming up with many ethical solutions to a problem	.142	**.671**	.136	.285
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	.263	.223	**.646**	.277
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.171	.216	**.636**	.134
Producing large numbers of solutions for a better future comes natural to me	.176	.275	.224	**.811**
I am good at generating many ideas that capture the responsible side of innovation	.310	.342	.391	**.529**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007).

5.3.4 Validity 1.4: PAF with Direct Oblimin (Delta = 0) in Full Sample

Table 22 shows the same value with Table 14 because the communality is not affected by the rotation method.

Table 22. Communality using PAF with Direct Oblimin (Delta = 0) in full sample

	Initial	Extraction
I am good at coming up with ideas that are novel, but also right	.463	.553
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	.424	.741
I have a knack for coming up with many ethical solutions to a problem	.395	.571
Producing large numbers of solutions for a better future comes natural to me	.509	.814
I am good at generating many ideas that capture the responsible side of innovation	.590	.646
It is important to me to explore the various ethical aspects of my ideas	.362	.562
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.340	.498
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	.461	.613

Table 23 and Table 24 respectively show the pattern matrix and the structure matrix. The substantive factor loadings the pattern matrix and the structure matrix show that the items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample.

Table 23. Pattern matrix using PAF and Direct Oblimin (Delta = 0) in full sample

	Factor			
	1	2	3	4
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	**.699**	-.004	.030	.043
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	**.661**	.073	-.131	.003
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	-.058	**.907**	.070	.034
I am good at coming up with ideas that are novel, but also right	.129	**.629**	-.104	-.040
Producing large numbers of solutions for a better future comes natural to me	.016	-.015	**-.880**	.036
I am good at generating many ideas that capture the responsible side of innovation	.239	.144	**-.457**	.145
It is important to me to explore the various ethical aspects of my ideas	.128	-.024	.079	**.722**
I have a knack for coming up with many ethical solutions to a problem	-.096	.050	-.142	**.701**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007)

Table 24. Structure matrix using PAF and Direct Oblimin (Delta = 0) in full sample

	Factor			
	1	2	3	4
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	**.770**	.473	-.517	.471
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	**.705**	.356	-.364	.416
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	.390	**.857**	-.323	.274
I am good at coming up with ideas that are novel, but also right	**.485**	**.728**	**-.431**	.306
Producing large numbers of solutions for a better future comes natural to me	.496	.398	**-.901**	.529
I am good at generating many ideas that capture the responsible side of innovation	**.638**	**.521**	**-.730**	**.583**
I have a knack for coming up with many ethical solutions to a problem	.399	.306	**-.504**	**.744**
It is important to me to explore the various ethical aspects of my ideas	**.479**	.255	-.380	**.742**

Note. Bold indicates substantial loading (Stevens, 2012; B. G. F. Tabachnick, L.S., 2007)

Table 25 shows the correlation between factors. This table shows that the correlation between factors is not perfectly orthogonal.

Table 25. Component correlation matrix using PAF with Direct Oblimin (Delta = 0) in full sample

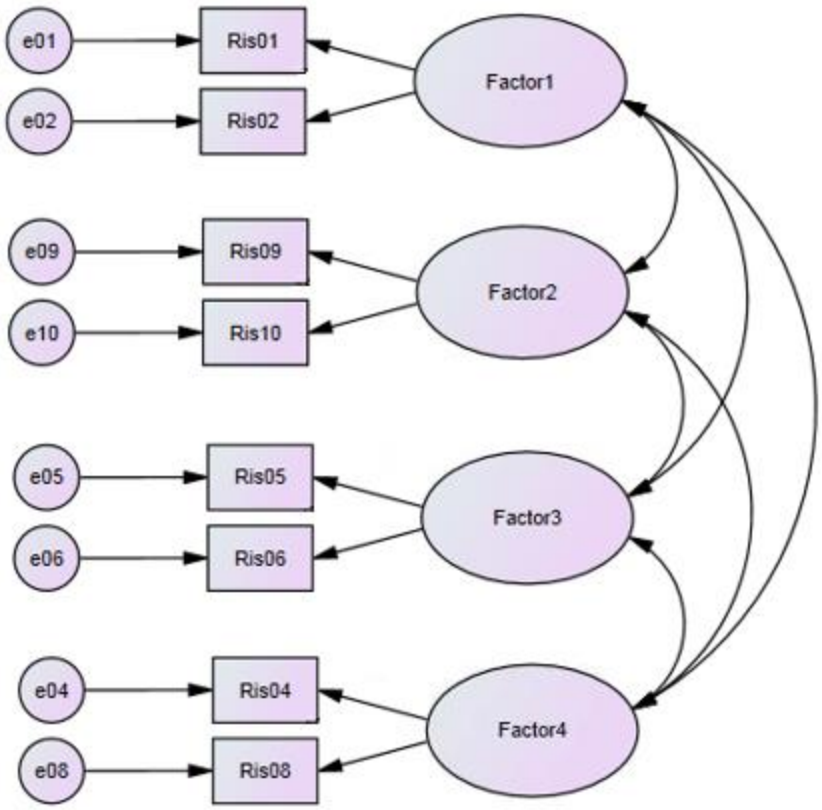
Factor	1.	2.	3.	4.
1.	-			
2.	.514	-		
3.	-.532	-.446	-	
4.	.560	.344	-.556	-

5.4 VALIDITY 3: CONFIRMATORY FACTOR ANALYSIS

This section describes the validity assessment of Ris_Model1 using CFA.

5.4.1 Model Summary

Based on the factors structure of Ris_Model1, a model was created to assess the fitness of this structure. As shown in Figure 3, the model is represented by a path diagram that consists of four latent constructs (factors) and eight variables. Latent construct is connected with the variables by the factor loadings (same like EFA). In total, the model contains of eight observed (endogenous) variables and twelve unobserved (exogenous) variables (Table 26).



Note. Factor 1: Responsible Idea Generation; Factor 2: Responsible Idea Realization; Factor 3: Responsible Fluency, Factor 4: Responsible Flexibility

Figure 3. Ris_Model1

Table 26. Observed and unobserved variables

Observed Variables			Unobserved Variables		
• Ris10	• Ris02	• Factor2	• Factor3	• Factor1	• Factor4
• Ris09	• Ris01	• e10	• e06	• e02	• e08
• Ris06	• Ris08	• e09	• e05	• e01	• e04
• Ris05	• Ris04				

5.4.2 Model Evaluation

Model evaluation consists of two parts: evaluation of parameter estimates and evaluation of overall (general) model (Barbara, 2001; Hair et al., 2014).

Parameter Estimates Evaluation

The model parameter estimates are shown in Appendix 15: Table 67 for the factor loadings (regression weights in Amos), Table 68 for covariance between factors, and Table 69 for variances between factors and measurement errors. These tables show that all estimates are statistically significant different from zero, which indicate a good parameter estimation.

Overall Model Evaluation

The overall model evaluation consists of three parts: model fit, construct validity, and model misspecification (Barbara, 2001; Hair et al., 2014; Schreiber, Nora, Stage, Barlow, & King, 2006; Schumacker & Lomax, 2004)

Model Fit

- Model Fit Summary

In Structural Equation Modelling (SEM), χ^2 is used to test if the null hypothesis (the hypothesized model fits in the population) is true. The result shows the χ^2 = 20.870, with $p = .105$ (Table 70 in Appendix 15). Thus, the Ris_Model1 (Figure 3) fits with the population.

- Root Mean Square Residual (RMR)

Table 71 (Appendix 15) shows that the standardized RMR value of the Ris_Model1 (Figure 3) is -.002. It implies that the Ris_Model1 has an acceptable standardized RMR value, since its RMR is less than .05 (Schumacker & Lomax, 2004).

- Incremental (Baseline, Relative, or Comparison) Fit Indices: NFI, RFI, IFI, TLI, CFI

The recommended value for NFI is, at least, .90 (Bentler & Bonett, 1980), although recent study suggests .95 (L. t. Hu & Bentler, 1999). L. t. Hu and Bentler (1999) also suggest RFI to be .95 as the indicator of superior fit. In regards to IFI and TLI, L. t. Hu and Bentler (1999) explain that they have to be .95. In addition, they also suggest the CFI to be at least .95.

Table 73 (Appendix 15) shows that the Ris_Model1 (Figure 3) has NFI = .943; RFI = .990; IFI = .981; TLI = .990, and CFI = .990. As such, the Ris_Model1 (Figure 3) indicates a superior fit.

- Model Parsimony

Model parsimony consists of parsimony ratio (P ratio), Parsimony NFI (PNFI), and Parsimony CFI (PCFI) (James, Mulaik, & Brett, 1982; Mulaik et al., 1989). Mulaik et al. (1989) recommend the good model to have the parsimony indices within .05.

Table 74 (Appendix 15) shows that Ris_Model1 (Figure 3) has PRATIO = .500, PNFI = .486, PCFI = .495. Thus, Ris_Model1 (Figure 3) indicates a good model.

Another parameter regarding to the model parsimony is the Akaike's Information Criterion (AIC) (Akaike, 1987). The good model has the AIC and BCC value that are lower than the saturated and independence model (Akaike, 1987; Browne, 2000; Browne & Cudeck, 1989).

Table 75 (Appendix 15) shows that the Ris_Model1 (Figure 3) has AIC default model = 80.870, AIC saturated model = 88.000, AIC independence model = 764.810; and BCC default model = 83.178, BCC saturated model = 91.385, BCC independence model = 766.041. This result indicates the better fit of the Ris_Model1 (Figure 3) and also implies that the parameter estimates that was obtained from the original sample can cross-validate in the future sample (Bandalos, 1993).

- Population Discrepancy

The first indices to assess population discrepancy is Non-centrality Parameter Estimates (NCP) (Bentler, 1990; Widaman & Thompson, 2003). Table 76 (Appendix 15) shows that the Ris_Model1 (Figure 3) has low NCP value of 6.870 which indicates a good model (J. E. H. F. L. Schmidt, Hunter, Harlow, Mulaik, & Steiger, 1997).

Another measure to assess the population discrepancy is the minimum discrepancy function (F_{MIN}) (Schumacker & Lomax, 2004). Table 77 (Appendix 15) reveals that Ris_Model1 has F_{MIN} = .086 which indicates a good model.

Another measure to assess the population discrepancy is the Root Means Square Error of Approximation (RMSEA) (Steiger, 1990; Steiger & Fouladi, 1997). MacCallum and Austin (2000), Schumacker and Lomax (2004), and Barbara (2001) suggest the acceptable RMSEA value to be less than or equal to .05. Table 78 (Appendix 15) shows that Ris_Model1 has RMSEA = .045.

Next, the PCLOSE value is used to assess if the RMSEA is good in the population (Barbara, 2001). Jöreskog and Sörbom (1993) suggests that a good model has a PCLOSE value that is larger than .50. Table 78 (Appendix 15) shows that Ris_Model1 has PCLOSE = .541.

Another measure of model fit is the Hoelter's Critical N (CN) (Hoelter, 1983). Hoelter suggests that the Hoelter's Critical N (CN) value of 200 is enough to indicate a model fit. Following this suggestion, the Ris_Model1 (Figure 3) has adequately represented the sample data in both the HCN .05 = 276 and HCN .01 = 340 (Table 79 in Appendix 15).

- Model Validation: Expected Cross-Validation Index (ECVI)

The model represents the best fit if its hypothesized model has a lower ECVI value that the saturated and independence model (Barbara, 2001; Browne & Cudeck, 1989). Ris_Model1 has ECVI default model = .333, ECVI saturated model = .362, ECVI independence model = 3.147. This result shows that the Ris_Model1 (Figure 3) represents a good fit (Table 80 in Appendix 15).

Construct Validity

- Convergent Validity: Factor Loadings, Average Variance Extracted, Reliability

The component of convergent validity in the Ris_Model1 (Figure 3) is shown in Table 27. The loading of every variables to their associated factor indicate a good correlation (> .70). The Average Variance Extracted (AVE) also implies a good value (> .50). The reliability is also considered good (about more than .700). Thus, the Ris_Model1 (Figure 3) has meet a good convergent validity (Hair et al., 2014).

Table 27. Convergent validity of CFA model

	Responsible Idea Generation	Responsible Idea Realization	Responsible Fluency	Responsible Flexibility
Factor Loadings				
Ris01	.846			
Ris02	.728			
Ris09		.651		
Ris10		.829		
Ris05			.760	
Ris06			.882	
Ris04				.763
Ris08				.711
AVE	.787	.740	.821	.737
Construct Reliability	.761	.698	.802	.702

Internal consistency reliability is assessed using the Cronbachs' Alpha value (Cronbach, 1951; Nunnally, 1978; Peter, 1979). As shown in Table 11 and Table 27, the Cronbach's Alpha value of the Ris_Model1 (Figure 3) is good.

- Discriminant Validity

Hair et al. (2014, p. 619) define discriminant validity "as the extent to which a construct is truly distinct from other constructs." In order to measure discriminant validity, I will follow the suggestion from him: comparing the AVE estimates for every construct (factor) with its squared inter-construct correlations. For a construct, the discriminant validity holds if the inter-construct square correlation in that construct is less than its AVE. Table 28 shows that all the constructs hold the discriminant validity.

Table 28. Inter-construct correlation, square inter-construct correlation, and AVE of the Ris_Model1

	1.	2.	3.	4.
1. Responsible Idea Generation	1.000	.372	.360	.167
2. Responsible Idea Realization	.610	1.000	.582	.382
3. Responsible Fluency	.600	.763	1.000	.511
4. Responsible Flexibility	.408	.618	.715	1.000
AVE	.787	.740	.821	.737

Note: Values below the diagonal are correlation estimates among constructs, diagonal elements are construct variances, and values above the diagonal are squared correlations.

Model Misspecification

- Standardized Residuals

The standardized residuals is shown in Table 86 (Appendix 15). Following suggestion from Hair et al. (2014), the good model has a standardized residual more than |2.5|. Table 86 (Appendix 15) shows that all standardized residuals in Ris_Model1 are more than |2.5|. It implies that every variables represent their construct without having a common variance with other constructs.

- Modification Indices

From the Amos output, I find that all variances, regression weights, means, and intercepts are not subject to modification indices. However, Table 29 shows that there are three items in covariance that need attention. Regarding to this result, it is important to note that all the items mentioned in that table (e05 and e04; e05 and e02; and e06 and e02) are not belong to the same construct (see the Ris_Model1 in Figure 3). As explained by Hair et al. (2014, p. 636), "there are generally not any MIs for the relationships between constructs because each construct has an estimated path to every other construct". Following this view, I will not do any changes since the Ris_Model1 (Figure 3) does not allow me to do so.

Table 29. Covariance MI and EPC

			M.I.	EPC
e05	<-->	e04	4.815	0.106
e05	<-->	e02	6.284	-0.107
e06	<-->	e02	5.970	0.091

5.5 VALIDITY 4: MULTI REGRESSION ANALYSIS

Another method to assess the construct validity of the new scale is by comparing it with the existing scales (L. A. Clark & Watson, 1995). For example, Donnellan et al. (2006) compare their new personality scale with the existing Big Five Personality scale. Spanier (1976) also assessed his new marriage quality scale with the existing scale. The similar approach is also used by Schwarzer, Bäßler, Kwiatek, Schröder, and Zhang (1997) to assess the self-efficacy scales. In this study, I compared the result of Ris_Model1 with several existing scales that are related with the responsible innovation concept.

5.5.1 Hypothesis Development: Mini International Personality Item Pool-Five Factor Model (Mini IPIP)

Scholars argue that innovativeness and ethical behavior is related with personality (Doris, 2002; Goldsmith & Foxall, 2003; Munro, Bore, & Powis, 2005; Rodgers, 1995; Stead, Worrell, & Stead, 1990; Walumbwa & Schaubroeck, 2009). One of the scale to measure personality is Mini IPIP. This scale was developed by Donnellan et al. (2006) to address the 'boring or irritating task' of the respondent to complete the original "Big Five" personality measure that is developed by Costa and McCrae (1992a) and Costa and McCrae (1992b). The Mini IPIP model measures the five factors of the original scale: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. The questionnaires is arranged as shown in Table 88 (Appendix 16). In following explanation, the hypothesis related to responsible innovation scale and IPIP measure is developed.

Openness and Responsible Innovation

Costa and McCrae (1992b, p. 6) explains that individual with high level of openness to experience is "imaginative and sensitive to art and beauty and have a rich and complex emotional life; they are intellectually curious, behaviorally flexible, and non-dogmatic in their attitudes and values". McCrae (1987) explains that openness indicates a behavior to experience an interaction with people from different backgrounds. In addition, Rogers (1961, p. 352) argues that if "the individual is 'open' to all of his experience . . . then his behavior will be creative". Being open to other people, especially in the early phase of innovation processes, would bring an innovator to be more responsibly (Stirling, 2010). For example, motivations Rose (2014) explains that openness would make innovators to anticipate and reflect their motivations. As a consequence, different actors would achieve a mutual responsiveness (Lubberink et al., 2017). Thus, this study hypothesizes that openness will be positively related to responsible innovation.

Hypothesis 1a: An individual with high openness will tend to innovate responsibly.

Agreeableness and Responsible Innovation

Costa and McCrae (1992b, p. 6) defines agreeableness as "a pirimarily dimension of interpresonal behavior". He explains that individual with high degree of agreeableness is "trusting, sympathetic, and cooperative". Individual with high level of agreeableness is more likely to bring an advantage during a negotiation process in (Carnevale & Isen, 1986; Forgas, 1998). In this case, cooperativeness bring a positive influence on the expectations, approaches, and consequences during a decision making process (Forgas, 1998). As a consequence, it would bring a positive impact to a negotiation, especially in an innovation with high uncertainty (Grunwald, 2014a; Lubberink et al., 2017; Pavie et al., 2014; Selin, 2011). Building on this view, this study hypothesizes that agreeableness will positively be related to responsible innovation.

Hypothesis 1b: An individual with high agreeableness will tend to innovate responsibly.

Extraversion and Responsible Innovation

Costa and McCrae (1992b, p. 6) refer extraversion as "the dimension underlying a broad group of traits, including sociability, activity, and the tendency to experience positive emotion such as joy and pleasure". According to Ashby and Isen (1999, p. 530), such personality plays an important role to "flexibility and facilitates creative problem solving across a broad range of settings". In addition, Lyubomirsky, King, and Diener (2005, p. 840) explains that people with positive "more efficiently solve the task or when creativity and flexibility are required". Indeed, extraversion is an important behavior to include stakeholders from different perspective in an innovation process (Owen et al., 2013; Pesch, 2015; Van den Hoven, 2014). Thus, moral obligation can be fulfilled by identifying the socially desirable outcomes from multi-actor involvement (Owen et al., 2012; Berndt C. Stahl et al., 2013). Thus, this study hypothesizes that extraversion will be positively related to responsible innovation.

Hypothesis 1c: An individual with high extraversion will tend to innovate responsibly.

Conscientiousness and Responsible Innovation

Costa and McCrae (1992b, p. 6) indicate that conscientiousness is "a dimension that contrasts scrupulous, well-organized, and diligent people with lax, disorganized, and lackadaisical individuals". Cropley (1997) and (McCrae, 1987) explain that individuals with pro-social aspect of conscientiousness is more creative because they see creativity as an accomplishment. In other words, talented innovators may not attain creatively without a hard work and self-discipline. A high degree of conscientiousness will bring an advantage to the innovators. In this case, they feel that they innovate responsibly by formulating an ambitious goal to address the problems that society is currently facing, like societal problem or environmental problem (Blok & Lemmens, 2015; Lubberink et al., 2017; Von Schomberg, 2011a). Thus, this study hypothesizes that conscientiousness will be positively related to responsible innovation.

Hypothesis 1d: An individual with high conscientiousness will tend to innovate responsibly.

Neuroticism and Responsible Innovation

According to Costa and McCrae (1992b, p. 6), neuroticism is "the individual's tendency to experience psychological distress, and high standing on". Cropley (1990) find that creative artists is usually linked to bizarre artists. An artist with high degree of neuroticism is likely to have a high level of mental health. In a similar vein, Eysenck and Furnham (1993); Glue, Wilson, Coupland, Ball, and Nutt (1995); McCormick, Dowd, Quirk, and Zegarra (1998) also observe that neuroticism is closely related to psychopathology (e.g., sensation seeking, anxiety, or hostility). Regarding to this, neuroticism relates to superior coping and discriminating well-being (Scheier, Carver, & Bridges, 1994). Based on this view, this study hypothesizes that neuroticism will be negatively related to responsible innovation.

Hypothesis 1e: An individual with high neuroticism is less likely to innovate responsibly.

5.5.2 Hypothesis Development: Non-IPIP Scales

Ethical Climate

Ethics plays an increasingly important role in developing (technological) innovations. The Ethical Climate Scale (EthCl) was developed by Cullen et al. (1993); Victor and Cullen (1988) to measure a prevailing perception within an organization about how ethical issues are tackled. Ethical climate refers to "an employee's general perception of an enterprise's operations and procedures to promote ethical behavior" (Lu & Lin, 2014, p. 209). In this case, ethical climate ensures that employee satisfies the rules, from both the internal company (internal company policy) and the external company (e.g., professional standards and national law) (Cullen et al., 1993; Lu & Lin, 2014; Victor & Cullen, 1988). However, it does not imply that

the employees must not show moral beliefs. Rather, employees have a freedom to decide what is right and wrong as long as it does not break the legal laws or society norms. Further, ethical climate also emphasize a view about societal caring. Ethical climate is measured using a scale as shown in Table 89 (Appendix 16).

Such view about ethical climate is in line with the concept responsible innovation. For example, Lubberink et al. (2017) explains that by following a legal standard, innovator can reflect the actions and responsibilities that they have in society. In addition, Von Schomberg (2011a) highlights the sustainability and societal desirability in the innovation processes. Thus, this study hypothesizes that Ethical Climate is postively related to responsible innovation.

Hypothesis 2: Ethical climate is positively related to responsible innovation.

Ethical Behavior

The Ethical Behavior Scale (Eb), developed by Fraedrich (1993), measures the extent to which people tend to behave ethically or unethically. The size is specifically intended to measure such behavior in the workplace. Ethical Behavior is measured using a set of questions as shown in Table 90 (Appendix 16).

Fraedrich (1993, p. 215) explains that Ethical Behavior scale is a "rule oriented" measure. For example, it measure about how employee should provide report or document to their colleague and their behavior related to company's policy. This view implies a top-down decision making approach. For that reason, it might not in line with the inclusion and deliberation dimension (Owen et al., 2013; Stilgoe et al., 2013). In this case, employee should merely follow company rules without considering the society at large. Based on this view, this study hypothesizes that ethical behavior is negatively related to responsible innovation.

Hypothesis 3: Ethical behavior is positively related to responsible innovation.

Sustainable Development Goals

Responsible innovation depends partly on how innovators see the world around them, and how they can make the environment better, cleaner and more pleasant. Recently, such concept has been linked to Sustainable Development Goals (Sdg) (Voegtlin & Scherer, 2017). Sdg is measured using a set of questions as shown in Table 91 (Appendix 16).

Promoting sustainable development goals implies a clear roadmaps to anticipate the impact of innovation (Lubberink et al., 2017). Blok and Lemmens (2015) have pointed out that sustainable development is one of the issue that should be addressed by responsible innovation concept. It could be an innovation that is more environmental and societal oriented (Owen et al., 2013). Based on this view, this study hypothesizes that ethical behavior is negatively related to responsible innovation.

Hypothesis 4: Sustainable development goal is positively related to responsible innovation.

Creative Self-Efficacy

The term 'self-efficacy' refers to faith in own ability Bandura (1997). Ford (1996) explain that self-efficacy is important to bring a success in innovation. Tierney and Farmer (2002) have developed a Creative Self-efficacy scale to measure employee behavior in business environment. It is measured using a set of questions as shown in Table 92 (Appendix 16). They define creative self-efficacy as "creative self-efficacy as the belief one has the ability to produce creative outcomes" (Tierney & Farmer, 2002, p. 1138). Lubberink et al. (2017) explains that creative self-efficacy relates to anticipation aspect. In this case, it would influence innovator to thinking creative in determining the outcome and impact of innovation. For example, Mair and Noboa (2006) highlight that creative self-efficacy helps the innovators to develop an

innovation that could address the societal and environmental needs. Building on this view, this study hypothesizes that creative-self efficacy is positively related to responsible innovation.

Hypothesis 5: Creative self-efficacy is positively related to responsible innovation.

Innovative Work Behavior

Innovative behavior in the workplace is crucial for business success. Having an innovative work behavior would influence employee to think creative. Furthermore, it would create a sustain growth for the company (Amabile, 1988; Van de Ven, 1986). Innovative work behavior also emphasized that employees should not only think creatively but also have the ability to translate creative ideas into genuine innovations. This ability to translate the idea into a useful product or process is relevant with the responsible innovation concept. As pointed out by Von Schomberg (2013), the challenge of responsible innovation is to improve the responsiveness to the societal challenge. In addition, Stilgoe et al. (2013) explains that this innovative ability to transform the idea into a useful application is important due to different perspectives emerge in society. Furthermore, Lubberink et al. (2017) explain that organization needs a creative environment so that it can give the appropriate response to recent recognized needs. Building on this view, this study hypothesizes that creative-self efficacy is positively related to responsible innovation.

The Innovative Work Behavior scale (InWBeh), is developed by Janssen (2000) based on S. G. Scott and Bruce (1994). This scale measures the extent to which people have this talent using a set of questions as shown in Table 93 (Appendix 16).

Hypothesis 6: Innovative work and behavior is positively related to responsible innovation.

5.5.3 Initial Assessment

The first thing to do before applying MRA is to check the correlation coefficients between the dependent and independent variables (Hair et al., 2014). In this case, correlation coefficient is used as the initial prediction of the dependent measures. The correlation values is shown in Table 30. It shows that Ris_Model1 has significant correlation with eight independent variables. It also shows that all correlation is less than than .900 which indicates that multicollinearity does not exist.

Table 30. Descriptive statistic and correlation matrix (N = 244)

		M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	Extraversion	3.413	.772	-										
2.	Agreeableness	3.956	.609	.249**	-									
3.	Conscientiousness	3.670	.700	-.025	.021	-								
4.	Neuroticism	2.610	.663	-.030	.005	.011	-							
5.	Openness	3.656	.604	.177**	.136*	.109*	-.056	-						
6.	Ethical Climate	4.418	.094	-.001	.056	-.075	-.172**	.004	-					
7.	Ethical Behavior	4.212	1.064	-.031	-.010	.149**	-.049	.067	-.061	-				
8.	Sustainable Development Goals	5.272	1.119	-.042	.105	-.021	.014	.200**	-.011	.141*	-			
9.	Creative Self-Efficacy	4.748	.845	.204**	.102	.018	-.123*	.472**	.081	.037	.217**	-		
10.	Innovative Working Behavior	4.760	.811	.263**	.221**	.122*	-.132*	.332**	.063	-.006	.181**	.613**	-	
11.	Ris_Model1	4.486	.773	.172**	.213**	.092	-.130*	.329**	.131*	.019	.232**	.548**	.716**	-

Note. **. Correlation is significant at the .01 level (1-tailed); *. Correlation is significant at the .05 level (1-tailed).

5.5.4 Hypothesis Testing

In this section, all the hypotheses are tested using both zero-order correlation and multi-regression analysis (MRA). The rationale behind this follows suggestion from Hair et al. (2014, p. 161) who explain that the additional independent variables ability to increase the prediction of the dependent variable is "related not only to its correlation to the dependent variable, but also to the correlation(s) of the additional independent variable to the independent variable(s) already in the regression equation".

Ris_Model1 vs. IPIP Scale

Zero-order Correlation

Table 31 shows the correlation value between responsible innovation behavior and IPIP behaviors. It shows that responsible innovation behavior has a significant positive correlation with extraversion, agreeableness, and openness; and significant negative correlation with neuroticism. The correlation between responsible innovation behavior and conscientiousness is not significant.

Table 31. Descriptive statistic and correlation matrix between Ris_Model1 and IPIP Scales (N = 244)

		M	SD	1.	2.	3.	4.	5.	6.
1.	Extraversion	3.413	.772	-					
2.	Agreeableness	3.956	.609	.249**	-				
3.	Conscientiousness	3.670	.700	-.025	.021	-			
4.	Neuroticism	2.610	.663	-.030	.005	.011	-		
5.	Openness	3.656	.604	.177**	.136*	.109*	-.056	-	
6.	Ris_Model1	4.486	.773	.172**	.213**	.092	-.130*	.329**	-

Note. **. Correlation is significant at the .01 level (1-tailed); *. Correlation is significant at the .05 level (1-tailed).

MRA: Model Summary

Table 32 shows a summary of the regression model. This table indicates that the independent variables correlate, R = .399, significantly with the dependent variable. In addition, the table shows that the independent variables account for the 15.9% of dependent variable. In other words, the remaining 44.8% variation cannot be explained by these independent variables alone. Next, the table also provides the Adjusted R Square parameter. The Adjusted R Square gives an insight about how fit the regression model can be generalized. In this case, the differences between R Square and Adjusted R Square is .017. It means that if the model were derived from the population (rather than from the sample), it would account approximately 1.7% variance in the outcome. The change statistics is provided based on the F-ratio. It implies that the regression model causes R Square to change from 0 to .159, and this change in the amount of variance explained gives rise to an F-ratio of 9.013, which is significant with a probability less than .001. Another parameter in this table is the Durbin-Watson statistics (Durbin & Watson, 1951). Durbin-Watson statistics indicates (1.925) if the assumption of independent error is acceptable. The rule of thumb says that the good model has Durbin-Watson value of 2. Based on this view, the regression model has met the assumption of independent error.

Next, the regression model is assessed using analysis of variance (ANOVA). ANOVA tests if the model is significantly better to predict the outcome that using the mean as the predicting method (Field, 2009). As shown in Table 32 the regression model has F value of 9.013, which is significant at $p < .001$. This value indicates that there is less than a 0.1% chance that an F-ratio this large would happen if the null hypothesis were true.

Table 32. Model Summary Ris_Model1 vs. IPIP Scales

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
				R Square Change	F Change	df1	df2	Sig. F Change	
.399[a]	.159	.142	.71574	.159	9.013	5	238	.000	1.925

Note: a. Predictors: (Constant), Openness, Agreeableness, Conscientiousness, Neuroticism, and Extraversion.
b. Dependent Variable: Ris_Model1

MRA: Model Parameters

Table 35 shows that responsible innovation behavior can be significantly predicted by extraversion, openness, and neuroticism. Another important aspect to note in Table 35 is the VIF and tolerance statistics. The largest VIF is 1.094 and the lowest tolerance value is .914. This result indicates that the assumption of no multicolinearity is met (Bowerman & O'Connell, 1990; Hair et al., 2014; Menard, 1995; Myers, 1990).

Ris_Model1 vs. Non-IPIP Scales

Zero-Order Correlation

Table 33 shows the correlation value between responsible innovation scale and non-IPIP behaviors. It shows that responsible innovation behavior has a significant positive correlation with ethical climate, sustainable development goals, creative self-efficacy, and innovative working behavior. The correlation between responsible innovation behavior and ethical behavior is not significant.

Table 33. Descriptive statistic and correlation matrix between Ris_Model1 and Non-IPIP Scales (N = 244)

		M	SD	1.	2.	3.	4.	5.	6.
1.	Ethical Climate	4.418	.094	-					
2.	Ethical Behavior	4.212	1.064	-.061	-				
3.	Sustainable Development Goals	5.272	1.119	-.011	.141*	-			
4.	Creative Self-Efficacy	4.748	.845	.081	.037	.217**	-		
5.	Innovative Working Behavior	4.760	.811	.063	-.006	.181**	.613**	-	
6.	Ris_Model1	4.486	.773	.131*	.019	.232**	.548**	.716**	-

Note. **. Correlation is significant at the .01 level (1-tailed); *. Correlation is significant at the .05 level (1-tailed).

MRA: Model Summary

Table 34 shows a summary of the regression model. This table indicates that the independent variables correlate, R = .739, significantly with the dependent variable. In addition, the table shows that the independent variables account for the 54.6% of dependent variable. In other words, the remaining 44.8% variation cannot be explained by these independent variables alone. Next, the table also provides the Adjusted R Square parameter. The Adjusted R Square gives an insight about how fit the regression model can be generalized. In this case, the differences between R Square and Adjusted R Square is .010. It means that if the model were derived from the population (rather than from the sample), it would account approximately 1.0% variance in the outcome. The change statistics is provided based on the F-ratio. It implies that the regression model causes R Square to change from 0 to .159, and this change in the amount of variance explained gives rise to an F-ratio of 57.351, which is significant with a probability less than .001. Another parameter in this table is the Durbin-Watson statistics (Durbin & Watson, 1951). Durbin-Watson statistics indicates (1.867) if the assumption of independent error is acceptable. The rule of thumb

says that the good model has Durbin-Watson value of 2. Based on this view, the regression model has met the assumption of independent error.

Table 34. Model Summary Ris_Model1 vs. Non-IPIP Scales

				Change Statistics					
R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
.739[a]	.546	.537	.52568	.546	57.351	5	238	.000	1.867

a. Predictors: (Constant), Innovative Working Behavior, Ethical Behavior, Ethical Climate, Sustainable Development Goals, Creative Self-Efficacy

b. Dependent Variable: Ris_Model1

Next, the regression model is assessed using analysis of variance (ANOVA). ANOVA tests if the model is significantly better to predict the outcome that using the mean as the predicting method (Field, 2009). As shown in Table 34, the regression model has F value of 57.351, which is significant at $p < .001$. This value indicates that there is less than a 0.1% chance that an F-ratio this large would happen if the null hypothesis were true.

MRA: Model Coefficient

Table 36 shows that responsible innovation behavior can be significantly predicted by sustainable development goals, creative self-efficacy, and innovative working behavior. Another important aspect to note in Table 35 is the VIF and tolerance statistics. The largest VIF is 1.639 and the lowest tolerance value is .610. This result indicates that the assumption of no multicollinearity is met.

Table 35. Multi regression coefficient Ris_Model1 vs. IPIP Scale

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	2.223	.491		4.525	.000	1.255	3.190					
Extraversion	.082	.062	.082	1.319	.188	-.040	.204	.172	.085	.078	.914	1.094
Agreeableness	.194	.078	.153	2.485	.014	.040	.348	.213	.159	.148	.929	1.077
Conscientiousness	.068	.066	.062	1.033	.303	-.062	.199	.092	.067	.061	.985	1.015
Neuroticism	-.133	.069	-.114	-1.911	.057	-.269	.004	-.130	-.123	-.114	.996	1.004
Openness	.358	.078	.280	4.579	.000	.204	.512	.329	.285	.272	.944	1.059

Note. a. Dependent Variable: Ris_Model1

Table 36. Multi regression coefficient Model1 vs. Non-IPIP Scales

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.445	.312		1.427	.155	-.170	1.060					
Ethical Climate	.067	.036	.082	1.860	.064	-.004	.138	.131	.120	.081	.989	1.012
Ethical Behavior	.006	.032	.009	.200	.841	-.057	.070	.019	.013	.009	.975	1.026
Sustainable Development Goals	.062	.031	.090	1.982	.049	.000	.123	.232	.127	.087	.931	1.075
Creative Self-Efficacy	.141	.051	.154	2.750	.006	.040	.241	.548	.176	.120	.610	1.639
Innovative Working Behavior	.572	.053	.601	10.846	.000	.468	.676	.716	.575	.473	.621	1.611

Note. a. Dependent Variable: Ris_Model1

5.5.5 Assessing the Regression Model

Previous section has generated the multi regression model based on the sample data. This section assesses if the regression model represents a good model (Field, 2009). This assessment consists of two parts: assessment to check if the model fits with the observed data and assessment to check if the model can generalized to other samples.

Assessing the Model Fits

Assessing the fitness of a regression model is also called a regression diagnostics. It contains two methods: outliers checking and influential cases checking (Field, 2009). The throughout analysis in Appendix 17 shows that the regression model of responsible innovation behavior and IPIP behaviors; and the regression model of responsible innovation behavior and non-IPIP behaviors conforms to what expected as a fairly accurate model

Assessing Assumptions

This assessment check if the regression model meets certain statistical assumptions (Field, 2009; Hair et al., 2014). Based on a careful analysis in Appendix 17, it was found that the regression model of responsible innovation behavior and IPIP behaviors; and the regression model of responsible innovation behavior and non-IPIP behaviors satisfies the linearity, homoscedasticity, and normality assumption.

5.6 CONCLUSION OF VALIDITY MEASURE

This chapter is primarily used to assess the validity and reliability of the responsible innovation scale that has been derived in Chapter 4 (Ris_Model1). First, this chapter identifies that Ris_Model1 is reliable, in both the aggregate level (overall Ris_Model1 items) and factor levels (each factors in Ris_Model1). Next, after testing the Ris_Model1 using multiple combination of factor extraction and factor rotation methods, this chapter finds that the Ris_Model1's items that cluster on the same components are consistent with the factor structure that is obtained from the random half sample. Next, this chapter has also observed that the Ris_Model1 satisfies the convergent validity and discriminant validity. In order to strengthen the convergent validity and discriminant validity of Ris_Model1, this chapter has also examined hypothesis testing using zero-order correlation and MRA. It seems like the finding of the hypothesis testing does not only support the convergent and discriminant validity of the Ris_Model1, but also the nomological validity of Ris_Model1. Nevertheless, the explanation about this hypothesis finding is needed to get a better understanding about the observed phenomena. This explanation about the finding of the hypothesis testing will be explained in the subsequent chapter (Chapter 6).

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CHAPTER 6
DISCUSSION

The aim of argument, or of discussion, should not be victory, but progress - Joseph Joubert

This chapter is intended to discuss the finding that is obtained from the empirical from the theoretical perspective. In other words, it provides another evidence of convergent validity, discriminant validity, and nomological validity from theoretical perspective. This chapter starts by explaining the factor structure of Ris_Model1. Next, it explains the association between the scale that is proposed in this study (Ris_Model1) and the existing scales. The explanation about this association is used as a mean to assess the nomological validity of responsible innovation scale (L. A. Clark & Watson, 1995; Gatignon et al., 2002; Hair et al., 2014; Hinkin et al., 1997).

6.1 FOUR FACTOR STRUCTURE

The factor structure that was obtained in Chapter 4 (Ris_Model1) lends an empirical support to the factor structure that was hypothesized in Chapter 3 (Ris_Original). This is indicated by the same factor components of that shape this structure. Based on the extensive examination of this factor structure in Chapter 5, it is found that the factor structure is statistically valid. Building on this foundation, the responsible innovation behavior can be decomposed into four distinct yet interrelated factors: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization.

6.1.1 Responsible Idea Generation (Originality)

In the literatures of creativity, originality is conceptualized as "the uncommonness and infrequency of an idea and reflects the ability to approach a problem or situation in a new way, without relying on routine or habitual thought" (Baas et al., 2008, p. 781). Pertinent to the finding from the present study was a confirmation that such concept exists in the responsible innovation behavior. The association between originality and creativity is in agreement with those obtained from literatures that discuss creativity in academic Baas et al. (2008); Runco and Jaeger (2012); West (2002)) and industry domain (Audia & Goncalo, 2007; A. J. Scott, 1999; Tschang, 2007).

Nevertheless, the conventional view of originality and creativity puts less attention in incorporating the ethical perspective. Thus, the present study extends the established originality-creativity association by adding ethical perspective into account. In regards to the responsible innovation concept, responsible idea generation mainly relates to the anticipation and responsiveness aspects. The former one consists of the aspect of determining the desired impacts and outcomes of innovation. In this case, companies may facilitate idea generation by exploiting the internal resources (e.g., brainstorming session, training, increase R&D expenditure) and exploring the external resources (e.g., stakeholder mapping and external knowledge transfer) (N. M. P. Bocken, Farracho, Bosworth, & Kemp, 2014; Dangelico & Pujari, 2010; Ketata, Sofka, & Grimpe, 2015) (Bourne & Walker, 2005; Chalmers & Balan-Vnuk, 2013). In the responsiveness aspect, responsible idea generation can be considered as a way to offer an appropriate solution to address grand challenges. This has been seen in the case of innovation in the social, environment, or economic issues (Bartlett, 2009; Hart & Christensen, 2002; Larson, 2000).

6.1.2 Responsible Fluency

In regards to creativity, (Baas et al., 2008, p. 781) define fluency as "the number of unique, non-redundant ideas or problem solutions that are generated". Findings from present study show that this concept of fluency does present in the responsible innovation behavior. This finding further support several scholars' idea Baas et al. (2008); (P. M. Clark & Mirels, 1970); Runco and Jaeger (2012); West (2002) and some practitioners' idea (Audia & Goncalo, 2007; Jung, 2001; S. C.-k. Wong & Ladkin, 2008) that observed the relationship between fluency and creativity.

However, this conventional conclusion seems to be largely based on the fact that do not take ethical perspective into account. Along similar lines with the prior idea fluency literatures, the present study yields conclusion from a line of research in responsible innovation domain. Responsible idea fluency can be clearly illustrated in the whole responsible innovation dimensions. For example, as a reflection to their values and responsibilities toward society, innovators have offered a number of unique solutions to develop the sustainable energy resources (Dossa & Kaeufer, 2014) (Rivera, Goebel, Sardari, & Jacobsen, 2015; Warren & McFadyen, 2010; Zhao & Zhu, 2014). Another evidence of responsible fluency was exemplified in the inclusion dimension. Scholars have found that multi-stakeholders involvement, be it from end-users (Ayuso, Ángel Rodríguez, & Enric Ricart, 2006; Franke, Keinz, & Klausberger, 2013; Marjanovic, Fry, & Chataway, 2012), distributors (Chalmers & Balan-Vnuk, 2013; Hoejmose, Brammer, & Millington, 2013), or government bodies (Carrillo-Hermosilla, del Río, & Könnölä, 2010; Levén, Holmström, & Mathiassen, 2014), is effective to produce a large number of innovative idea.

6.1.3 Responsible Flexibility

In the creativity context, flexibility refers to "the breadth and number of distinct semantic categories that a person accesses, and it reflects the capacity to switch approaches, goals, and sets" (Baas et al., 2008, p. 781). Present studies confirm that such concept of flexibility exist in responsible innovation scale. Along this line, this finding is in accord with recent studies that indicate the relationship between flexibility and creativity both in the theoretical Baas et al. (2008); (P. M. Clark & Mirels, 1970); Runco and Jaeger (2012); West (2002) and managerial perspective (Martins & Terblanche, 2003; Nadkarni & Herrmann, 2010; S. Wong & Pang, 2003).

Having said that, this conventional view seems to be largely based on an assumption of not taking into account the ethical perspective. The present study made an attempt to extend the prior literatures by incorporating ethical perspective in the flexibility concept. In this fashion, the present study indicate that such association still holds in the context of responsible innovation. A notable concept of responsible idea flexibility can be identified within the anticipation and responsiveness dimensions. The latter is exemplified, for example, in giving the actual response to the address the grand challenges by withdrawing innovation from the market (Baba & Walsh, 2010; Stilgoe et al., 2013; Van den Hoven, 2014). In the anticipation dimensions, responsible flexibility shows up to prevent the negative impact of innovation by, like the changing innovation products and applying adaptive management (Rahm & Riha, 2014; Schulte et al., 2014; Small et al., 2014; Wodzisz, 2015).

6.1.4 Responsible Idea Realization

Idea realization can be described as an effort to translate the creativity into a useful application (Runco & Jaeger, 2012; West, 2002). The present study supports the evidence of such perspective in the responsible innovation context. This finding is consistent with prior theoretical (Janssen, 2000; Runco & Jaeger, 2012; West, 2002) and practical studies (Gurteen, 1998; Kristensson, Gustafsson, & Archer, 2004) that observed the relationship between idea translation skill and creativity.

While acknowledging this mainstream concept, the present study views a broader perspective that such relationship may also be relevant in the responsible innovation concept. Extending a support to universal association between idea realization and creativity, the present study recommends the involvement of the ethical perspective also for the sake of idea realization. According to responsible innovation literatures, responsible idea realization can be seen, for example, in the responsiveness and inclusion dimension. Idea translation skill is vital to provide concrete solutions in responding to the present dynamics in the society, such as applying a suitable innovation strategy (Kiron, Kruschwitz, Reeves, & Goh, 2013; Lettice & Parekh, 2010) or following a guideline from regulatory bodies (Berker, 2010). Such solution can be achieved by inclusively tying together a partnership from actors in the demand-pull area (i.e., customers, competition, supplier) and science-push area (e.g., research institutes or universities) (Murovec & Prodan, 2009).

6.2 RESPONSIBLE INNOVATION SCALE AND OTHER SCALES

Based on the empirical findings in Chapter 4, the purpose of this section is to deliver an understanding of the relation between the responsible innovation scale and other existing scales that personality measures (IPIP Scales), applied psychology and organizational measures (creative self-efficacy and innovative work behavior), and business ethics (ethical climate, ethical behavior, sustainable development goals).

6.2.1 Responsible Innovation and IPIP Scales

The purpose of this section is to discuss the relationship between the responsible innovation scale and five individual personality measures. Empirical findings clearly indicate a support that openness, agreeableness, neuroticism, and extraversion affect the individual to implement responsible innovation in the business context. However, the role of conscientiousness is not significantly related to responsible innovation behavior.

Responsible Innovation and Openness

In the present study, I found support for Hypothesis 1a, which projected a positive significant correlation between openness and responsible innovation behavior. This result provides another evidence to the previous findings (e.g., Costa and McCrae (1992a), Barron and Harrington (1981), and Rogers (1961)) that show the relationship between openness and creativity. Openness describes an interest in experiencing a new activity. It illustrates that an open person is intellectually curious. A relationship between openness and creativity was empirically found by Costa and McCrae (1992a). In his study, he found that all openness facets were associated with creativity measure.

However, standard definition of openness has little discussion when it comes to the ethical context in innovation. Thus, in regards to society ethical perspective, the present study found that openness to experience apparently relates to the 'innovate responsibly' concept. An openness to experience is likely to drive individual to interact with people from different backgrounds. Such behavior is vital for innovators so that they can gather ethical aspect of innovation from relevant stakeholders. In the responsible innovation concept, such behavior characterizes an inclusion and deliberation aspect. Besides, an open behavior also shows an anticipative aspect. In this case, a behavior to involve diverse actors would hinder the undesired impact of innovation. It is especially important to apply since the very beginning of innovation process. In addition, motivated by a need to anticipate an adverse impact of innovation, a prevention individual displays an aspect of reflexivity. In this case, openness makes innovators to reflect the motives that they have while developing an innovation product or process. Furthermore, this finding suggests that a person with open personality is likely to show a responsive aspect. In particular, a person can ensure that he/she could respond to the current challenges.

Responsible Innovation and Agreeableness

Further, I found confirmation from Hypothesis 1b, which predicted that agreeableness positively relates to innovate responsibly. People with high degree of agreeableness display a more cooperative behavior while collaborating with other parties, which confirms also important in creative environment (McCrae & Costa, 1987). Such behavior is especially important for an innovator in considering a societal aspect in the innovation product or processes. A cooperative person is likely to show a trusting, modest, and compliant behavior (Graziano & Eisenberg, 1997{McCrae, 1999 #504). This finding was similar with the study that was observed by Graziano and Eisenberg (1997), in which he suggested that agreeableness is related with pro-social behaviors.

Nevertheless, the present study goes beyond mainstream personality literature by providing an evidence between agreeableness and the emerging concept of ethical and innovative behavior. In such a way, the present study advances evidence between the effect of agreeableness and responsible innovation behavior (Lubberink et al., 2017; Owen et al., 2013; Von Schomberg, 2011a). In this case, agreeableness provides the innovators with a cooperative environment to collaborate between different stakeholders. It is relevant for them while doing a negotiation processes. This conclusion may be largely based on the fact that agreeableness displays a more motives to be inclusive and deliberative. In this case, stakeholders from different backgrounds can raise a shared commitment and maintain a growing relationship. As a consequence, a commonly agree decision would be achieved. Along similar lines, this finding shows a motive to incorporate a preventive and mitigative action to hinder negative consequences of innovation. Applying a soft-hearted environment indicates a behavior to act selfless. It then leads innovators to uncover different path through which the innovation goal can be acquired. Furthermore, a trusting person is likely to demonstrate a reflexivity aspect. Thus, a person with such behavior leans towards a critically thinking about his/her actions and responsibility towards a society. Fulfilled with a pro-society behavior, an innovator inclines to make sure that he/she can be responsive to adjust the innovation processes in regards to the changing circumstances.

Responsible Innovation and Neuroticism

I also found confirmation for Hypothesis 1c, that predicted neuroticism negatively correlates with responsible innovation. It was found that the higher level of neuroticism, the lower the level of responsible innovation behavior. This is in line with suggestion in personality literature (McCrae & Costa, 1987). Characterized with a depressed mood, anxiety, dissatisfaction, and anger, people with higher neuroticism are unlikely to behave innovatively (Costa & McCrae, 1980; McCrae & Costa Jr, 1999).

However, the present study provides more than just a support to the pervasive association between idea neuroticism and creativity. Acknowledging an ethical perspective in the innovation context, the present study extend the current personality literatures. Building on this view, this finding provides a considerable support for a relation between neuroticism and responsible innovation behavior. In this case, an individual with high level of neuroticism is not likely to react a pro society behavior. This was also observed by scholars like Denissen and Penke (2008), Bienvenu, Hettema, Neale, Prescott, and Kendler (2007), and Eisenberger, Jarcho, Lieberman, and Naliboff (2006). This socio phobia behavior has a tendency to reject an effort to bring together values from different stakeholders in order to agree upon a diverse perspective. Having such social exclusion would not allow a person to be aware with the inevitable uncertainties in the innovation product or process. Further, such person does not seem to have an ability to reflect the intention of the activity that they are doing nor address the current challenges that society are currently facing.

Responsible Innovation and Extraversion

The empirical finding also gave a support for Hypothesis 1d, which predicted a positive correlation between extraversion and responsible innovation. This finding provides another evidence to literatures that discuss extraversion and creativity (King et al., 1996; McCrae & Costa Jr, 1999). However, it is interesting to note that MRA found the insignificant regression coefficient between extraversion and responsible innovation behavior. Taking a further look at the correlation tables, this insignificant regression coefficient was caused by a significant positive correlation between extraversion and agreeableness. Insignificant regression coefficient is somehow unexpected. However, previous studies explains that relation between traits might happen in a pro-society behavior (Carlo et al., 2005; Omoto & Snyder, 1995). For example, Carlo et al. (2005) show that extraversion has a significant positive correlation with agreeableness. Similar findings were also found by De Raad (1995) and Trapnell and Wiggins (1990). In particular Koole, Jager, van den Berg, Vlek, and Hofstee (2001) find a relationship between extraversion and agreeableness in a societal-related decision making.

With regards to the relation between extraversion and agreeableness, scholars argue that individuals with high extraversion score is likely to strive for warm and encourage social interactions if it is combined with the altruistic positioning occurred integrally in agreeableness (King et al., 1996). Extraverts have a frequent contact with other parties and at the same time create a positive networking quality (Okun et al., 2007). It implies that such person has an ability to progress a cooperative action.

Extraverted individuals are associated with sociability, assertiveness, and warmth. Such encouraging emotions is vital while doing a cooperative action that involve actors with diverse objectives. Such positive behavior would then potentially create a satisfied decision, especially for the topic that is threatened by controversies. Individuals with an active social interaction are easy to consider societal value, be it to prevent a negative consequence of innovation or to provide an answer to address the current societal challenges. For that reason, an extravert person translates an anticipation and responsiveness aspect of responsible innovation.

Responsible Innovation and Conscientiousness

The present study cannot provide an evidence to confirm the Hypothesis 1e. It is found that conscientiousness do not correlate with responsible innovation behavior. This result provides evidence that explains the puzzle relation between conscientiousness and creativity and conscientiousness and cooperative interaction (King et al., 1996; Witt, Burke, Barrick, & Mount, 2002). Having said that, the present study extends the common personality discussion that explain the dilemma between conscientiousness and creativity in the context of responsible innovation.

Insignificant relationship between conscientiousness and responsible innovation behavior could be explained by the fact that an innovator with high level of conscientiousness may give an advantage to incorporate ethical perspective in the innovation processes. In addition, such well-organized individuals could be more creative because they see creativity as an accomplishment. In this case, a talented innovator may not attain creatively without a hard work and self-discipline. In particular, they reflect an anticipative action by formulating an ambitious goal to address the problems that society is currently facing (Blok & Lemmens, 2015; Lubberink et al., 2017; Von Schomberg, 2011a).

There are, however, other possible explanations between conscientious and responsible innovation behavior. In a general personality literature, scholar explain that a well-organized behavior may not necessarily associate with creativity {Tierney, 2002 #407}(Amabile, 1988). I argue that such behavior may also exemplify in the responsible innovation context. (Lopes et al., 2004), for example, argue that conscientious would hinder a social interaction. In this case, conscientious describes a self-regulation

capacity. Scholars like Lopes et al. (2004), Larsen (2000), and Muscanell and Guadagno (2012) then explain that such self-regulation capacity can inhibit a social adaptation. Considering this dilemma, therefore, it does make sense that conscientiousness cannot clearly predict an individual behavior towards responsible innovation concept.

Ris and Ethical Climate

Next, I found a confirmation for Hypothesis 2, which predicted a significant positive correlation between ethical climate and responsible innovation behavior. As expected, people with higher ethical climate scores displayed a more positive behavior in regards to the responsible innovation concept. At the most basic, this finding is in line with ethical climate literatures which suggested that employees are allowed to show their moral beliefs in the work place as long as they comply with company rules, legal laws, and societal norms (Elçi & Alpkan, 2009; Lu & Lin, 2014; Mayer, Kuenzi, & Greenbaum, 2010; Weeks, Loe, Chonko, & Wakefield, 2004).

Having said that, conclusions from prior literatures may be largely based on the fact that did not take creativity (innovative) aspect into account. In this regards, the present study provides an additional agreement with the responsible innovation academia. Following legal rules or professional standards would make the innovators to be more reflexive. In this case, formal regulations will give a guidance for the innovators to cope with the societal problems and at the same time maintain their business growth (Chou & Chou, 2012). In particular, a clear guidance is important for innovators to evaluate their decision in the innovation processes (Armstrong et al., 2012). In addition, professional regulations also give a clear direction for the innovators to address an appropriate solution in solving recent problems (Krucoff, Brindis, Hodgson, Mack, & Holmes, 2012; Prahalad, 2012). Furthermore, a combination between creativity, formal regulations, and societal caring will help the innovators to reduce the uncertainty in regards to the adverse impact of innovation (Lubberink et al., 2017).

Ris and Ethical Behavior

The results obtained in the data analysis do not lend an empirical support towards Hypothesis 3. Contrary to the expectation, the results from correlation analysis and MRA did not find a statistically significant relation between ethical behavior and responsible innovation behavior.

This evidence might favor that there is little overlap between responsible innovation scale that was proposed in the present study and the ethical behavior scale that was developed by Fraedrich (1993). In the original paper, Fraedrich (1993) explained that "Unethical people are so defined in that they become dishonest relative to the organization's goals and procedures". Based on his ethical behavior measure, Fraedrich (1993) found that a deontological business practitioner has a higher ethical behavior score than a utilitarian business practitioners. This view indicates that ethical behavior is prescribed by the company and therefore is considered as a rule-oriented scale. Such perspective implies that the company is used as a basis to determine the ethical assessment over its employee. Thus, a deviance behavior from the company's rules is considered unethical. Baker, Hunt, and Andrews (2006) found an empirical finding that observed such ethical perspective. In their research, they observed that employee who has a high score in ethical behavior also has a high level of commitment to the company.

The ethical behavior definition from Fraedrich (1993) implies that the ethical perspective can merely be seen from the company's perspective. This definition somehow does not relate to the concept of responsible innovation. As argued by responsible innovation scholars, the company's perspective must not become the single innovation objective in a company (Stilgoe et al., 2013; Von Schomberg, 2011a). Innovation is value laden and, therefore, can have a moral agency. Ignoring a society ethical perspective by blindly focusing

on the company goal would not only make a rejection to the innovation products, but also give a detrimental impact to society (Correljé et al., 2015; Friedman & Kahn Jr, 2003; Van de Poel & Verbeek, 2006). For that reason, innovators in the company have a responsibility towards the society (Doorn & van de Poel, 2012; J. Hankins, 2015b; Pesch, 2015; Roeser, 2012; Van den Hoven, 2014).

Ris and Sustainable Development Goals

Further, I found a positive relationship between sustainable development goals and Responsible Innovation which confirmed Hypothesis 4. This finding corroborates the idea that is in line with the suggestion in the innovation literature (Provasnek, Sentic, & Schmid, 2017) and in the organizational practice (Maak, Pless, & Voegtlin, 2016; Ovchinnikov, Kozenko, Bichkov, Kabanov, & Karpova, 2015) that discusses a relationship between sustainability and social-oriented innovation.

While acknowledging that sustainability has become the new trends in recent innovation practices, the present study seems to provide an additional feature that such innovation can also be driven by an ethical perspective. Regarding to this, an SDG-oriented innovation seems to be consistent with existing researches in responsible innovation domain. Following (Blok & Lemmens, 2015; Lubberink et al., 2017), it does relate with the responsiveness dimension that emphasizes a solution to solve the grand challenges in recent era, be it in social (Bartlett, 2009; Edwards-Schachter, Matti, & Alcántara, 2012; Jamali, Yianni, & Abdallah, 2011) or environmental context (Carrillo-Hermosilla et al., 2010; Larson, 2000; Wodzisz, 2015). In addition, such innovation also indicates a degree of awareness to anticipate the unwanted consequences of innovation. In this case, a company prerequisites knowledge from internal and external sources to set up the goals that is in line with the societal goals (Chalmers & Balan-Vnuk, 2013; Dean & McMullen, 2007; Meek, Pacheco, & York, 2010; Wilson & Post, 2013). Moreover, a high score in sustainable development goal indicates a reflexivity to improve a better living and at the same time avoiding harm while doing innovation (N. M. P. Bocken et al., 2014; Carrillo-Hermosilla et al., 2010; Dossa & Kaeufer, 2014). Furthermore, considering the sustainable development implies an inclusiveness and deliberative dimension to maintain a collaborative thinking between different viewpoints (Ayuso et al., 2006; Bartlett, 2009; Dossa & Kaeufer, 2014; Gassmann, Daiber, & Enkel, 2011; Zeng, Xie, & Tam, 2010).

Ris and Creative Self-Efficacy

Next, as expected, this study confirmed the Hypothesis 5, which predicted a positive relationship between creative self-efficacy and responsible innovation behavior. This finding extends the work of Tierney and Farmer (2002) that demonstrates creative self-efficacy as a combination between self-efficacy (Bandura, 1997) and creativity (Amabile, 1988). Conceptually, this finding is in line with those of previous studies that examined creative self-efficacy in the organization theory and managerial practice (Gong, Huang, & Farh, 2009; Richter, Hirst, Van Knippenberg, & Baer, 2012; Tierney & Farmer, 2011).

However, the current discussion of creative self-efficacy seems to give little attention to the role of ethical perspective. In response to fulfil this gap, finding from present study advances a connection between creative self-efficacy and responsible innovation. Along similar lines, this finding conforms a conclusion from a line of research suggesting the importance of creative-self efficacy in the ‘innovation for society’ concept. For example, creative self-efficacy indicates a reflexivity dimension in thinking the value and motivations in the innovation process (Lubberink et al., 2017). In order to create a worthwhile innovation, different levels of efficacy from various actors can be linked by setting up the priority among those values and motivations (N. Bocken, Short, Rana, & Evans, 2013; Harrisson, Chaari, & Comeau-Vallée, 2012; Thøgersen & Zhou, 2012). This priority setting can be more effective by incorporating the relevant actors and deliberatively sharing value criteria (Ayuso et al., 2006; Chalmers & Balan-Vnuk, 2013; Davari & Strutton, 2014; Harrisson et al., 2012; Holmes & Moir, 2007; Kumar & Malegeant, 2006; Rohrbeck,

Konnertz, & Knab, 2013). In addition, creative self-efficacy also supports the idea of anticipation and responsiveness. The former can emerge from an effort to develop a short term and long term visions in regards to develop roadmaps for impact (M. G. Arnold & Hockerts, 2011; Loorbach, van Bakel, Whiteman, & Rotmans, 2010; Lubberink et al., 2017), while the latter can stem from changing the organizational routines as an actual response to a changing environment (Bartlett, 2009; Becker, Lazaric, Nelson, & Winter, 2005; Feldman & Pentland, 2003).

Ris and Innovative Working Behavior

This present study also found a support for Hypothesis 6, which predicted a significant positive correlation between responsible innovation behavior and innovative working behavior. This finding is in accord with earlier studies in theorizing (J. De Jong & Den Hartog, 2010; Janssen, 2000); S. G. Scott and Bruce (1994) and showing (S.-C. Chen, Wu, & Chen, 2010; Reuvers, Van Engen, Vinkenburg, & Wilson-Evered, 2008; Slåtten & Mehmetoglu, 2011) the level of individual innovativeness in a workplace. Similar finding was also observed in several studies that incorporate the ethical aspect to measure innovative working behavior (A. Agarwal, 2014; Carmeli & Spreitzer, 2009; Yidong & Xinxin, 2013).

However, previous studies perceive the ethical aspect simply from a company perspective. Thus, the present study offers an important finding between innovativeness in the workplace setting and its relation to the society ethical perspective. In this fashion, the present study corroborates the idea of responsible innovation that underlines creativity in the innovation processes. In particular, innovative working behavior shows an importance to generate new ideas and transform these ideas into useful applications. This view implies a responsiveness dimension that can be seen as an aspect to provide solutions to global challenges (Pode, 2013; Van den Hoven, 2014; Wodzisz, 2015). In addition, innovative working behavior ensures innovators to have an ability to mobilize support while transforming new ideas into useful application. For that reason, it complies with the inclusiveness and deliberative dimension (Alvial-Palavicino, Garrido-Echeverría, Jiménez-Estévez, Reyes, & Palma-Behnke, 2011; Edwards-Schachter et al., 2012; Franke et al., 2013; Hienerth, Lettl, & Keinz, 2014; Ornetzeder, 2001). Furthermore, innovative working behavior provides an innovator to evaluate the ideas that they develop. Having an evaluation process implies an effort to recognize society needs that are vital in the anticipation dimension (Chalmers & Balan-Vnuk, 2013; Dangelico & Pujari, 2010; Wilson & Post, 2013). At the same time, the evaluation process will help the innovators to reconsider their actions and responsibilities toward society (Andersson, Jansson, & Lundblad, 2012; Armstrong et al., 2012; Joore, 2008).

6.3 Conclusion of Discussion

This chapter has described that responsible innovation behavior contains four factors: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea generation. This chapter has also explained the relationship between responsible innovation behavior and individual personality. It is observed that responsible innovation behavior has a positive correlation with openness, agreeableness, and extraversion. However, the role of extraversion is not strong because, in social-oriented activity, extraversion is often linked to agreeableness.

This chapter has also given details that responsible innovation behavior has a positive correlation with other behaviors that are related to ethical climate, sustainable development goal, creative self-efficacy, and innovative working behavior. However, it is found that responsible innovation behavior is not related to ethical behavior because these two behaviors see ethics from different perspective. In this case, the former emphasizes ethics from society perspective, while the latter stresses ethics merely from company point of view. All in all, this chapter provides another solid evidence to support the convergent validity, discriminant validity, and nomological validity of the Ris_Model1.

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CHAPTER 7
CONCLUDING CHAPTER

"One worthwhile task carried to a successful conclusion is better than 50 half-finished tasks" — B. C. Forbes

Responsible innovation is such a vital concept to take society ethical perspective into account in the innovation process (Owen et al., 2012; Owen et al., 2013; Van den Hoven, 2014; Von Schomberg, 2011a). As innovation is value laden (Correljé et al., 2015; Friedman & Kahn Jr, 2003; Van de Poel & Verbeek, 2006), many evidences have proved that the ignorance of society ethical perspective would only bring the negative consequences into society (Blowers, 2011; Van de Poel, 2011) (Grunwald, 2005; Tavani, 2008; Van den Hoven, 1997, 2007).

Currently, the concept is still much in an explorative phase (Blok & Lemmens, 2015; Bos et al., 2014; De Hoop et al., 2016; Koops, 2015; Pavie & Egal, 2014; Rip, 2016) and, therefore, has little interest to discuss the application in the business context (Blok & Lemmens, 2015; Bos et al., 2014; De Hoop et al., 2016; Koops, 2015; Pandza & Ellwood, 2013; Pavie & Egal, 2014; Rip, 2016) (Baregheh et al., 2009; Lubberink et al., 2017; Scholten & Blok, 2015). In fact, in the business context, innovators play a significant role to determine the impact of the innovation toward society (Doorn & van de Poel, 2012; J. Hankins, 2015b; Pesch, 2015; Roeser, 2012; Van den Hoven, 2014). For that reason, it is important to understand innovator behaviors in regards to society ethical perspective.

This understanding needs a scale that can quantitatively measure individual behaviors in regards to responsible innovation concept (M. de Jong et al., 2015; Fisher, 2016; Foley et al., 2016; Ribeiro et al., 2016). However, there is no study that has made an attempt to address such demand. The main objectives of this thesis are therefore to (1) reviewing the responsible innovation literatures and (2) to developing and validating a scale that can measure the level of individual behaviors in regards to responsible innovation concept in the business context. In order to support such objectives, the central question of this study is "What is the validated tool that can be used to measure a level of individual behavior in regards to responsible innovation concept in a business context?" The present study shows that this is indeed the case that the scale that is proposed in this study can provide such demands and, therefore, fills the gap in the responsible innovation literatures.

This concluding chapter will address four aspects that relate to the findings that have been achieved in this study. First, it will give a summary of the findings by answering the research questions. Next, it will describe the contribution of this study from the academic and managerial perspective. Subsequently, it will present the limitation from this study and the recommendations for future research. Last, this chapter will end with an overall conclusion.

7.1 SUMMARY OF THE MAIN FINDINGS

In this study, firstly, I explored responsible innovation literatures to see what scale that is suggested by these literatures that can measure a level of individual behavior in regards to responsible innovation concept in the business context (*Sub-RQ1*). The answer of this question is given in Chapter 2. The literature review

shows that current responsible innovation scholars have mainly focused on the concept development. These concepts present several responsible innovation dimensions: anticipation, reflexivity, inclusion, deliberation, and responsiveness. In the business context, each of these dimensions has several key strategies that need to apply. The explanation about key strategies in anticipation, reflexivity, inclusion, deliberation, and responsiveness are respectively given in Appendix 1, Appendix 2, Appendix 3, Appendix 4, and Appendix 5).

However, the literature review shows that the measure of individual behavior is regrettably missing in the responsible innovation discussion. In other words, the responsible innovation literatures have not provided a clear suggestion on how to develop such measurement tool. I then argue that such measurement tool can be developed using the study of individual behavior.

After getting the theoretical understanding from Chapter 2, I propose responsible innovation scale. This scale development is discussed in Chapter 3. Thus, Chapter 3 provides the answer for *Sub-RQ2: What is the scale that is proposed by this study that can measure a level of individual behavior based on the current concept of responsible innovation concept in the business context?* In this study, responsible innovation scale is defined as a scale that can measure the level of individual behavior based on the responsible innovation concept in the business context. From existing literatures, it is found that there are two individual behaviors that can represent the concept of responsible innovation: creativity behavior and ethical behavior. I argue that the latter one can be constructed by the responsible innovation literatures, while the former one can be derived from creativity literatures. Combining the insight from these literatures, I find that, in the business contexts, responsible innovation behavior consists of responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization. Based on these dimensions, I then propose responsible innovation scale: a 7-Likert scale that contains 12 items.

Next, the proposed scale is tested using a survey to see if there is modification that should be applied. The finding about this empirical data is discussed in Chapter 4 as a mean to answer *Sub-RQ3*: *Based on empirical data that is acquired from the proposed measurement scale, what is the finalized scale that can measure a level of individual behavior based on the current concept of responsible innovation concept in the business context?* After analyzing the data, it is found that the factor structure of the finalized scale is consistent with the factor structure of the proposed scale. However, several items need to be eliminated. Based on this finding, the finalized responsible innovation scale contains 8 items. The differences between the proposed scale and the finalized scale is shown in Table 37.

Last, I assessed the validity of finalized responsible innovation scale to answer Sub-RQ4: *What is the result of validity testing of the proposed measurement scale?* This validity discussion is explained in Chapter 5 and Chapter 6. Statistical analysis in Chapter 5 shows that the finalized responsible innovation scale meets all validity assessment required in the scale development process. In line with this result, Chapter 6 has also showed that the finalized responsible innovation scale is consistent with other existing scales that are related with individual behavior and ethical behavior. Thus, the finalized responsible innovation scale has satisfied the nomological validity by accurately predicting the relations with other concepts from theoretical perspective.

First, the finding shows a support to the individual behavior theory. In this case, the responsible innovation behavior is positively related to openness, agreeableness, and extraversion, but have negative correlation with neuroticism. The study finds no correlation between responsible innovation behavior and neuroticism. This finding also finds a support to the theory that responsible innovation behavior does not correlate with conscientiousness. Further, the study also confirms the hypothesis that the responsible innovation behavior is positively correlated with other individual behaviors that are associated with ethical climate (Cullen et

al., 1993; Victor & Cullen, 1988), sustainable development goals (Voegtlin & Scherer, 2017), creative self-efficacy (Bandura, 1997; Tierney & Farmer, 2002), and innovative working (Janssen, 2000; S. G. Scott & Bruce, 1994). Furthermore, the present study shows no correlation between responsible innovation behavior and the Fraedrich's (1993) ethical behavior concept as these two behaviors see ethical consideration from different perspectives.

Table 37. The proposed and the finalized responsible innovation scale

Factor Structure	Ris Items	
	Proposed (Ris_Original)	Finalized (Ris_Model1)
Responsible Idea Generation (Originality)	I am good at coming up with ideas that are novel, but also right	I am good at coming up with ideas that are novel, but also right
	I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	I find it easy to generate original solutions that reflect how the problem at hand ought to be solved
	The originality of an idea is of much more interest to me than the ethical side of that idea	-
Responsible Fluency	I have a knack for coming up with many ethical solutions to a problem	Producing large numbers of solutions for a better future comes natural to me
	Producing large numbers of solutions for a better future comes natural to me	I am good at generating many ideas that capture the responsible side of innovation
	I am good at generating many ideas that capture the responsible side of innovation	-
Responsible Flexibility	When generating ideas, I find it easy to explore a wide range of politically correct alternatives	I have a knack for coming up with many ethical solutions to a problem
	It is important to me to explore the various ethical aspects of my ideas	It is important to me to explore the various ethical aspects of my ideas
Responsible Idea Realization	Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me
	I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements
	I have no particular interest in evaluating the moral aspects of my new ideas	-
	I like to contribute to the implementation of new ideas when these are appropriate to solving a meaningful problem	-

Note. In order to measure the items, this scale applies a 7-item Likert scale:
1 = very strongly disagree, . . . , 7 = very strongly agree.

7.2 STUDY CONTRIBUTION

In carrying out the master theses, this study has accomplished several contributions. This section will present such contributions that are relevant to both academia and business practitioners.

7.2.1 Scientific Contribution

In the scientific domain, the present study has given a significant implications to a number of literature streams.

Responsible Innovation Literatures

First, the main contribution of this study lies in the responsible innovation literatures. It provides an understanding about the current situation of responsible innovation concept especially in the business context especially. So far, responsible innovation literatures have emphasized on the conceptual discussion. Therefore, the understanding about this concept is the business domain has put little attention (Blok & Lemmens, 2015; Davies & Horst, 2015; De Hoop et al., 2016; M. de Jong et al., 2015; Lubberink et al., 2017; Pavie et al., 2014). In this fashion, the present study gives a summary about the responsible innovation in the business context.

In addition, notwithstanding with the fact that that are some studies that recently hve examined the responsible innovation in the business context, the present study hardly find the researches that examine the individual innovator as the subject of the study. Regarding to this, the present study has provided an important evidence by identifying four dimensions that relate to the individual behavior in regards to the responsible innovation concept in the business context: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea generation. From theoretical perspective, current responsible innovation literatures has conceptualized the responsible innovation according to five dimensions: anticipation, reflexivity, inclusion, deliberation, and responsiveness (Stilgoe et al., 2013). However, little is known on how this concept can relate to individual behavior. Thus, the present study adds to responsible innovation literatures on identifying these four dimensions of individual behavior.

Personality and Social Psychology Literatures

In addition, the present study has opened the possibility to a broader understanding of individual personality. Admittedly, prior personality studies have examined the relationship between the role of personality and creativity (innovativeness) (Barron & Harrington, 1981; Costa & McCrae, 1980; King et al., 1996; McCrae & Costa Jr, 1999; McCrae & Costa, 1987; Rogers, 1961). However, little is known about the relationship between personality and innovativeness if the society ethical perspective is taken into account. Thus, the present study sheds more light on the issue by offering an empirical evidence between personality and responsible innovation behavior.

Managerial Literatures

The present study has also given a significant contribution to the stream of literatures that focuses on managerial area, be it from applied psychology and organizational behavior studies. In regards to the former, this study provides a new ground for the study of creative self-efficacy. As a concept, creative self-efficacy has traditionally been related innovativeness in company (Gong et al., 2009; Richter et al., 2012; Tierney & Farmer, 2011). However, prior literatures have little evidence about the association between creative self-efficacy when it comes to incorporate society ethical perspective in the innovation process. Thus, the present study has also captured the association between the creative self-efficacy discussion and its applications towards responsible innovation.

In the context of organizational behavior literatures, the present study has closed the gap between innovative working behavior and 'innovate responsibly' concept. To date, mainstream innovative working behavior scholars have focused on theorizing (J. De Jong & Den Hartog, 2010; Janssen, 2000); S. G. Scott and Bruce (1994) and showing (S.-C. Chen et al., 2010; Reuvers et al., 2008; Slåtten & Mehmetoglu, 2011) support for innovative working behavior based on the workplace perspective. Recently, some studies have enriched this concept by taking into account an ethical perspective (A. Agarwal, 2014; Carmeli & Spreitzer, 2009; Yidong & Xinxin, 2013). Nevertheless, these studies see the ethical aspect simply from the organization (business) perception. Thus, the present study has provided an important finding between the creativity in the workplace setting and the involvement of society ethical perspective in such creative process.

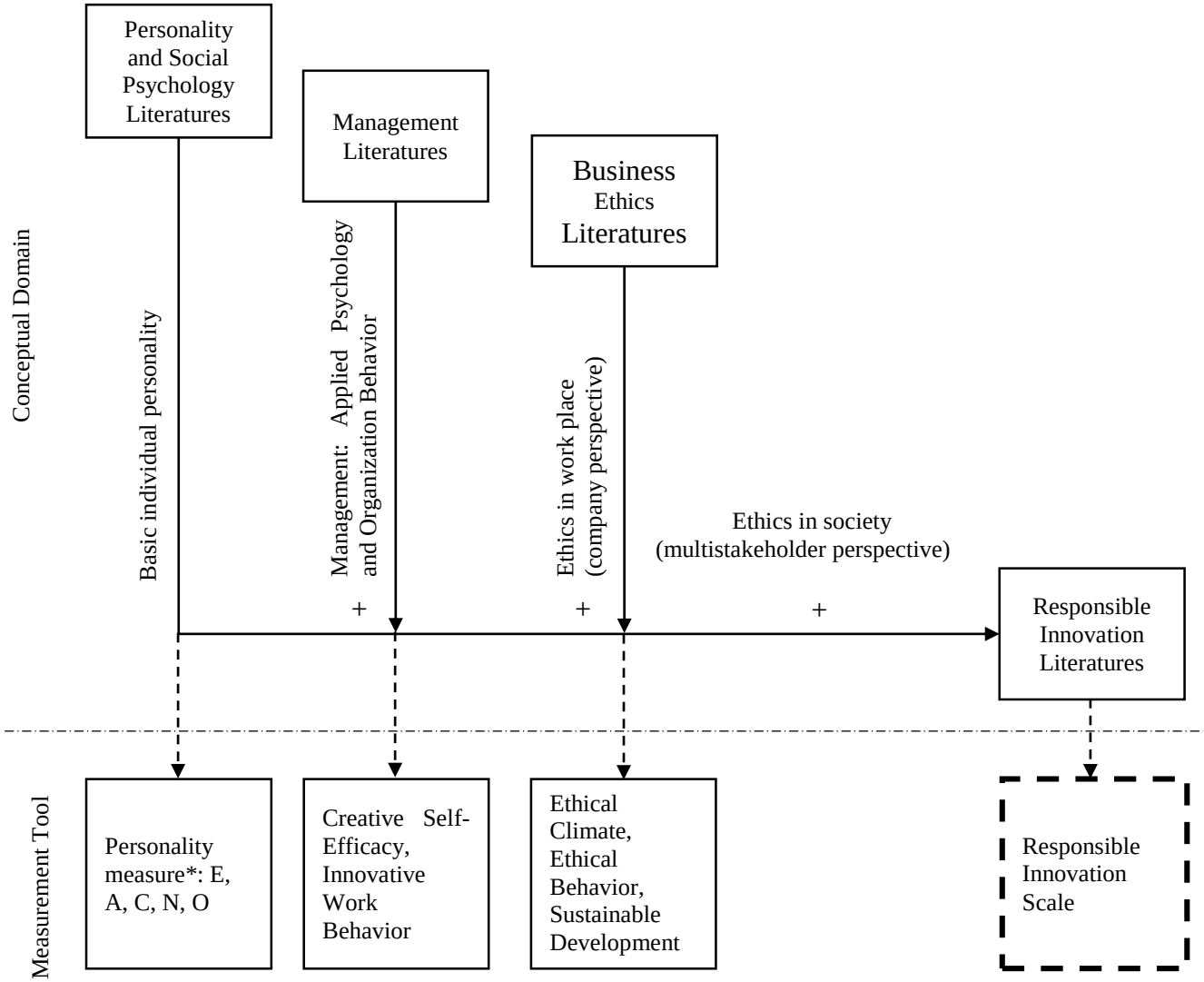
Business Ethics Literatures

In the domain of business ethics, the present study has given three contributions. First, this study presents a differ perspective from prior cross-level research in the area of ethical climate. Existing studies in ethical climate show that employees could have a freedom to decide what is right and wrong in the work place as long as it is comply with the company rules, legal laws, and societal norms (Elçi & Alpkan, 2009; Lu & Lin, 2014; Mayer et al., 2010; Weeks et al., 2004). However, prior ethical climate studies have ignored the role of creativity (innovativeness) in the ethical perspective. In addition to this conceptual root, the present study has provided the relationship between the existing ethical climate theory and the concept of responsible innovation. Thus, this study adds a breakthrough evidence in the relation between ethical climate and responsible innovation.

Along similar lines, the present study offers a new insight to the domain of ethical behavior research. Recently, scholars working in the ethical behavior domain have primarily assessed employee's ethical aspect from a company perspective (Fraedrich, 1993). Thus, conclusion from prior literatures maybe largely based on the fact that have not taken into account society ethical perspective. The present study reveals that a single-minded perspective by focusing merely on company objective does fit with the concept of responsible innovation. Thus, the present study provides a contribution by making an available confirmation about the dissociation between these contrasting concepts.

Moreover, the present study contributes to the domain of sustainable development goals. Current literatures in sustainable development goals mainly emphasizes the innovation from societal and environmental aspect (Provasnek et al., 2017). Although consistent with this conceptual root, the present study makes clear that the social and environment innovation is also associated with the ethical perspective. Thus, the present study allows an understanding on the relationship between the sustainable development goals and the responsible innovation concept

Based on the discussion above, Figure 4 is given to summarize the contribution of the present study from academic perspective.



Note: *E: extraversion, A: agreeableness, C: conscientiousness, N: neuroticism, O: openness

Figure 4. Scientific contribution of the present study

7.2.2 Practical Contribution

In addition, it would also be relevant to apply the result of the present study to a number applications in the managerial practice.

The Scale as a Measurement Tool

From organization perspective, the main contribution of the present study is providing a validated scale that can be used to measure individual behavior in regards to responsible innovation concept in the business context. Through their innovative products and process, innovators play a big responsibility toward society (Doorn & van de Poel, 2012; J. Hankins, 2015b; Pesch, 2015; Roeser, 2012; Van den Hoven, 2014). Building on this view, responsible innovation becomes a promising concept that can incorporate the society ethical perspective in the innovation process (Stilgoe et al., 2013; Von Schomberg, 2011a). However,

innovators have adifficulty to implement such concept in their work (Blok & Lemmens, 2015; Davies & Horst, 2015; De Hoop et al., 2016; M. de Jong et al., 2015; Lubberink et al., 2017; Pavie et al., 2014). Thus, the present study has given a significant contribution for the innovators to operationalize the concept of responsible innovation in their innovative tasks.

Innovators and managers in the business context could use the responsible innovation scale for various objectives, either in the company level or in the industry level. The relationship between responsible innovation behavior and basic individual behaviors has indicated that personality plays an important role in determining responsible innovation behavior (Barron & Harrington, 1981; Costa & McCrae, 1980; King et al., 1996; McCrae & Costa Jr, 1999; McCrae & Costa, 1987; Rogers, 1961). Thus, in the company level, this scale could help line managers and human resource department officers to assess an employee candidate during the job application processes. In addition, this scale could be used as a benchmarking tool for project managers to assess their teams' behavior before starting a project. It importantly applies for the disruptive project, be it the project that involves in disruptive technology (e.g., nanotechnology or GMO) or disruptive market (e.g., bottom of the pyramid market). In the industry level, responsible innovation scale could benefit the government to measure different characteristics between industries (e.g., the industry that deals with the high technology sector and the industry that focuses in the low technology sector). Therefore, by creating the responsible innovation scale, the present study has provided a checklist for a company and industry to assess the responsible innovation behavior.

Societal Benefit

As there are only eight variables, the responsible innovation scale is relatively concise. At the minimum, I would argue that the scale could measure a sufficient psychometric properties to serve as a measurement tool for business perspectives. The positive association between responsible innovation scale and ethical climate, sustainable development goals, creative self-efficacy, and innovative working behavior scale; and the disassociation between responsible innovation scale and ethical behavior scale implies that responsible innovation scale is also reliable as it is premised on the sound methodologies designed to assess its psychometric properties that are relate with the concept of responsible innovation. By developing responsible innovation scale, the present study has provided a tool to reduce the level of uncertainty in which the innovation is not run in an ethical way. In this fashion, it is likely that the society could reap the benefit by being less vulnerable from undesired impact of innovation.

7.3 STUDY LIMITATIONS

In addition, it is important to note that the results of this study needs to be interpreted in light of several important limitations. This section will explain the limitations bounded in this study.

7.3.1 Insufficient Factor Component

From the empirical data, every factor in the responsible innovation scale only consists of two variables. Scholars, like Hair et al. (2014, p. 676), argue that every factor should at least have three or four factors to ensure the "minimum coverage of the construct's theoretical domain". In addition, Cook (1981) has highlighted that the sufficient internal consistency reliability can be achieved if there are at least three items. Yong and Pearce (2013, p. 80) also explain that "A factor with 2 variables is only considered reliable when the variables are highly correlated with each another ($r > .70$) but fairly uncorrelated with other variables".

The empirical finding of this study (as shown in correlation matrix in Table 9), however, do not conform to this requirement. These explanations describe why although the factor structure is stable, the responsible idea realization (Ris09 and Ris10) and the responsible idea flexibility (Ris04 and Ris08) do not have a high reliability. These factors have Cronbach's Alpha value of .702 and .698 respectively. Following the

suggestion from Carmines and Zeller (1979), I suggest to add more items to ensure the reliability of the scale.

Nevertheless, it should be noted that this suggestion does not imply that the factor structure that is derived in this study is not stable. For the set of questions that are available, I am certain that this factor structure is stable as it is.

7.3.2 Lack of Panel Interview

During the item development processes, a panel interview was not administered to assess the item (question) sets. Hardesty and Bearden (2004) argue that expert interview is needed to ensure face validity of the content.

However, Schriesheim, Powers, Scandura, Gardiner, and Lankau (1993) and Hinkin et al. (1997) have explained that the content assessment could also be examined using the factor analysis. Therefore, by applying the factor analysis in a large number of random half sampling (and assess them with various methods), I have minimized the content inadequacy of the measured construct.

In addition, it is also important to note that Hinkin et al. (1997, p. 5) have also explained that none of the expert interview or factor analysis will "guarantee a content valid scale". Therefore, I would suggest to apply an expert interview as a complementary method to factor analysis to ensure the content validity.

7.3.3 Debate over Factor Extraction Method

This study applies PCA as the factor extraction method. Although there is a considerable debate about what factor extraction and factor rotation method that should be used while doing exploratory factor analysis (EFA) (L. A. Clark & Watson, 1995; Costello & Osborne, 2005; Field, 2009; Hair et al., 2014; Hinkin et al., 1997; B. Williams et al., 2010; Worthington & Whittaker, 2006), this debate seems to argue that PCA do not entirely consistent with EFA. I believe that this debate will always remain (Gorsuch, 1990; Guadagnoli & Velicer, 1988; Velicer & Jackson, 1990) and, therefore, I do not have the ambition to distinguish these differences.

The whys and wherefores I chose PCA is explained in Section 3.3.1: PCA is suitable in the initial data analysis to reduce the number of items (Hair et al., 2014; B. G. F. Tabachnick, L.S., 2007). In order to minimalize the undesired impact of PCA in the factor extraction process, I have assessed the suitability use of PCA in every steps of item reduction process (Section 4.3.1 until Section 4.3.5) and I have also applied another factor extraction method (Principal Axis Factoring) to validate the factor structure. Considering the fact that the PCA suitability assessment and the result of Principal Axis Factoring gives a supporting evidence to the observed factor structure, I would argue that it is unlikely that the use of PCA in this study is unacceptable.

7.3.4 Possibility of Response Bias

Although I have argued that the use of university students in this study would represent a sufficient heterogeneity among respondents, I expect that this condition would only be applicable in the pilot testing research (L. A. Clark & Watson, 1995). Thus, it would be advantageous for the future studies to administer the survey using the respondents who have sufficient background in the innovation-related activities.

In addition, the possibility of response bias also comes from the fact that this study examines the individual ethical perspective. Randall and Fernandes (1991) has explained that the response bias is "pose an even greater threat to the validity of findings" in ethics research that other organizational behavior studies. According to him, this bias stems from "the presence of a social desirability" (Randall & Fernandes, 1991).

7.4 SUGGESTION FOR FUTURE STUDIES

Developed and validated using the solid methodologies, I would argue that, at the minimum, the scale could measure a sufficient psychometric properties that are related with the responsible innovation concept. Thus, this scale serve as an initial point to a more sophisticated research that is needed for both academic and business perspectives. In order to generalize this scale, I suggest several fruitful avenues for future studies.

7.4.1 Different Innovation Context

First, the future research could analyze on how individuals working in different innovation context would produce a different result in regards to the responsible innovation behavior. I argue that the people working in the radical innovation activities would have a lower responsible innovation behavior score that the one that works in the incremental innovation activities. This comes from the fact that the incremental innovation has a more "business as usual" situation than radical innovation (Christensen & Overdorf, 2000). Following this view, it is likely that the radical innovation would create a non-standard situation that challenges the existing moral respect (Grunwald, 2014b).

7.4.2 Different Department Context

Second, it would also be useful to replicate this study in different department in one company. I argue that employee who are working in explorative tasks (e.g., research and development department) would seems to have a lower responsible innovation behavior score than the employee who are working in exploitative tasks (e.g., sales department) (O'Reilly 3rd & Tushman, 2004). Similar with the explanation in previous section, the explorative activity is likely to challenge the existing moral standard (Grunwald, 2014b).

7.5 OVERALL CONCLUSION

On the whole, the major strength of the present study is it is the first to crystalize the scale to measure individual behavior in regards to responsible innovation in the business context, namely responsible innovation scale. In the light of very limited resource, I have taken a challenging step to open the door to develop and validate such scale. Responsible innovation scale contains eight questions that represent four factors: responsible idea generation, responsible fluency, responsible flexibility, and responsible idea realization. It is my hope that this study advances the overall understanding of responsible innovation, especially in the business context. Last, I also encourage future researches to explore the fertile ground of the present study to understand the responsible innovation behavior in different settings.

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APPENDIX 1

Anticipation

DETERMINING DESIRED IMPACTS AND OUTCOMES OF INNOVATION

In order to anticipate the future impact of innovation, the company needs to determine the desired impact of innovation. Determining the impact of innovation requires the company to apply three key activities (Lubberink et al., 2017). At first, company engages in several activities that will improve its knowledge about the innovation context (Balachandra & Friar, 1997; Bartlett, 2009; Chadha, 2011; Gaziulusoy, Boyle, & McDowall, 2013; Ortt & van der Duin, 2008). This engagement necessitates the company to monitor the innovation environment, like technological development, market dynamics, or regulation changes. Monitoring innovation environment is not only intended to multinational companies, but also on the Small and Medium Sized Enterprises (SMEs) (Biondi, Iraldo, & Meredith, 2002). In order to do this, company is advised set up a dedicated team to handle the monitoring tasks (Chadha, 2011). Based on this view, technology monitoring is aimed to overcome the competence lock-in when the company do the radical innovation development. Addressing the competence lock-in would increase the company's awareness to the environment changes, and at the same time, it would also help the company to set up the suitable strategy based on different characteristics (Noci & Verganti, 1999).

Another way to monitor the innovation environment in the context of determining the desired innovation impacts is by mapping the relevant stakeholders. Different stakeholders usually have different power and scope that will influence the decision making in the company (Spitzeck & Hansen, 2010). Related to this, the company might use a value mapping tool to develop the sustainable value creation from different stakeholder perspective (N. Bocken et al., 2013). Mapping the stakeholder value would help the company to engage with the relevant stakeholders (Bourne & Walker, 2005). Stakeholder mapping is especially important for the company that is dealing with radical innovation in which the company faces high uncertainties (e.g., organizational, technological, social, and commercial). In this case, the company identifies the stakeholder based on the level of stakeholder ambiguity (contradictory demands, goals, and interests) and the level of stakeholder complexity (the number of stakeholder interactions) (Hall & Martin, 2005).

After the company monitors the innovation environment, it needs to recognize the societal and environmental needs (Lubberink et al., 2017). In other words, understanding the stakeholder values would be needed (N. Bocken et al., 2013). For the societal needs, the company prerequisites to set up the goals that is in line with the societal goals (Wilson & Post, 2013). Scholar have identified that there are two factors that influence a company to do this alignment: the perceived social venture desirability (i.e., the intention that is affected by attitudes, like empathy and moral judgment) and the perceived social venture feasibility (i.e., the belief about the ability to create something that is influenced by social support and self-efficacy beliefs) (Mair & Noboa, 2006). In order to include the societal needs in the innovation processes, company is encouraged to do both internal (e.g., facilitating variation and sharing knowledge) and external routines (e.g., identify value of external knowledge and knowledge transfer from external environment to the internal organization) (Chalmers & Balan-Vnuk, 2013). Related to this, the company implements the societal needs to the innovation processes based on three phases: initial phase: emergence of a social idea

for a venture; development phase: building the social venture; and scaling phase: growing the social venture (Bhatt & Altinay, 2013).

The company's mission can also relate to the identification of environmental needs (Wilson & Post, 2013). In this case, the concern related to the environment brings an environmental entrepreneurship (Dean & McMullen, 2007). The entrepreneurs could identify the opportunity from the market failure and environmental degradation to create the opportunities to become environmental entrepreneurs. Related to this, social norms, like the norms of the family or society, may encourage the entrepreneur to create the environmentally responsible new venture (Meek et al., 2010). In addition, one should note that existing company can also generate an opportunity for the environmental needs, like improve the new product development processes (Dangelico & Pujari, 2010).

Once the company have identified and understand the societal and environmental needs, the company can start generating the ideas or solutions; and determining the outputs and impacts to be achieved and the subsequent social, environmental and/or economic value proposed (Lubberink et al., 2017). In this case, company may apply multiple-stakeholder idea generation. Engaging different stakeholders' idea will potentially capture different knowledge to social learning (Carrillo-Hermosilla et al., 2010; Mathur, Price, & Austin, 2008). Thus, the dialogue shifts from a merely technical perspective into a more sustainable oriented view. The example can be found in the case of LEGO in which multi-stakeholder idea generation helps LEGO to build up a sustainable producer-user ecosystem (Hienerth et al., 2014). In order to increase the shared understanding from multiple ideas, company can use several tool to increase the shared understanding, like storyboards, mock-ups demonstrators, or prototypes (Steen, Buijs, & Williams, 2014). In addition, during the idea generation, it is important for the involved stakeholders to not only consider about the novelty and creativity, but also to create trust between stakeholders in order to know each other's expectations (Rohrbeck et al., 2013).

Company might also get through the idea using the individual or collective idea generation (Lubberink et al., 2017). The common example is by doing the crowdsourcing. The popularity of crowdsourcing as the idea generation method is coined in the June 2006 issue of Wired magazine's by Jeff Howe and Mark Robinson (Howe, 2006). Enabled by the internet-based technology, it is a model of problem solving method by means of aggregating talent and ingenuity (Brabham, 2008). As one of the collective idea generation method, crowdsourcing requires the fairness aspect among the involved collaborators (Franke et al., 2013). Recently, crowdsourcing has been transformed beyond "the pool of the cheap labor" that is center on business-oriented activity into the sectors that focus at non-business orientation, like social and environment sustainability, emergencies handling, cultural heritage conservation, and urban planning (Zhao & Zhu, 2014). This way, crowdsourcing could generates economic and social benefit, like increase productivity, wealth, and quality of life, and enhance environment (Marjanovic et al., 2012).

Besides utilizing the external sources like discussed the previous paragraphs, company could generate the idea and determine the impact of the innovation by exploiting its internal resources (Lubberink et al., 2017). Investing in the employee training or technological R&D expenditure are the familiar methods that the company can use (Ketata et al., 2015). In addition, company can also promote the internal brainstorming session, informal discussion, or doing collaborative experiment (N. M. P. Bocken et al., 2014). The current trend regarding to the internal idea generation can be found in several companies in which they develop the new product development that more responsible to environment (Dangelico & Pujari, 2010). In this case, company changes several aspect, like changing the design of component, the product service deliverables, and product service processes (Carrillo-Hermosilla et al., 2010).

PREVENTING OR MITIGATING NEGATIVE IMPACTS

While the company determining the impact of innovation, it also aware of the unanticipated consequences of innovation. Therefore, the company takes part in several schemes to reduce that uncertainty (Berker, 2010; Biondi et al., 2002; Chadha, 2011; Rohrbeck et al., 2013). Related to this, another key activity of anticipation is the prevention or mitigation the negative impact of innovation (Lubberink et al., 2017). This activity needs an innovation environment. By monitoring the innovation environment, company can assess the risks, uncertainties, and impact of innovation that are perceived by the stakeholders, such as the regulatory risks (e.g., corruptive culture of bureaucratic procedures and regulation instability), political risks (e.g., low political instability and lack support from local government), until force majeure (e.g., natural disaster and terrorism) (Komendantova, Patt, Barras, & Battaglini, 2012). Risk and uncertainties assessment can be examined by the decision making model (van de Kaa, van Heck, de Vries, van den Ende, & Rezaei, 2014; Wang, Chan, Yee, & Diaz-Rainey, 2012). In this case, several indicators are used to measure the risks and uncertainties of negative impact of innovation (A. Evans, Strezov, & Evans, 2009).

After the company assesses the risks and uncertainties of particular impact of innovation, company can start determining on how to handle them in regards to the innovation development (Lubberink et al., 2017). It requires the company to assess the value missed, value destroyed, sensing the external environment. In this case, the value destroyed can be in the form of negative consequences of damaging environmental and social impacts, like pollution; while the missed value refers to the condition where the stakeholders fail to reap the best benefit it could get (e.g., due to the lack of persuasive skill or lack of poor designed value creation system) (N. Bocken et al., 2013). Different value missed or value destroyed needs different handling mechanism. For example, the lack of customer knowledge about the products benefit can be managed doing the partnership with another NGOs, the expensive up-front purchasing price can be handled by doing the partnership financial credit company , and the lack of supporting infrastructure by can be handled by lobbying local government (Wesseling, Niesten, Faber, & Hekkert, 2015).

Once the company has decided how to deal with the risks and uncertainties in the innovation development, the company can start deal with the possible negative impact of innovation (Lubberink et al., 2017). The example can be found in the R-1234yf Refrigerant development processes (Wodzisz, 2015). In this case, in order to anticipate the negative possible impact of 1234yf Refrigerant, Daimler develop its own mobile air conditioning system. Dealing with the adverse impact of innovation may also requires the company to change the management process of innovation. For example, in regards to the risks of water pollution due to the shale gas development, the company is suggested to develop the adaptive wastewater management before the beginning of the shale gas development or to coordinate with local government (Rahm & Riha, 2014; Small et al., 2014). The effort to deal with the adverse impact of innovation is also raised for the emerging technology like nanotechnology (Schulte et al., 2014). In this case, to consider the impact of safety and healthy criteria for the workers dealing with the nanotechnology products, company need to rack potentially hazardous nanomaterials in the workplace, measure workers' exposures to nanomaterials, communicate hazards and risks to workers, manage work-related safety and health risks, and improve the safe development of nanotechnology.

DEVELOPMENT OF ROADMAPS FOR IMPACT

Once the company has prevented the negative impact of innovation, it can develop the roadmaps that consists of several alternative ways on how to achieve the desired impact of innovation (M. Arnold, 2010; M. G. Arnold & Hockerts, 2011; Gaziulusoy et al., 2013; Rohrbeck et al., 2013). The roadmaps for impact development compromises four key strategies (Lubberink et al., 2017). The first strategy is to develop forward and backward scenarios by taking into account long-term vision and short-term actions (Lubberink

et al., 2017). For example, it can be done by visualizing scenarios in which storyboards, mock-ups and prototypes, and project management visuals can promote the shared understanding among stakeholders (Steen et al., 2014). Another example is a double scenario method (Gaziulusoy et al., 2013). Subsequently, when the forward and backward scenario is clear, the company can go to the second strategy by assessing the plausibility of those scenarios (Lubberink et al., 2017). In this case, again the double scenario method would give an advantage (Gaziulusoy et al., 2013).

Next, after the company has assessed the different scenarios, it needs to determine an ambitious and conceivable roadmap in the operational activity (Lubberink et al., 2017). It requires the company to translate the organizational mission into the innovation requirements and daily activities. Regarding to this, company can categorize the business strategies into different levels: strategic (e.g., formulating ambitious target and developing company strategic vision), tactical (e.g., forming coalitions and restructuring organization), and operational level (e.g., setting up pilot projects and learning for new routines) (Loorbach et al., 2010). For example, the Dutch electronics company, Philips, develops a detail steps to improve sustainability impact in regards to its corporate innovation strategy (M. G. Arnold & Hockerts, 2011). In addition, company can also use a V-cycle model to link the short-term commercial opportunities and the longer-term vision of society (Joore, 2008). Similar approach can also be applied in designing the product and service innovation (Joore & Brezet, 2015; Marchand & Walker, 2008).

Following the conceivable roadmap in the operational activity, company now has to align business strategies with impact vision and translating it to day-to-day activities of employees (Lubberink et al., 2017). Company can start this activity by identifying the necessary resources. This strategy can be applied by the means of human resource management (e.g., teamwork, training, and employee involvement) (Longoni, Golini, & Cagliano, 2014) or the organizational design and governance (e.g., cross-organizational collaboration and ambidexterity) (Carayannis, Sindakis, & Walter, 2015). In addition, this identification needs an analysis of the company capability to adopt the technological development, collaborate with other companies, and improve innovation capability (Hofmann, Theyel, & Wood, 2012). In the similar vein, a company can do resource combination, like financial capital (equity and liability), capabilities (knowledge and intellectual property right), social (inter-company network and research and development cooperation), reputational asset (Halme & Korpela, 2014). For example, in the case of electronic vehicle sector, networks and industry knowledge identification have helped the producers to seek the government support and doing the alliance with other partners (Wesseling et al., 2015). Related to the collaborative strategies, it is important for the company to acknowledge the barriers that would hamper the effective cooperation (Lewis, Cassells, & Roxas, 2015).

The summary of the explanation above is given in Table 38.

Table 38. Operationalization of anticipation dimension (Lubberink et al., 2017)

Key Activities	Strategies	Examples	Scholars
Determining desired impacts and outcomes of innovation	Monitoring the innovation environment (legislation, technologies, market/societal trends and supply chain)	Monitoring environment	Chadha, A. (2011), Biondi, V., Iraldo, F., & Meredith, S. (2002), Noci, G., & Verganti, R. (1999)
		Stakeholder mapping	Bocken, N., Short, S., Rana, P., & Evans, S. (2013), Spitzeck, H., & Hansen, E. G. (2010), Bourne, L., & Walker, D. H. (2005), Hall, J. K., & Martin, M. J. (2005)

	Identifying and understanding societal and/or environmental needs	Identification of social needs	Bocken, N., Short, S., Rana, P., & Evans, S. (2013), Chalmers, D. M., & Balan-Vnuk, E. (2013), Bhatt, P., & Altinay, L. (2013), Wilson, F., & Post, J. E. (2013), Mair, J., & Noboa, E. (2006)
		Identification of environmental needs	Meek, W. R., Pacheco, D. F., & York, J. G. (2010), Dean, T. J., & McMullen, J. S. (2007), Wilson, F., & Post, J. E. (2013), Dangelico, R. M., & Pujari, D. (2010)
	Generating ideas for solutions; determining the outputs and impacts to be achieved and the subsequent social, environmental and/or economic value proposed	Multi-stakeholder idea generation	Steen, M., Buijs, J., & Williams, D. (2014), Steen, M. (2013), Rohrbeck, R., Konnertz, L., & Knab, S. (2013), Mathur, V. N., Price, A. D., & Austin, S. (2008), Hienerth, C., Lettl, C., & Keinz, P. (2014)
		Individual or collective idea generation	Zhao, Y., & Zhu, Q. (2014), Franke, N., Keinz, P., & Klausberger, K. (2013), Marjanovic, S., Fry, C., & Chataway, J. (2012)
		Internal firm idea generation	Bocken, N. M. P., Farracho, M., Bosworth, R., & Kemp, R. (2014), Ketata, I., Sofka, W., & Grimpe, C. (2015), Dangelico, R. M., & Pujari, D. (2010), Carrillo-Hermosilla, J., del Río, P., & Könnölä, T. (2010)
Preventing or mitigating negative impacts	Monitoring the innovation environment (legislation, technologies, market/societal trends and supply chain)	Assessment of risks, uncertainties and impacts of the innovation	Wang, X., Chan, H. K., Yee, R. W., & Diaz-Rainey, I. (2012), van de Kaa, G., van Heck, E., de Vries, H. J., van den Ende, J., & Rezaei, J. (2014), Evans, A., Strezov, V., & Evans, T. J. (2009), Komendantova, N., Patt, A., Barras, L., & Battaglini, A. (2012)
	Assessing risks, uncertainties and influence of external forces on the development and impact of the innovation	Dealing with value missed and value destroyed, sensing the external environment	Bocken, N., Short, S., Rana, P., & Evans, S. (2013), Komendantova, N., Patt, A., Barras, L., & Battaglini, A. (2012), Wesseling, J. H., Niesten, E. M. M. I., Faber, J., & Hekkert, M. P. (2015)
	Assessment of possible negative consequences of the innovation	Dealing with adverse effects	Wodzisz, R. (2015), Rahm, B. G., & Riha, S. J. (2014), Small, M. J., et al. (2014), Schulte, P. A., et al. (2014)
Development of roadmaps for impact	Developing forward and backward scenarios by taking into account long-term vision and short-term actions	Visualising scenarios	Steen, M., Buijs, J., & Williams, D. (2014), Gaziulusoy, A. İ., Boyle, C., & McDowall, R. (2013)
		double-flow scenario method	Gaziulusoy, A. İ., Boyle, C., & McDowall, R. (2013)
	Plausibility assessment of the different scenarios	Double-flow scenario method	Gaziulusoy, A. İ., Boyle, C., & McDowall, R. (2013)

Developing and determining an ambitious and conceivable roadmap regarding the firm's operations	Translating organisational vision into innovation requirements and day-to-day activities	Arnold, M. G., & Hockerts, K. (2011), Joore, P. (2008), Joore, P., & Brezet, H. (2015), Marchand, A., & Walker, S. (2008), Loorbach, D., van Bakel, J. C., Whiteman, G., & Rotmans, J. (2010)
Aligning business strategies with impact vision and translating this to day-to-day activities of employees in the firm	Identifying resources necessary for sustainable development	Halme, M., & Korpela, M. (2014), Wesseling, J. H., Niesten, E. M. M. I., Faber, J., & Hekkert, M. P. (2015), Hofmann, K. H., Theyel, G., & Wood, C. H. (2012), Lewis, K. V., Cassells, S., & Roxas, H. (2015), Carayannis, E. G., Sindakis, S., & Walter, C. (2015), Longoni, A., Golini, R., & Cagliano, R. (2014)

APPENDIX 2

Reflexivity

ACTIONS AND RESPONSIBILITIES

While doing the innovation, innovators take part in various actions and responsibilities (Pavie et al., 2014). Related to this, reflexive innovators would evaluate the current and previous actions in regards to achieve the desired impact of innovation (Berker, 2010; Chalmers & Balan-Vnuk, 2013; Joore, 2008). Actions and responsibilities consists of three strategies (Lubberink et al., 2017). The first one is to make sure that there are formal evaluations, third party critical appraisal, or an informal (self-) assessment culture. In this case, actions and responsibilities become important. For example, companies in the financing sector can develop New Product Committees (NPC) to serve the responsible innovation in the financing bodies, like checking the regulation compliance and validating innovation decision (Armstrong et al., 2012). Another case about the third party evaluation in the innovation processes can also be found in the automotive sector when it improves the safety concern (Andersson et al., 2012). In addition, it is important to note that the evaluation is not necessarily be a formal evaluation. Rather, company may apply several informal approach, like raising the commitment from senior managers and the investors in the innovation processes (Wilson, Post, Grzywinski, & Houghton, 2014); or apply self-assessment culture (e.g., understanding the old-age patient behavior) (Joore, 2008).

The second strategy in regards to the actions and responsibilities is by creating a culture where there is an employee empowerment (Lubberink et al., 2017). Company can raise up the employee empowerment by facilitating variation (i.e., encourage emerging ideas form internal organization, like regular staff meetings and conferences participation); managing internal selection regime (i.e., the decision making process to enable the resource allocation to obtain new knowledge, like joint board-staff alignment meeting and feasibility testing of pilot project); sharing knowledge and superior practices across the organization (e.g., regular staff meetings and updated bulletin boards); and reflecting, updating, and replication (i.e., interpreting current and future changes, like annual report and self-reflective ethos) (Chalmers & Balan-Vnuk, 2013). Employee empowerment is useful for the company to create an innovation that is more oriented into the environmental needs (Muduli, Govindan, Barve, Kannan, & Geng, 2013). For example, involving employee in the environmental activity could lead to the better company performance towards environmental product quality (Y. Chen, Tang, Jin, Li, & Paillé, 2015).

Next, company can understanding its action and responsibility by scrutinizing the its function in the society and then being aware of the responsibility that comes with that (Lubberink et al., 2017). In other words, company needs to reflect its responsibilities. For example, realizing its function in the renewable energy development, company in the financial sector initiate the development of Wind Energy Fund as the response to Chernobyl Disaster in 1986. The similar approach also arises in the establishment of Fair Trade Fund as the response to the debt crisis in South America during 1994. These examples show how the formation of positive ethical networks has created sustainable financial innovation in response to the external crisis (Dossa & Kaeufer, 2014). In addition, the company should also realize that raising the awareness could beneficial to the organizational learning process (von Weltzien Hoivik, 2011). For example, initiated to cope with the environmental problem, IT companies have learnt how to comply with the industry standard

and, at the same time, take the economic benefit and society appreciation benefit from it (Chou & Chou, 2012).

VALUES AND MOTIVATIONS

Besides actions and responsibilities, reflexivity also requires a company to examine its values and motivations (Lubberink et al., 2017). It is most likely that the company has several (conflicting) values and motivations with other stakeholders while performing the innovation. Therefore, it is essential for the company to set up the priority among those values and motivations. In this case, a value mapping tool might be useful to identify the conflicting values between different stakeholders (N. Bocken et al., 2013). After that, the company may seek the compatibility value between the competing stakeholders (Harrisson et al., 2012). In the end, analyzing the value priority would help the acceptance of company's product in the society (Thøgersen & Zhou, 2012).

After the company has set the primary values and motivations, company can start thinking the effect of one's values on innovation governance and outcome(s) (Lubberink et al., 2017). For example, in order to achieve the sustainability value, company can implement several innovation governances, like democratic organizational structure, innovation workshops, or innovation task force (Ayuso et al., 2006). Adjusting innovation governance may also relevant with the company's motivation toward the environmental-friendly goals. In this case, company can adjust the innovation governance by the direct involvement of the technology development, provision of a supportive policy agenda, or influential role in demand articulation (Carrillo-Hermosilla et al., 2010). Besides, one study find that encouraging the environmental innovation may be effective if the company hires the employees who have multidisciplinary working experience (N. M. P. Bocken et al., 2014).

As explained before, it is common that the innovation possesses the conflicting values and motivations. Therefore, the next key strategy in regards to the values and motivations is by determining the action on how to take the opportunity from the incompatible values and motivations (Lubberink et al., 2017). This strategy requires the company to identify the suitable business values and innovation governance. Related to this, one also should note that the company's likelihood of motivations to deal with incompatible values is influenced by the company's prior experience (Levy & Kolk, 2002). In this case, one study finds how the major oil and gas companies with prior renewable energy technology experience is unlikely to invest in renewable energy technology due to their bad experience in the investment's returns. Nevertheless, scholar suggests several tactics that can be applied to create business model from the conflicting values, like doing the stakeholder bridging and convincing the community champion (Matos & Silvestre, 2013). The example of stakeholder bridging can be found in the funding of renewable energy sector. In this case, reflected by the incompatible value of company profit and societal and environmental benefit, the company in the banking sectors coordinate with working group or foundation organization to pool the funding resources or apply the discourse and framing strategy to fund the renewable energy project (Dossa & Kaeufer, 2014). However, one should note that stakeholder bridging stakeholder bridging would not be effective unless there is a legitimation of agreement between the involved stakeholders (Harrisson et al., 2012).

KNOWLEDGE AND PERCEIVED REALITIES

The third key activities of reflexivity is about how the company can critically think about its knowledge and perceived realities have an effect in the innovation processes (Lubberink et al., 2017). This activity consists of four strategies. At first, company should analyze the presence, absence and subjectivity of information. In other words, it requires the company to reflect and reframe the perceived realities. For example, the company can apply the changing the lens approach: re-express the problem in an alternative way to come up with the solution (Lettice & Parekh, 2010). The common example is to reframe the problem

of ‘expensive green products’ into ‘sustainable design is potential to decrease the utility costs and improve the brand value’. Reframing the problems needs an innovator who is strong storytellers and visionaries and understand the socio-technical system boundaries, like Sir Richard Branson of Virgin, Jeff Bezos of Amazon, and Steve Jobs of Apple (Alvial-Palavicino et al., 2011; Lampikoski, Westerlund, Rajala, & Möller, 2014).

The second strategy in regards to the knowledge and perceived realities is the assessment of the knowledge and abilities that are present in the company (Lubberink et al., 2017). The company resources and capabilities is important to improve the company’s competitive advantage (Aragón-Correa & Sharma, 2003). In addition, the knowledge assessment is also important to understand different consumer perceived realities behavior (Long & Murray, 2013; Masini & Menichetti, 2012). The knowledge assessment needs to be presented with clarity and consistency (Ozaki, 2011). For example, companies that are dealing with the green electricity production can develop a user-friendly websites, formal tariffs comparison report between different areas, or eco-labelling.

The next strategy in in regards to the knowledge and perceived realities is the company’s awareness related to different perceived realities between actors (Lubberink et al., 2017). This strategy calls for the company to reconcile the different information and realities. There are several efforts that company can related to the information reconciliation. For example, company can develop the internal approach, like a sharing knowledge and superior practice routines across the organization, either in formal (e.g., staff meeting, regular bulletin board, or cross-functional coordination) or informal way (e.g., discussion during a coffee break) (Chalmers & Balan-Vnuk, 2013; Pujari, 2006). In addition, reconciling different information can also be done externally. For example, company develop a community participation and empowerment to understand the communities cultural and emotional aspect (Richards, Noble, & Belcher, 2012; Wolsink, 2012). Besides reconciling the different information and realities, company can raise the awareness of different perceived realities by encouraging diversity (Lubberink et al., 2017). Bringing the diversity allows the company to know the wide ranging of actors: from the conservative actors who are retain to the status quo and the progressive actors who are prone to the new ideas (Bridgstock, Lettice, Özbilgin, & Tatli, 2010). By bringing the stakeholders with different perspective, company can expand its relational capital and would further improve its skill and capabilities to sustain the growth (Vickers & Lyon, 2014).

The fourth strategy in regards to the knowledge and perceived realities is the reframing of problems and solutions (Lubberink et al., 2017). Reframing the problems would lead the company to find the new business opportunities (Lettice & Parekh, 2010). In order to reframe the problems into solutions, at the beginning, the company needs a support from the top management, like formulating ambitious target or developing a strategic discussion (Loorbach et al., 2010). In addition, reframing the problem might also involve the communities. Sometimes, it is originated from the grassroots initiatives that is driven by enthusiastic volunteers (Middlemiss & Parrish, 2010). The support from community would help the company to overcome the resistance coming from the consumers (Heiskanen, Johnson, Robinson, Vadovics, & Saastamoinen, 2010). Regardless of the actor who reframes the problems and solutions, one should note that reframing activity needs to consider consumer behavior (L. Evans et al., 2013). For example, in the case of environment-friendly products, different approaches of ‘reframing sentences’ would give different pro-environmental behavior. In this case, one study finds that emphasizing a pro-environmental value (e.g., community benefit) would increase the pro-environmental behavior, while activating self-interested values (e.g., save money) is prone to decrease the pro-environmental behavior.

Table 39 provides the summary of the explanation above.

Table 39. Operationalization of reflexivity dimension (Lubberink et al., 2017)

Key Activities	Strategies	Examples	Scholars
Actions and responsibilities	Making sure that there are formal evaluations, third party critical appraisal or an informal (self-) assessment culture	Actions and responsibilities	Armstrong, M., et al. (2012), Andersson, E. R., Jansson, B., & Lundblad, J. (2012), Wilson, F., Post, J., Grzywinski, R., & Houghton, M. (2014), Joore, P. (2008)
	Creating a culture where there is empowerment of employees	Empowerment	Chalmers, D. M., & Balan-Vnuk, E. (2013), Chen, Y., Tang, G., Jin, J., Li, J., & Paillé, P. (2015), Muduli, K., Govindan, K., Barve, A., Kannan, D., & Geng, Y. (2013)
	Becoming aware of the function and power of the firm in society, and the responsibility that comes with that	Reflection on responsibilities	Dossa, Z., & Kaeufer, K. (2014), von Weltzien Hoivik, H. (2011), Chou, D. C., & Chou, A. Y. (2012)
Values and motivations	Prioritization of values and motivations	Prioritization and conflicts	Bocken, N., Short, S., Rana, P., & Evans, S. (2013), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Thøgersen, J., & Zhou, Y. (2012)
	Thinking of the effect of one's values on innovation governance and outcome(s)	Effect of values and motivations on innovation governance	Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006), Bocken, N. M. P., Farracho, M., Bosworth, R., & Kemp, R. (2014), Carrillo-Hermosilla, J., del Río, P., & Könnölä, T. (2010)
	Determining how to deal with incompatible values and/or motivations	Business values and innovation governance	Dossa, Z., & Kaeufer, K. (2014), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Levy, D. L., & Kolk, A. (2002), Matos, S., & Silvestre, B. S. (2013)
Knowledge and perceived realities	Scrutinizing the presence, absence and subjectivity of information	Reflecting on and reframing perceived realities	Lettice, F., & Parekh, M. (2010), Lampikoski, T., Westerlund, M., Rajala, R., & Möller, K. (2014), Alvial-Palavicino, C., Garrido-Echeverría, N., Jiménez-Estévez, G., Reyes, L., & Palma-Behnke, R. (2011)
	Assessment of the knowledge and abilities present in the firm	Knowledge, Concept, Proposal process (KCP)	Masini, A., & Menichetti, E. (2012), Aragón-Correa, J. A., & Sharma, S. (2003), Ozaki, R. (2011), Long, M. A., & Murray, D. L. (2013)
	Becoming aware of different perceived realities between actors	Reconciling different information and realities	Chalmers, D. M., & Balan-Vnuk, E. (2013), Pujari, D. (2006), Wolsink, M. (2012), Richards, G., Noble, B., & Belcher, K. (2012)
		encouraging diversity management for innovation	Bridgstock, R., Lettice, F., Özbilgin, M. F., & Tatli, A. (2010), Vickers, I., & Lyon, F. (2014)

	Reframing of problems and solutions	KCP process	Loorbach, D., van Bakel, J. C., Whiteman, G., & Rotmans, J. (2010), Heiskanen, E., Johnson, M., Robinson, S., Vadovics, E., & Saastamoinen, M. (2010), Lettice, F., & Parekh, M. (2010), Middlemiss, L., & Parrish, B. D. (2010), Evans, L., Maio, G. R., Corner, A., Hodgetts, C. J., Ahmed, S., & Hahn, U. (2013)

APPENDIX 3

Inclusion

INVOLVEMENT OF STAKEHOLDERS AT DIFFERENT STAGES (WHO AND WHEN)

Inclusion needs involvement of various stakeholders. Stakeholder involvement refers to the strategy to consult, integrate, and collaborate with several stakeholders (Lubberink et al., 2017). There are several actors that company can involve to consult the innovation processes. First, the company can involve the wider public. One example of wider public involvement is by using the living lab inclusion (Schuurman, De Moor, De Marez, & Evens, 2011). Living lab treats the public as the technology end-user to be involved in the real-life socio-technical experiment (Liedtke, Baedeker, Hasselkuß, Rohn, & Grinewitschus, 2015). It allows the users to express their needs and use company's product innovation. Besides living lab, company may also use community involvement (Alvial-Palavicino et al., 2011; Hienerth et al., 2014; Ornetzeder, 2001) or focus group approach (Dossa & Kaeufer, 2014). For the former one, the company should make sure that the community are familiar on how to relate the company's innovation with their local reality.

In addition, company also needs a collaboration with the supply chain actors (Lubberink et al., 2017). Supplier involvement is important as a source of external knowledge (Chalmers & Balan-Vnuk, 2013). In other words, its role cannot be excluded from the company's competitive advantage (Hoejmose et al., 2013; Hofmann et al., 2012; Knudsen, 2003; Watts, Kim, & Hahn, 1995). For example, to increase the market acceptance, collaborating with the supply chain actors who are responsible in the environmental care would increase the market acceptance due to the positive company images (Hoejmose et al., 2013).

Company can also do a partnership with the end-user (Lubberink et al., 2017). This strategy can be realized by including the end-user in the formal organization structure (Ayuso et al., 2006). This way, consumer can participate in the owner-worker decision making process. Another way to involve the end-user is by applying the crowdsourcing concept (Marjanovic et al., 2012). However, one should note that crowdsourcing can no longer be seen merely as a method to pool of cheap labor. Nevertheless, in order to get an optimal output, crowdsourcing needs a company to consider the fairness aspect for the involved contributors (Franke et al., 2013).

Another important stakeholder to involve is Non-governmental Organizations (NGOs) (Lubberink et al., 2017). NGOs may help the company to promote the products to the market (MacLean, Brass, Carley, El-Arini, & Breen, 2015). In addition, company-NGOs collaboration also facilitate the company to create more impact, like developing the CSR program, company foundation, or even joint venture (Jamali & Keshishian, 2009). In particular, this collaboration would improve company innovation towards the social-oriented view (Jamali et al., 2011). Further, it brings the advantage to the company by giving them a decent image in the society perspective (Holmes & Moir, 2007; Kumar & Malegeant, 2006).

Next, company is encouraged to work together with the expert (Lubberink et al., 2017). The expert involvement would bring the clear explanation about the epistemic aspect of the underlying technology breakthrough (Baba & Walsh, 2010). In addition, it might also be useful for the in-depth anticipation of

innovation, like safety and security concern (Joore, 2008) or solving the technological problems (Halila & Rundquist, 2011). The expert can also be organized as the ad hoc team: external research and evaluation team. In this case, it is likely that the expert could give the more neutral evaluation (Harrisson et al., 2012). The external expert is usually found in the specific industry, like the defense or aerospace sector, in which the balance between the openness and security is the main concern (Mortara & Minshall, 2011).

The company is also suggested to team up with the governmental agencies (Lubberink et al., 2017). Public-private partnership is especially important for the emerging technology in which both parties can obtain the benefit (Carrillo-Hermosilla et al., 2010). To encourage the innovation development, government might deliver several programs like subsidies or incentives. Government may also play a role as the sponsor of the innovation program (Levén et al., 2014). In addition, a recent study finds that government can foster the company's innovativeness by setting up the city hall as the meeting point between stakeholders to interact (Bakici, Almirall, & Wareham, 2013). This interactions would reduce the bureaucracy problem that the public sector usually has. As a result, the private-public partnership can improve the cognitive distance (project execution).

Besides, company can also create a multi-stakeholder activity (Lubberink et al., 2017). This diverse stakeholder involvement may improve company's network (Bridgstock et al., 2010). As a consequence, company can get the knowledge from various stakeholders and then increase the company capability to establish the new opportunities (Chalmers & Balan-Vnuk, 2013; Russo Spena & De Chiara, 2012).

PROVISION OF RESOURCES AND CAPITAL (HOW)

Company can do several activity to implement the stakeholder inclusion. Therefore, after understanding the relevant stakeholders that the company needs to involve, the second key activity in regards to the inclusion is the provision of resources and capital (Lubberink et al., 2017). This activity has five key strategies. The first one requires the company to have the consultancy, like with the experts or the regulators. The former would benefit the company by giving the consultancy that focus on the technology related aspects (Baba & Walsh, 2010). In addition, company might have a consultancy from the government. In this case, the content of the consultation should be adopted based on the company needs, ranging from the free information sharing, financial advice, or extensive mentoring support (Parry, 2012).

The second strategy related to the provision of resources and capital is the user-innovation approach (Lubberink et al., 2017). To implement this strategy, company may allow the users in the official role of company structure (Ayuso et al., 2006; Dossa & Kaeufer, 2014). Another way of provisioning the resources from the users is by using the crowdsourcing approach. Recent study finds that the crowdsourcing can be applied in diverse sectors, like cultural heritage conservation, urban planning, or renewable energy sector (Rivera et al., 2015; Zhao & Zhu, 2014). Another approach to do the user-innovation is by doing the user-driven innovation approach. This approach allows the company to get feedback from the consumer and further understand the consumers behavior (Bosch-Sijtsema & Bosch, 2015; Ornetzeder, 2001).

Company can also improve the provision of resource and capital by doing the community visits (Lubberink et al., 2017). It enables the company to directly discuss with the community and build an upright stakeholder engagement (Idemudia, 2009). As a result, the potential conflicting values between the local community and the company is likely to decline (Ikelegbe, 2005). An effective community visit needs the role of front line staff as the mediators between the company and the public (Bartlett, 2009). Besides using the internal employee, company might also employ social organization to do the community visit. In this case, the social organizations acts as the gatekeepers between the company and society. It would bring the partnership dynamics between the company's philanthropic and strategic orientation can improve the company's innovation (Jamali et al., 2011). The innovation can also come from the alliance between the company and

non-profit organization (Holmes & Moir, 2007). Both the collaboration between the company and the social organization and the non-profit organization would improve the company's image (Kumar & Malegeant, 2006).

Another strategy in regards to company resource and capital provision is by doing the indirect representatives (e.g., thought experiments, role playing or via intermediaries) (Lubberink et al., 2017). In this strategy, company invites and has a discussion with the representation of stakeholders (N. Bocken et al., 2013). In addition, company could also seek for the intermediaries, like universities, knowledge institutions, and or local government, to support the innovation processes (Gassmann et al., 2011; Zeng et al., 2010). The function of intermediaries can be in the form of the foresight and diagnostic; gatekeeping and brokering; testing, validation, and training; or accreditation and standards (Howells, 2006). In this case, the support from intermediaries would improve the company's product innovation, market acceptance, and public reputation (Hansen, Bullinger, & Reichwald, 2011).

Another strategy in regards to provision of resources and capital is the public platform for expressing needs and concerns (Lubberink et al., 2017). For example, using an ICT platform to exchange information and experience (Edwards-Schachter et al., 2012). In addition, public can also directly test the innovation product in the everyday setting (Liedtke et al., 2015; Schuurman et al., 2011).

RAISED COMMITMENT AND CONTRIBUTION (HOW)

The third activity in regards to the inclusion dimension is how the company can raise the stakeholders' commitment and contribution (Le Ber & Branzei, 2010; Lubberink et al., 2017). This activity has five key strategies. The first one is the balancing transparency and openness in relationships and the innovation process, and receiving input from external actor. Transparency is central to raise the actors commitment and requires a clear communication about the cost and benefit among different stakeholders (Russo Spena & De Chiara, 2012). In other words, the less transparent innovation processes would hinder the external actors to participate give the contribution to the innovation processes (Franke et al., 2013). However, transparency or openness is not free of charge. Company has to carry several costs like difficulty to differentiate, guarding business secrets, reducing community entry barriers, giving up control, and organizational inertia (Stuermer, Spaeth, & Von Krogh, 2009). Therefore, company is suggested to apply selective openness: only open the components that they believe to bring the benefit from the user innovation (Balka, Raasch, & Herstatt, 2014). Related to this, company also needs to consider the fact that the openness would not always improve the innovation performance. One study reveals that the relation between community participation and the innovation performance curvilinear (Stam, 2009).

The second strategy to raise commitment and contribution is by applying the fair relationships regarding the tasks and returns for stakeholder input (Lubberink et al., 2017). The common example of unfairness can be found in the crowdsourcing system, like the lack of workers' financial benefit and job protection (Kittur et al., 2013). In the similar vein, one study also shows how crowdsourcing system is inadequately implement the distributive fairness and procedural fairness (Franke et al., 2013). The absence of fairness would hinder the external stakeholders to participate in the innovation processes. Related to this, one study finds how several elite developers in the crowdsourcing community reap the benefit by controlling and manipulation multiple technologies (Shaikh & Vaast, 2016). Therefore, one scholar suggests an ethical consideration in regards to raise the commitment and contribution in the crowdsourcing system (F. A. Schmidt, 2013).

Next, the company can raise the commitment and contribution by applying the role recalibrations as roles change over time and need to be readjusted (Lubberink et al., 2017). This strategy emphasizes the maintaining workable stakeholder relationships over time. Role calibration allows the involved partners

ability to sustain the momentum for success and tackle the temporary failures (Le Ber & Branzei, 2010). In this case, company can apply the reflexivity and paradoxical thinking attitudes (Galuppo, Gorli, Scaratti, & Kaneklin, 2014). In the similar vein, company might apply the dynamic capabilities to continuously sensing, engaging, learning, and changing based on the changes in stakeholders' orientation (Dentoni, Bitzer, & Pascucci, 2015).

Another strategy in regards for raising the commitment and contribution is by working with actors who share the same values (Lubberink et al., 2017). This collaboration can be found in many cases, ranging from the LEGO product innovation (Hienerth et al., 2014) to the development of Wind Energy Fund as the response to the Chernobyl Disaster (Dossa & Kaeufer, 2014). Working together with these actors would enable the company to identify the new value creation (Dahan, Doh, Oetzel, & Yaziji, 2010). In this case, the company is suggested to find the complementary partners that are able to pool the resources and leverage the knowledge (Yunus, Moingeon, & Lehmann-Ortega, 2010).

Raising a commitment and contribution can also be applied by working with actors with different (sometimes opposing) values (Lubberink et al., 2017). In this case, finding the strategies to reconcile opposing views is important. To implement this reconciliation, company may design the institutions and organization that suits with the given community (Harrisson et al., 2012). In this case, the company needs to take into account the cognitive dimensions (i.e., organizational forms and practice), the normative dimensions (i.e., adoption of cognitive dimensions by individuals and credible expertise), and the regulatory dimensions (i.e., monitoring and sanction activities). One of the successful example on the reconciling the conflicting value can be found in the case of Danone. Being unoptimistic about the shareholders expectations about his effort to pursue the company orientation towards the society benefit, Danone's CEO stop the funding of his company from the stock market and reconcile another actor to become the alternative funding resource in order to pursue social-oriented benefit (Yunus et al., 2010). Besides reconciling opposing views, company might also bridge the opposing values and then create new value (Le Ber & Branzei, 2010). For example, in the conflicting values between the energy production and visual impacts, the wind farm developer creates another value (the sense of local community ownership) to foster the wind farm development (Warren & McFadyen, 2010).

The explanation above is summarized in Table 40.

Table 40. Operationalization of inclusion dimension (Lubberink et al., 2017)

Key Activities	Strategies	Examples	Scholars
Involvement of stakeholders at different stages (who and when)	Wider public	Living lab inclusion	Bocken, N. M. P., Farracho, M., Bosworth, R., & Kemp, R. (2014), Schuurman, D., De Moor, K., De Marez, L., & Evens, T. (2011), Liedtke, C., Baedeker, C., Hasselkuß, M., Rohn, H., & Grinewitschus, V. (2015)
		Community involvement	Hienerth, C., Lettl, C., & Keinz, P. (2014), Alvial-Palavicino, C., Garrido-Echeverría, N., Jiménez-Estévez, G., Reyes, L., & Palma-Behnke, R. (2011), Ornetzeder, M. (2001)
		Focus group with the wider public	Dossa, Z., & Kaeufer, K. (2014)

	Supply-chain actors	Alliance formation and responsible supply-chain development	Chalmers, D. M., & Balan-Vnuk, E. (2013), Hofmann, K. H., Theyel, G., & Wood, C. H. (2012), Hoejmose, S., Brammer, S., & Millington, A. (2013)
	End-users	Formal role of the end-user in the company and crowdsourcing	Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006), Franke, N., Keinz, P., & Klausberger, K. (2013), Marjanovic, S., Fry, C., & Chataway, J. (2012)
	Non-governmental organisations (NGOs)	Innovation system with NGOs	MacLean, L. M., Brass, J. N., Carley, S., El-Arini, A., & Breen, S. (2015),
		Creating more impact with NGOs	Jamali, D., & Keshishian, T. (2009)
		Social alliance innovation	Jamali, D., Yianni, M., & Abdallah, H. (2011), Kumar, S., & Malegeant, P. (2006), Kumar, S., & Malegeant, P. (2006), Holmes, S., & Moir, L. (2007)
	Experts	Expert involvement for epistemic problems	Baba, Y., & Walsh, J. P. (2010),
		External research and evaluation	Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Mortara, L., & Minshall, T. (2011)
		Support of experts for in-depth anticipation	Joore, P. (2008)
		Inclusion for technological problems	Halila, F., & Rundquist, J. (2011)
	Multiple stakeholders	(Multi-)stakeholder involvement activities	Chalmers, D. M., & Balan-Vnuk, E. (2013), Bridgstock, R., Lettice, F., Özbilgin, M. F., & Tatli, A. (2010), Russo Spena, T., & De Chiara, A. (2012)
	Governmental agencies	Role of private firms versus government	Carrillo-Hermosilla, J., del Río, P., & Könnölä, T. (2010), Bakici, T., Almirall, E., & Wareham, J. (2013), Levén, P., Holmström, J., & Mathiassen, L. (2014)
Provision of resources and capital (how)	Consultancy (e.g., scientific support or governmental support)	Bridging and bonding with experts	Baba, Y., & Walsh, J. P. (2010), Parry, S. (2012)
	User-innovation (e.g., crowdsourcing, focus groups or bottom-up innovation)	Official role in firm for users and focus group with wider public	Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006), Dossa, Z., & Kaeufer, K. (2014)
		Crowdsourcing	Zhao, Y., & Zhu, Q. (2014), Rivera, J., Goebel, C., Sardari, D., & Jacobsen, H. A. (2015, November)

		User-driven innovation	Ornetzeder, M. (2001), Bosch-Sijtsema, P., & Bosch, J. (2015)
	Community visits	Community visiting	Idemudia, U. (2009), Ikelegbe, A. (2005), Bartlett, D. (2009)
		Using social organisations as gatekeepers between the firm and society	Kumar, S., & Malegeant, P. (2006), Holmes, S., & Moir, L. (2007), Jamali, D., Yianni, M., & Abdallah, H. (2011)
	Indirect representatives (e.g., thought experiments, role playing or via intermediaries)	Representation of stakeholders for anticipation	Bocken, N., Short, S., Rana, P., & Evans, S. (2013)
		Intermediaries support in innovation processes	Hansen, E. G., Bullinger, A. C., & Reichwald, R. (2011), Howells, J. (2006), Zeng, S. X., Xie, X. M., & Tam, C. M. (2010), Gassmann, O., Daiber, M., & Enkel, E. (2011)
	(Public) platform for expressing needs and concerns	Living lab	Edwards-Schachter, M. E., Matti, C. E., & Alcántara, E. (2012), Schuurman, D., De Moor, K., De Marez, L., & Evens, T. (2011), Liedtke, C., Baedeker, C., Hasselkuß, M., Rohn, H., & Grinewitschus, V. (2015)
Raised commitment and contribution (how)	Balancing transparency and openness in relationships and the innovation process, and receiving input from external actors	Examples of cost-benefit struggles	Russo Spena, T., & De Chiara, A. (2012), Stuermer, M., Spaeth, S., & Von Krogh, G. (2009), Balka, K., Raasch, C., & Herstatt, C. (2014), Stam, W. (2009)
	Fair relationships regarding the tasks and returns for stakeholder input	Creating crowdsourcing satisfaction	Shaikh, M., & Vaast, E. (2016), Franke, N., Keinz, P., & Klausberger, K. (2013), Schmidt, F. A. (2013, September), Kittur, A., et al. (2013, February).
	Role recalibrations as roles change over time and need to be readjusted	Maintaining workable stakeholder relationships over time	Le Ber, M. J., & Branzei, O. (2010), Galuppo, L., Gorli, M., Scaratti, G., & Kaneklin, C. (2014), Dentoni, D., Bitzer, V., & Pascucci, S. (2016)
	Working with actors sharing the same values	Creating positive ethical networks	Dossa, Z., & Kaeufer, K. (2014), Dahan, N. M., Doh, J. P., Oetzel, J., & Yaziji, M. (2010), Hienerth, C., Lettl, C., & Keinz, P. (2014), Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010)

	Working with actors with different (sometimes opposing) values	Strategies to reconcile opposing views	Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012)
		bridging opposing values and new value creation	Le Ber, M. J., & Branzei, O. (2010), Warren, C. R., & McFadyen, M. (2010)

APPENDIX 4

Deliberation

TWO-WAY EXCHANGE OF VIEWS AND OPINIONS

Scholars find that, in order to implement the deliberative governance, company engages in various ways of dialogue (e.g., crowdsourcing (Franke et al., 2013), focus group discussions (Dossa & Kaeufer, 2014), or community visits (Chadha, 2011). Related to this, deliberation requires an activity of two way exchange of views and opinions (Lubberink et al., 2017). Company might apply this activity by formalizing the process of deliberation governance. For example, company can apply a formal stakeholder-dialogue to share a common understanding among stakeholders (Asif, Searcy, Santos, & Kensah, 2013). In this formal process, company is encouraged to consider the cognitive aspect of institutional dimensions (i.e., set up the formal organizational structure) (Harrisson et al., 2012). For example, in the financial sectors, a bank can develop New Product Committees (NPC) to deliberate the potential issue in the financial innovation (Armstrong et al., 2012). Furthermore, company might also create a formal community forum meetings (Dobele, Westberg, Steel, & Flowers, 2014). It is important to note that the dialogue should not be seen as the attempt to influence or coerce one to another. Rather, it emphasizes the one party to deeply listen to other parties with empathy, showing the hidden assumption, and focus on the common goals, and looking for the solution (Ayuso et al., 2006).

Exchanging a two-way of views and opinions can also realized by enabling active systems of dialogue (e.g., discussions and focus groups or participation in societal debate) (Lubberink et al., 2017). To foster this dialogue, company can exercise the cross-functional integration, either with the sources from internal company (e.g., R&D and marketing) or external company (e.g., government and NGOs) (Chadha, 2011). The example of effective active dialogue is proven during the Wind Energy Fund development as the response to Chernobyl Disaster in 1986 and the development of Fair Trade Fund as the response to the debt crisis in South America during 1994 (Dossa & Kaeufer, 2014).

SHARED INFORMATION AND VALUE CRITERIA

Deliberation also requires several criteria that the company needs to improve the stakeholder dialogues (Lubberink et al., 2017). The shared information and value criteria has two strategies. At first, it is necessary for the company to provision the accurate and transparent information. In particular, the accurate information is vital for the company to market their product. Related to this, as information is important to consumer attitude, media plays the important role to communicate the message from the company to the consumers (Davari & Strutton, 2014). Company can provide the accurate information about its products in the label of the products (Rousseau & Vranken, 2013). Related to this, the study shows how consumer's willingness to buy the organic product depends on the information given in the product's label. Besides, the company may also put the information in the web sites, collateral media, or visitor center that attract the future customer attention (B. DiPietro, Cao, & Partlow, 2013). In general, inaccurate information would lead to decrease consumers' trust to the company (Y. Chen et al., 2015).

The subsequent activity after provisioning of accurate and transparent information is about how to evaluate the shared information and how to develop the criteria for evaluating the shared information (Lubberink et al., 2017). It is important because different stakeholders usually has different criteria (Hansen et al., 2011).

In general, the company may use the evaluation criteria to determine the next action (Harrisson et al., 2012; Rohrbeck et al., 2013). For example, after evaluating the particular criteria in one innovation phase, the company can determine the project resource allocation in the next innovation phase (Chalmers & Balan-Vnuk, 2013). Besides, company may also use the evaluation to cope with the identified risks (Baba & Walsh, 2010).

SUPPORT DECISION-MAKING WITH REGARD TO THE INNOVATION THAT IS UNDER CONSIDERATION

Deliberation requires the company to deal with many stakeholders (Ayuso et al., 2006; Chadha, 2011; Chalmers & Balan-Vnuk, 2013; Edwards-Schachter et al., 2012; Harrisson et al., 2012). Related to this, once the company finishes with the shared information and value criteria from different stakeholders, deliberation calls for the company to have the activity as the supporting system to make a decision making with regard to the innovation that is under consideration (Lubberink et al., 2017). This activity has two key strategies. The first one is the equal consideration of stakeholder interests. For example, the company may use a value mapping tool in which encourages the equal consideration between different stakeholders' interests (N. Bocken et al., 2013). This equal consideration would be useful to solve the problems when there are conflicting values between stakeholders (e.g., company profit vs. social justice) (Harrisson et al., 2012).

The second strategy in regards to support decision-making is the consultation with the wider group of stakeholder (Lubberink et al., 2017). For example, the company can develop a conferences, seminars, or social media platform to increase the cooperation among stakeholders (Edwards-Schachter et al., 2012). Wider group stakeholder consultation would be effective if the company use the stakeholder mapping. By mapping the stakeholders, company could understand the power of every stakeholder and how they use this power to make the influence in the decision (von Weltzien Hoivik, 2011). In addition, it is also important to note that company should not only focus at the frequency of consultation, but also the form of consultancy process (e.g., face-to-face meetings, public meetings), and the transparency in the consultancy process (Gray, Haggett, & Bell, 2005). The consultancy processes should be started before the innovation process starts (Dossa & Kaeufer, 2014). The late of consultancy process would hinder the public acceptance (Wheeler, Fabig, & Boele, 2002)

DECISION-MAKING POWER OF STAKEHOLDERS REGARDING THE INNOVATION PROCESS AND/OR OUTCOME

Company may apply various schemes to enable the stakeholders in the decision making process. The stakeholders' decision making power consists of three key strategies (Lubberink et al., 2017). The first one is by providing a place in the board of the firm. Related to this, the company can set up a formal position for customer in a formal organization structure. For example, the company creates customer council in order to enable customer to participate in the company decision making process (Ayuso et al., 2006). The same way might also be applied for the employee.

The second key strategy in regards to stakeholders' decision making power is by providing voting power in the process and regarding the outcomes (Lubberink et al., 2017). This strategy allows the allocation of decision making power among stakeholders (Edwards-Schachter et al., 2012). In other words, the decision making is not exclusively made by the top management, but also by the workers or the customers (Ayuso et al., 2006). The fair stakeholders' decision making indicates the company's transparency (Franke et al., 2013).

Another strategy in regards to the stakeholders' decision making power is by providing a platform to express the voice regarding the process and outcomes (Lubberink et al., 2017). In this case, every stakeholder has the opportunities to express needs and wants. This opportunity would give the company to gain the absorptive capacity to develop the innovation (Chalmers & Balan-Vnuk, 2013). The example can be found in the development of Wind Energy Fund as the response to Chernobyl Disaster in 1986 and the development of Fair Trade Fund as the response to the debt crisis in South America during 1994 (Dossa & Kaeufer, 2014).

FEEDBACK REGARDING THE DIALOGUE AND EXPLAINING HOW THE RESULTS ARE INTEGRATED IN THE INNOVATION

In order to make the stakeholders feel fulfilled about the deliberative governance, the company needs to give the feedback and explain to the relevant stakeholders regarding to the decision that it makes in the innovation processes (Franke et al., 2013). Therefore, this feedback and explanation become an important activity in the deliberation processes (Lubberink et al., 2017). The feedback and explanation activities consists of two strategies. The first one is by providing feedback and explanation on what is done (or not) in the innovation processes based on the stakeholders' input. This explanation can be published in the consumer's schools, magazines, or consumer's web site (Ayuso et al., 2006). Providing the feedback is the responsibility of the involved stakeholders and, therefore, it indicates the company strategic partnership with the external stakeholders (Jamali et al., 2011). Another key strategy regarding to the explanation of the company decision is the transparent process of how ideas are selected and integrated (Lubberink et al., 2017). The lack of transparency in the selection process would decrease the fairness of the company in the stakeholders' view (Franke et al., 2013). Related to this, the company needs the actors who are credible, possess expertise, and have the detail knowledge about the decision making in the organization (Harrisson et al., 2012).

Table 41 gives a summary of the explanation above.

Table 41. Operationalization of deliberation dimension (Lubberink et al., 2017)

Key Activities	Strategies	Examples	Scholars
Two-way exchange of views and opinions	Formalized process of how deliberation can be governed	Formal procedures for deliberating with stakeholders	Armstrong, M., et al. (2012), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Dobele, A. R., Westberg, K., Steel, M., & Flowers, K. (2014), Asif, M., Searcy, C., Santos, P. D., & Kensah, D. (2013)
	Enabling active systems of dialogue (e.g., discussions and focus groups or participation in societal debate)	Active communication activities with stakeholders	Chadha, A. (2011), Dossa, Z., & Kaeufer, K. (2014)
Shared information and value criteria	Provision of accurate and transparent information	Providing the right information	Davari, A., & Strutton, D. (2014), Rousseau, S., & Vranken, L. (2013), B. DiPietro, R., Cao, Y., & Partlow, C. (2013), Chen, Y. S., & Chang, C. H. (2013)

	Evaluation of shared information (determined beforehand or along the way)	Examples of how to act upon shared information	Chalmers, D. M., & Balan-Vnuk, E. (2013), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Hansen, E. G., Bullinger, A. C., & Reichwald, R. (2011), Rohrbeck, R., Konnertz, L., & Knab, S. (2013), Baba, Y., & Walsh, J. P. (2010)
Support decision-making with regard to the innovation that is under consideration	Equal consideration of stakeholder interests	Examples of how to equally consider stakeholder interests	Bocken, N., Short, S., Rana, P., & Evans, S. (2013), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012)
	Wider group of stakeholder consultation to decide	Living lab	Edwards-Schachter, M. E., Matti, C. E., & Alcántara, E. (2012)
		stakeholder mapping for consultation	von Weltzien Hoivik, H. (2011), Gray, T., Haggett, C., & Bell, D. (2005), Wheeler, D., Fabig, H., & Boele, R. (2002)
Decision-making power of stakeholders regarding the innovation process and/or outcome	Providing a place in the board of the firm	Giving consumers an official role in organisational structure	Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006),
	Providing voting power in the process and regarding the outcomes	Allocating decision-making power	Edwards-Schachter, M. E., Matti, C. E., & Alcántara, E. (2012), Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006), Franke, N., Keinz, P., & Klausberger, K. (2013)
	Providing a platform to express their voice regarding the process and outcomes	Opportunities to express needs and wants, etc.	Chalmers, D. M., & Balan-Vnuk, E. (2013), Dossa, Z., & Kaeufer, K. (2014)
Feedback regarding the dialogue and explaining how the results are integrated in the innovation	Providing feedback on what is done (or not) with the input of stakeholders	Providing appropriate feedback regarding deliberation	Ayuso, S., Ángel Rodríguez, M., & Enric Ricart, J. (2006), Jamali, D., Yianni, M., & Abdallah, H. (2011)
	Transparent process of how ideas are selected and integrated	Pre-determined transparent process of integrating information	Franke, N., Keinz, P., & Klausberger, K. (2013), Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012)

APPENDIX 5

Responsiveness

MAKING SURE THAT ONE CAN RESPOND TO CHANGES IN THE ENVIRONMENT

It is likely that while doing the innovation, company obtains new information from external environment that requires the company to adjust the innovation processes. Related to this, the company needs to ensure that it can respond to the possible changes in the environment (Lubberink et al., 2017). Making sure the respond regarding to the changes in the environment has three key strategies. The first one is ability to do mainstreaming/customizing to satisfy stakeholder needs. Mainstreaming activity allows the company to avoid the unintended consequences through the incremental improvement (Berker, 2010). In this case, company applies careful adaptation to achieve the best possible results. Related to this, company might develop a platform strategy as the product innovation governance: creating product architecture that allows many design variants (customizable) (S. Evans, Partidário, & Lambert, 2007). By implementing the customization strategy, the company can maintain the production cost, the quality and the delivery of the products based on the consumers' needs (Trentin, Forza, & Perin, 2015).

Ensuring the ability to respond the environment changes also requires the company not to trap in the organizational inertia (Kelly & Amburgey, 1991; Lubberink et al., 2017; Porter & Van der Linde, 1995). To prevent the organizational inertia, the company is encouraged to apply the autonomous thinking time through encouraging routines, like regular staff meeting or attending the conferences (Chalmers & Balan-Vnuk, 2013). Besides, the company is suggested to endorse organizational culture that would enrich the creativity and innovativeness. Regarding to this, it is important to endorse the ethical culture within the company for the reason that the ethical culture is associated with the company's innovativeness (Riivari & Lämsä, 2014). The ethical work climate would foster the inter-employee and employee-manager communication and trust between them. Furthermore, the trust would improve the commitment and innovativeness (Ruppel & Harrington, 2000). In addition, it is also important for the leader in the company to have a transformational leadership skill (Y.-S. Chen & Chang, 2013).

Another strategy to ensure the respond of changes in the environment is by doing the collaboration to achieve the fast and effective response (Lubberink et al., 2017). Collaboration is likely to improve company's absorptive capacity (Chalmers & Balan-Vnuk, 2013). Further, the absorptive capacity can improve company's business performance (Gluch, Gustafsson, & Thuvander, 2009). The collaboration requires the company to do the partnership from both demand-pull (i.e., customers, competition, supplier) and science-push aspect (e.g., research institutes or universities) (Murovec & Prodan, 2009).

ACTUAL RESPONSE TO CHANGING ENVIRONMENTS

It is likely that the company may not be able to cope with all risk and uncertainties. Therefore, it is encouraged to make an effective adjustments while the unintended consequences occur. Related to this, the actual response to the changing environments is considered as one of the activity that links to the responsiveness (Lubberink et al., 2017). This activity has three key strategies. The first one is to define nature, pace, and impact based on interactions with the innovation system. To apply this strategy, company

may do negotiation through institutional and structural layers. Besides, the company is encouraged to do the innovation governance by applying incremental innovation instead of creative destruction (Berker, 2010). It is especially important in the high risk innovation. For example, considering the risk of losing of big financial return due to the market uncertainty, big oil company is likely to reticent to invest in renewable energy technology (Kolk & Levy, 2003; Levy & Kolk, 2002).

Defining nature, pace, and impact based on interactions with the innovation system can also be done by determining pace of innovation based on capabilities (Lubberink et al., 2017). It does make sense because the speed of innovation is positively related with the radicalness of product and process innovation (Banu Goktan & Miles, 2011). Regarding to this, the company needs to consider the R&D strategy that suits with the type of innovation (Noci & Verganti, 1999). In addition, company is encouraged to consider the capital investment requirement before deciding to do the innovation, especially for the high risk product (Krucoff et al., 2012). In the condition when the company is lack of R&D and financial capability, company is suggested to form an alliance with other companies (Chalmers & Balan-Vnuk, 2013; Murovec & Prodan, 2009; Zhang & Yin, 2012).

Another strategy in regards to the actual response to changing environments is by reinventing (innovation and organization) to align with recent recognized needs (Lubberink et al., 2017). To do this strategy, company is advised to change the organizational routines (Becker et al., 2005; Feldman & Pentland, 2003). For example, endorsed by community needs, a company could transform its innovation orientation into the community social capital (Bartlett, 2009). In this case, changing the organizational routines has called for the company to change the lens from the status quo (business innovation) into the new framework (social innovation) (Kiron et al., 2013; Lettice & Parekh, 2010). Another way to reinvention strategy is to give response to the regulations and to the technology developments. Related to this, study finds that government initiative is still the major driver for innovation, especially for emerging technology (Borghesi, Cainelli, & Mazzanti, 2015). For example, government incentive is still the primary driver for pharmaceuticals firms to implement the environmental-based innovation (Blum-Kusterer & Hussain, 2001). The similar finding can also be found in the airline industry. In this case, the use of algae-based bio-fuels as the source engine of the airplane is still much influenced by the role of government (Nair & Paulose, 2014).

Another strategy in regards to the actual response to changing environments is by changing the environment (e.g., institutional barriers or social epistemologies) (Lubberink et al., 2017). This strategy can be implemented by substitution approach. For example, due to the raising concern of damage in the ozone layer and global warming, there is an effort for technology substitution from chlorofluorocarbons (CFCs) with hydrofluorocarbons (HFCs), and later substitute HFC with CO2 (Berker, 2010). In addition, changing the environment can also be done by knowledge creation to affect social epistemologies. Related to this, it is important to note that breakthrough innovation does not only depends on the firm capabilities in regards to address the technical barrier, but also on the new social epistemology aspect on what the society perceive as uncertainties. For example, the scientific networks can successfully introduce the development of statin (Baba & Walsh, 2010).

ADDRESSING GRAND CHALLENGES

The circumstance dynamics in which the company responds does not only originate from the external environment called grand challenges (Lubberink et al., 2017). Addressing grand challenges has four key strategies. The first one is by responding to social issues. In this case, the company might use the social challenges as the source of innovation and organizational transformation (Bartlett, 2009). For example, the company sets up the charity program to children and youth crime prevention in order to address community needs and improve their living standard (Edwards-Schachter et al., 2012; Jamali et al., 2011). By doing

such things, it is likely that there will be a partnership dynamics between the company and the society (Jamali et al., 2011).

Another key strategies in regards to the addressing grand challenges is by responding to environmental issues (Lubberink et al., 2017). The company uses the environmentally related challenges as the driver of innovation (Larson, 2000). In other words, safety and care for the natural environment is the aim of the innovation (Wodzisz, 2015). In order to develop the environmental innovation, company is encouraged to set up a creative team. To do so, the company is suggested to hire the team members who have not only the environmental knowledge, but also who have multidisciplinary background (N. M. P. Bocken et al., 2014). In addition, responding to the environmental challenges also requires the company to understand the dimensions of eco-innovation, like design component, user acceptance, innovation governance (Carrillo-Hermosilla et al., 2010).

Another key strategies in regards to the addressing grand challenges is by responding to economic issues (Lubberink et al., 2017). In this case, company is advised to develop an innovation to address the poverty related issue. Doing such thing would bring the benefit to the company in which the company could sustain the corporate growth and, at the same time, address the poverty issue. Addressing the poverty issue can be found in the development of product or service that targets the wide untapped market in the bottom of pyramid segment (Hart & Christensen, 2002). However, one should note that innovating in the low-income market does not necessarily mean that the company has to compromise with the customer's safety and comfort factor (Pitta, Van den waeyenberg, & Hens, 2008). To achieve the success in this market, company should understand the local customers, create the local networks, and support local business ecosystem (Khavul & Bruton, 2013).

Another way to respond the economic issue is by developing responsible financial products (Lubberink et al., 2017). In order to meet the consumer needs, companies that deal with the financial activity is suggested to endorse the aspects, like fairness, clear communication, timely delivery, transparency, and appropriate solution towards their customers (Asante et al., 2014). For example, to answer the needs of lower-income consumers to own affordable renewable energy source, the company provides two financing schemes to decrease the high upfront purchasing price (Pode, 2013). The suitable design and operational of the financing scheme would ensure the market to be self-sustained (Lemaire, 2011).

The fourth key strategies in regards to the addressing grand challenges is by preventing detrimental effects (Lubberink et al., 2017). This strategy obliges the company to withdraw the innovation from the market. Sometimes, the withdrawal is caused by the overly aggressive of innovators in the technical aspect objective in the beginning of innovation processes, while underestimating the non-technical factor (Baba & Walsh, 2010). For example, as the consequence of the lack treatment of privacy issue, the Dutch government withdraws the development of electronic patient record system and smart electricity meter (Van den Hoven, 2014). Another example can also be found in the UK's controversial geoengineering research (Stilgoe et al., 2013).

MUTUAL RESPONSIVENESS

The company get take the benefit from the partnership with other stakeholders in regards to the take the mutual respond to the unintended impact of innovation (Lubberink et al., 2017). This mutual responsiveness has three key strategies. The first one is by aligning stakeholder interests with overall innovation objective. It is relevant since disseminating the stakeholder alignment would decrease the mutual responsiveness (Blok et al., 2015). Interest alignment emphasizes the company to deliver the product or service that can align its strategic interest (e.g., profit) with the consumers' interest (e.g., affordable products) (Harrisson et al., 2012; Jamali et al., 2011). In order to tackle the issue of stakeholder interest alignment, company is

suggested to do several managerial practices, like applying intellectual property management to tackle the fear of losing competitive advantage or encouraging the open dialogue and relationship building to answer the conflicting visions among stakeholders (Blok et al., 2015).

The next key strategy in regards to the mutual responsiveness is the investment of resources from the involved stakeholders (Lubberink et al., 2017). Building a healthy partnership is a hard work. Therefore it needs a commitment of investment from the involved stakeholders (Jamali et al., 2011). In this case, the lack of investment from the involved stakeholders would erode the value of their relational attachment (the reciprocal bond of responsiveness) (Le Ber & Branzei, 2010).

Another key strategy to mutual responsiveness is the willingness to recalibrate the roles and responsibilities for sustaining stakeholder relationships (Lubberink et al., 2017). This strategy points out the (re)forming strategic cross-sector partnerships (Le Ber & Branzei, 2010). The collaboration is prevalent with the difficulties. In this condition, recalibration would help stakeholders to support one another to keep sustaining the momentum: reverse the failure into the success. In this case, the recalibration is likely to improve the gradual engagement among stakeholders. For example, instead of only delivering the innovative products to the market, company should also listen to their feedback so that the company can add improve its product.

Based on the explanation above, I provide the summary in Table 42.

Table 42. Operationalization of the responsiveness dimension (Lubberink et al., 2017)

Key Activities	Strategies	Examples	Scholars
Making sure that one can respond to changes in the environment	Mainstreaming/customizing to satisfy stakeholder needs	Customization activities	Berker, T. (2010), Evans, S., Partidário, P. J., & Lambert, J. (2007), Trentin, A., Forza, C., & Perin, E. (2015)
	Prevent or overcome organizational inertia (e.g., little bureaucracy, creativity trainings or enhancing (in)formal communication)	Autonomous thinking time	Chalmers, D. M., & Balan-Vnuk, E. (2013)
		organizational culture for creativity and innovation	Riivari, E., & Lämsä, A. M. (2014), Ruppel, C. P., & Harrington, S. J. (2000), Chen, Y. S., & Chang, C. H. (2013)
	Collaboration for fast and effective response	Absorptive capacity routines combining user and technical knowledge	Chalmers, D. M., & Balan-Vnuk, E. (2013), Murovec, N., & Prodan, I. (2009), Gluch, P., Gustafsson, M., & Thuvander, L. (2009)
Actual response to changing environments	Defining nature, pace and impact based on interactions with the innovation system	Negotiation through institutional and structural layers	Berker, T. (2010), Levy, D. L., & Kolk, A. (2002), Kolk, A., & Levy, D. (2003)
		determining pace of innovation based on capabilities	Noci, G., & Verganti, R. (1999), Krucoff, M. W., Brindis, R. G., Hodgson, P. K., Mack, M. J., & Holmes, D. R. (2012), Zhang, M., & Yin, X. (2012), Murovec, N., & Prodan, I. (2009), Banu Goktan, A., & Miles, G. (2011)

	Reinventing (innovation and organization) to align with newly recognized needs	Changing organizational routines	Bartlett, D. (2009), Lettice, F., & Parekh, M. (2010), Kiron, D., Kruschwitz, N., Reeves, M., & Goh, E. (2013)
		responding to rules and regulations and technology developments	Blum-Kusterer, M., & Hussain, S. S. (2001), Nair, S., & Paulose, H. (2014), Borghesi, S., Cainelli, G., & Mazzanti, M. (2015)
	Changing the environment (e.g., institutional barriers or social epistemologies)	Substitution strategies	Berker, T. (2010)
		knowledge creation to affect social epistemologies	Baba, Y., & Walsh, J. P. (2010)
Addressing grand challenges	Responding to social issues	Examples of articles looking into social aspects of innovations	Bartlett, D. (2009), Edwards-Schachter, M. E., Matti, C. E., & Alcántara, E. (2012), Jamali, D., Yianni, M., & Abdallah, H. (2011)
	Responding to environmental issues	Examples looking at responding to environmental challenges and integrating environmental goals in innovation	Larson, A. L. (2000), Bocken, N. M. P., Farracho, M., Bosworth, R., & Kemp, R. (2014), Wodzisz, R. (2015), Carrillo-Hermosilla, J., del Río, P., & Könnölä, T. (2010)
	Responding to economic issues	Responding to poverty	Hart, S. L., & Christensen, C. M. (2002), Khavul, S., & Bruton, G. D. (2013)
		Responsible financial products	Asante, K., Owen, R., & Williamson, G. (2014), Pode, R. (2013), Lemaire, X. (2011)
	Preventing detrimental effects	Consideration of withdrawing innovation from the market	Baba, Y., & Walsh, J. P. (2010), Van den Hoven, J. (2014), Stilgoe, J., Owen, R., & Macnaghten, P. (2013)
Mutual responsiveness	Aligning stakeholder interests with the overall innovation objective	Aligning stakeholders' strategic interests with the overall goal of the innovation	Harrisson, D., Chaari, N., & Comeau-Vallée, M. (2012), Blok, V., Hoffmans, L., & Wubben, E. F. M. (2015), Jamali, D., Yianni, M., & Abdallah, H. (2011)
	Investment of resources by involved stakeholders	Partners bringing in resources for successful development of innovation	Le Ber, M. J., & Branzei, O. (2010), Jamali, D., Yianni, M., & Abdallah, H. (2011)

	Willingness to recalibrate the roles and responsibilities for sustaining stakeholder relationships	(Re)forming strategic cross-sector partnerships	Le Ber, M. J., & Branzei, O. (2010)

APPENDIX 6

Relation between Ris items and responsible innovation concept

Table 43. Relation between Ris items and responsible innovation concept

	Anticipation			Reflexivity			Inclusion			Deliberation					Responsiveness			
	An1	An2	An3	Rf1	Rf2	Rf3	In1	In2	In3	Dl1	Dl2	Dl3	Dl4	Dl5	Rs1	Rs2	Rs3	Rs4
I am good at coming up with ideas that are novel, but in the right way	✓	✓	✓															
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved															✓	✓	✓	✓
The ethical side of an idea does not interest me as much as the originality of that idea (reverse scored)				✓	✓	✓												
I have a knack for coming up with many ethical solutions to a problem															✓	✓	✓	✓
Producing large numbers of solutions for a better future comes natural to me				✓	✓	✓									✓	✓	✓	✓
I am good at generating many ideas that capture the responsible side of innovation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I find it easy to explore a wide range of politically correct alternatives in idea generation							✓	✓	✓	✓	✓	✓	✓	✓				
It is important to me to explore the various ethical aspects of my ideas	✓	✓	✓															
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				

I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements				✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
I have no interest in evaluating the moral aspects of my new ideas (reverse scored)	✓	✓	✓		✓	✓	✓														
I like to contribute to the implementation of new ideas when these are appropriate to solving a meaningful problem				✓	✓	✓												✓	✓	✓	✓

Note.
Ant1: Determining desired impacts and outcomes of innovation
Ant2: Preventing or mitigating negative impacts
Ant3: Development of roadmaps for impact
Ref1: Actions and responsibilities
Ref2: Values and motivations
Ref3: Knowledge and perceived realities
Inc1: Involvement of stakeholders at different stages (who and when)
Inc2: Provision of resources and capital (how)
Inc3: Raised commitment and contribution (how)
Del1: Two-way exchange of views and opinions
Del2: Shared information and value criteria
Del3: Support decision-making with regard to the innovation that is under consideration
Del4: Decision-making power of stakeholders regarding the innovation process and/or outcome
Del5: Feedback regarding the dialogue and explaining how the results are integrated in the innovation
Res1: Making sure that one can respond to changes in the environment
Res2: Actual response to changing environments
Res3: Addressing grand challenges
Res4: Mutual responsiveness

APPENDIX 7

Missing Data Assessment

Hair et al. (2014, p. 32) define missing data as "a nuisance to researchers and primarily result from errors in data collection or data entry or from the omission of answers by respondents." Missing data can be caused from various reasons (Field, 2009). In this study, one variable is completely missing from the data collection process: InWBeh08 (please see Section 5.5). In order to analyze this missing data, I followed a guideline from Hair et al. (2014). A careful analysis in in this section concludes that the missing of InWBeh08 would not be significantly affect the measurement in this study. Therefore, InWBeh08 will be eliminated from the data analysis.

STEP 1: DETERMINING THE TYPE OF MISSING DATA

In general, there are two types of missing data: ignorable and non-ignorable (Hair et al., 2014). The missing data is ignorable if the missing data is expected and is part of the research design. There are three types of ignorable missing data: (1) the data that are missing because of the research are taking a sample of the population, instead of collecting the data from the whole population, (2) the data that are missing because of the particular strategy of data collection process, and (3) the data that are missing because the censored data. The ignorable missing data does not need any remedy technique.

In contrast with the ignorable missing data, the not-ignorable missing data needs further analysis (Hair et al., 2014). The missing data can be considered not ignorable if the researcher knows that the data are missing because of procedural factors (e.g., invalid codes, incomplete questionnaire collection, or respondent morbidity). Another type of not-ignorable missing data is the unknown missing data, like the respondent refusal to complete the questionnaire.

Based on this assessment, the missing of InWBeh08 data is classified as the not-ignorable missing data. Therefore, further assessment is needed to analyze this missing data.

STEP 2: DETERMINING THE EXTENT OF MISSING DATA

Step 2.1: Assessing the Extent and Patterns of Missing Data

The first step to determine the extent of missing data is by assessing the extent and the patterns of the missing data. Hair et al. (2014, p. 45) suggest that "Missing data under 10 percent for an individual case or observation can generally be ignored, except when the missing data occurs in a specific nonrandom fashion (e.g., concentration in a specific set of questions, attrition at the end of the questionnaire, etc.)"

In this study, the missing data is concentrated fully in one variable: not randomly distributed. In other words, it is not randomly distributed to the other variables. InWBeh08 itself is one of the variables to measure the Innovative Work Behavior (InWBeh). InWBeh scale consists of nine questions. Therefore, the InWBeh08 missing data represents missing 11.111% of the of the overall InWBeh measures. Following the suggestion from Hair et al. (2014) above, I can conclude that the missing of InWBeh08 data is not acceptably low.

Step 2.2: Deleting Individual Cases and/or Variables

Because the missing of InWBeh08 data is considered as high level missing data and it is concentrated in one variable, I may consider the remedy to delete this InWBeh08 variable from the overall measurement. In this case, there are two advices from Hair et al. (2014) that I may apply. Hair et al. (2014) explain that the researcher may delete an individual variable if (1) the researcher can ensure that there are alternative variables that can be used to represent the aim of the original variable, and to do that (2) the researcher should consider to perform the analysis both with or without the deleted cases in order to see the marked differences. Following this suggestion, I do several assessment.

- InWBeh08 is one of the variables to measure Innovative Working Behavior (S. G. Scott & Bruce, 1994), please also see (Janssen, 2000) and (Moss Kanter, 1988). The other variables are InWBeh01, InWBeh02, InWBeh03, InWBeh04, InWBeh05, InWBeh06, InWBeh07, and InWBeh09. In order to assess whether these remaining variables can represent the intent of the original Innovative Working Behavior construct, I will check the reliability of measure using Cronbachs' Alpha. Cronbachs' Alpha is the most extensively used parameter to assess the reliability (Cronbach, 1951; Nunnally, 1978; Peter, 1979). (Nunnally, 1978)

  In this case, I will compare the Cronbachs' Alpha of this study with the Cronbachs' Alpha in original paper. In the original paper, the Cronbachs' Alpha for all InWBeh variables are stretched between .950 – .960 (Janssen, 2000). While in this study, if I eliminate InWBeh08, the Cronbachs' Alpha of InWBeh is .889 (Table 44). Although the Cronbachs' Alpha in this study is lower than the one in the original paper, it is still considered good. In this case, I refer to Nunnally (1978) who explains that the basic research should have the Cronbachs' Alpha of .700 or better, while the applied research should have the Cronbachs' Alpha of at least .800.

Table 44. Reliability statistics after InWBeh08 is eliminated

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.889	.890	8

- In addition, from the original paper, I also get an information that the Innovative Working Behavior construct can be classified into three groups: idea generation (InWBeh01, InWBeh02, and InWBeh03), idea promotion (InWBeh04, InWBeh05, and InWBeh06), and idea realization (InWBeh07, InWBeh08, and InWBeh09) (Janssen, 2000). Thus, InWBeh08 is categorized as one of the variables to measure the idea realization group together with InWBeh07 and InWBeh09 (Moss Kanter, 1988). Although the original paper does not specify the value of Cronbachs' Alpha in every group, I try to omit InWBeh08 to see the Cronbachs' Alpha of the InWBeh07 and InWBeh09. The result (Table 45) shows that the Cronbachs' Alpha of InWBeh07 and InWBeh09 are still good (.736).

Table 45. Reliability statistics of idea realization without InWBeh08.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.736	.400	2

- Moreover, I also check the inter-correlation between different factors. Based on Janssen (2000, p. 292),

> "inter-correlations between the three aspects of innovative work behavior ranged from .840 (between idea generation and idea realization) to .870 (between idea generation and idea promotion) for the leader-reports, and from .760 (between idea generation and idea realization) to .850 (between idea promotion and idea realization) for the self-reports."

I then calculate the inter-correlation between these three factors if the InWBeh08 is excluded. The result is shown in Table 46. I use Pearson correlation (instead of Spearman's Rho) because the data distribution of InWBeh is normal. However, the Spearman's Rho correlation is also provided in Table 47. From these inter-correlation tables, the exclusion of InWBeh08 do not much drop the inter-correlation between InWBeh variable groups.

These tables also show that the inter-correlation between idea generation (InWBeh_IG), idea promotion (InWBeh_IP), and idea realization (InWBeh_IG) drops compared to the original paper. However, these inter-correlations are still statistically significant.

Table 46. Descriptive statistics and Pearson Correlations between InWBeh_IG, InWBeh_IP, and InWBeh_IR (N=244)

		M	SD	1.	2.	3.
1.	InWBeh_IG	4.740	.845	-		
2.	InWBeh_IP	4.792	.926	.653**	-	
3.	InWBeh_IR	4.740	1.02	.653**	.696**	-

Note. **. Correlation is significant at the .01 level (2-tailed).

Table 47. Descriptive statistics and Spearman's rho Correlations between InWBeh_IG, InWBeh_IP, and InWBeh_IR (N=244)

		M	SD	1.	2.	3.
1.	InWBeh_IG	4.740	.845	-		
2.	InWBeh_IP	4.792	.926	.653**	-	
3.	InWBeh_IR	4.740	1.02	.653**	.696**	-

Note. **. Correlation is significant at the .01 level (2-tailed).

Based on the explanation above, I can assume conclude that the elimination of InWBeh08 would not be significantly affect the measurement in this study. Therefore, I will delete the InWBeh08 variable from the data analysis.

APPENDIX 8

Outliers Checking

Hair et al. (2014, p. 62) define outliers as "observations with a unique combination of characteristics identifiable as distinctly different from the other observations." Compared to the other data, an outlier usually has an extreme value (Field, 2009; Hair et al., 2014). Outliers can be assessed using a graphical (histogram) and statistical approach (z-score) (Field, 2009). A careful examination in this section provides a conclusion that there is no outlier occurs in all variables of this study.

I will start detecting the outliers by checking using the graphical assessment (Histogram in Appendix 9). From the histogram checking, I found no outliers in all the datasets. In addition to the graphical approach, I will use the statistical approach to detect the outliers. In this case, I will assess their z-score values (Hair et al., 2014). Z-score is a standard score that has a mean of 0 and a standard deviation of 1. As the standard score, z-score is able to make the comparisons between variables easier. Hair et al. (2014, p. 65) explains that "For small samples (80 or fewer observations), outliers typically are defined as cases with standard scores of 2.5 or greater" and "For larger sample sizes, increase the threshold value of standard scores up to 4". The z-score of the variables in this study is presented in Table 48. This table shows that none of the variable has the z-score more than 4.00.

Table 48. Z-score of variables in this study (N=244)

		Range Statistic	Minimum	Maximum
1.	Extraversion	4.855	-2.800	2.055
2.	Agreeableness	5.334	-3.620	1.714
3.	Conscientiousness	5.003	-3.102	1.901
4.	Neuroticism	5.277	-2.427	2.850
5.	Openness	4.555	-2.328	2.226
6.	Ethical Climate	4.466	-2.571	1.895
7.	Ethical Behavior	5.010	-2.391	2.619
8.	Sustainable Development Goals	5.215	-3.670	1.545
9.	Creative Self-Efficacy	6.213	-3.548	2.665
10.	Innovative Working Behavior	6.162	-3.401	2.761
11.	Ris_Model1	6.721	-3.584	3.137

From the discussion above, either based on the graphical or statistical approach, I can conclude that there is no outlier occurs in all the variables of this study.

APPENDIX 9

Histogram

EXTRAVERSION

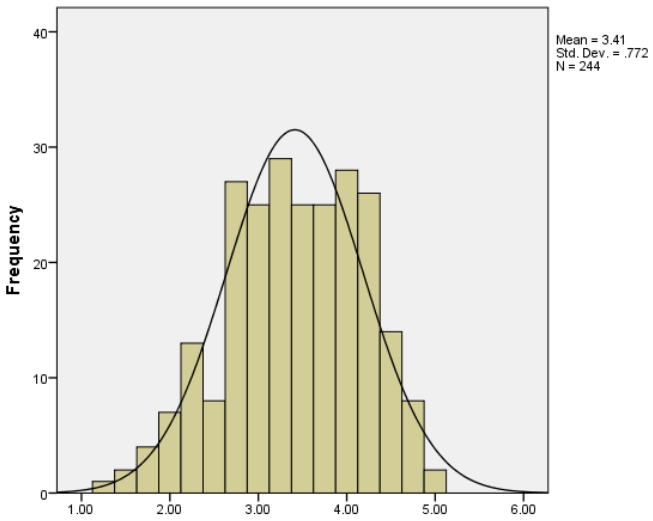


Figure 5. Histogram of extraversion

AGREEABLENESS

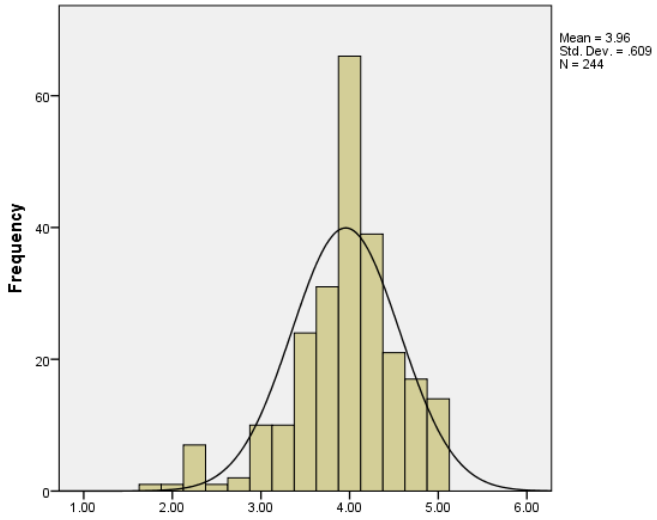


Figure 6. Histogram of agreeableness

CONSCIENTIOUSNESS

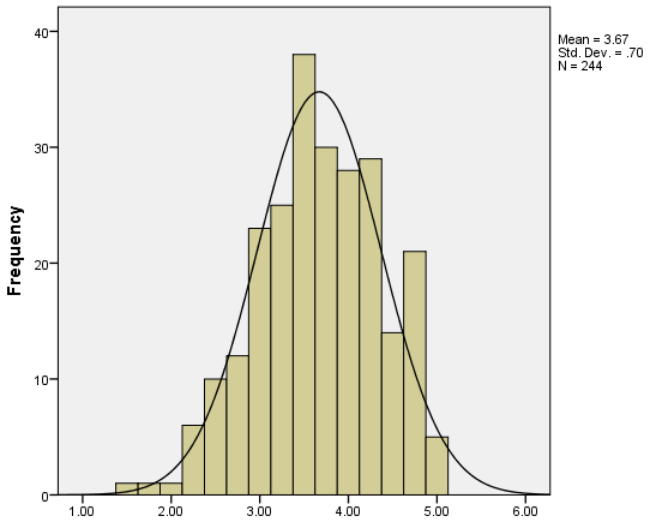


Figure 7. Histogram of conscientiousness

NEUROTICISM

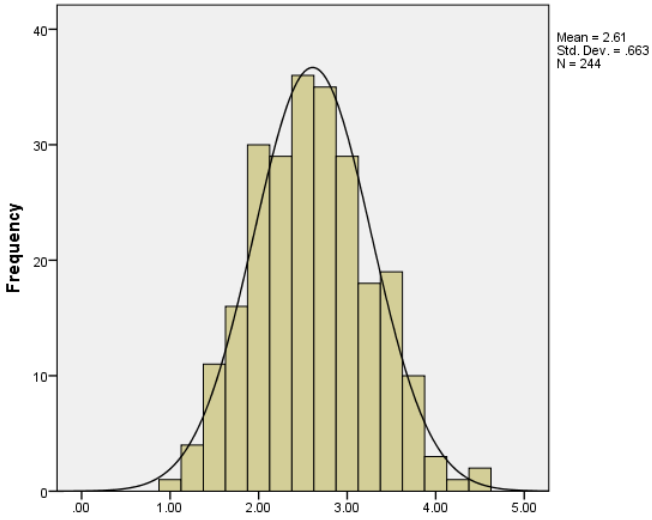


Figure 8. Histogram of neuroticism

OPENNESS

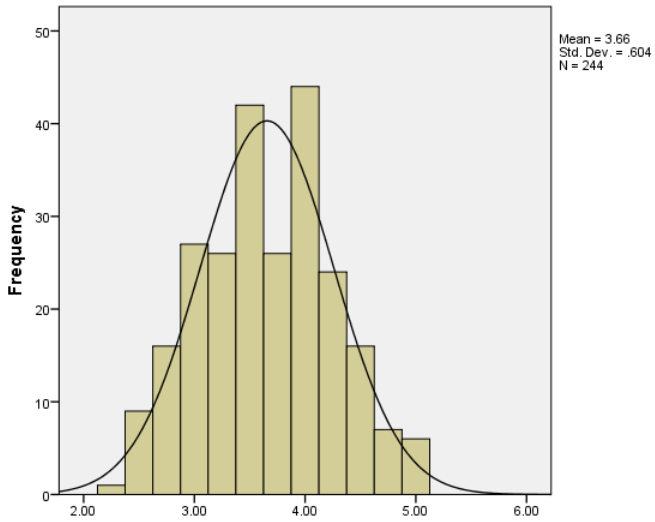


Figure 9. Histogram of openness

ETHICAL CLIMATE

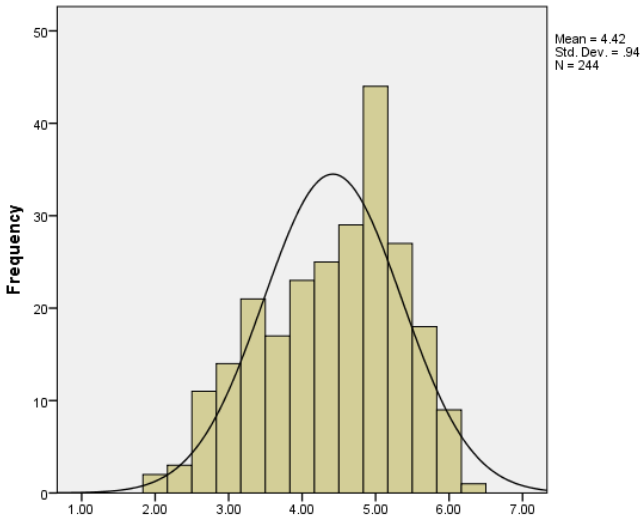


Figure 10. Histogram of Ethical Climate

ETHICAL BEHAVIOR

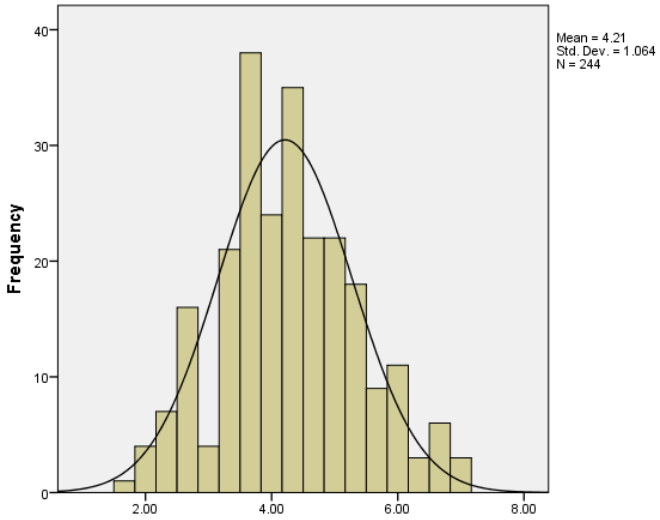


Figure 11. Histogram of Ethical Behavior

SUSTAINABLE DEVELOPMENT GOALS

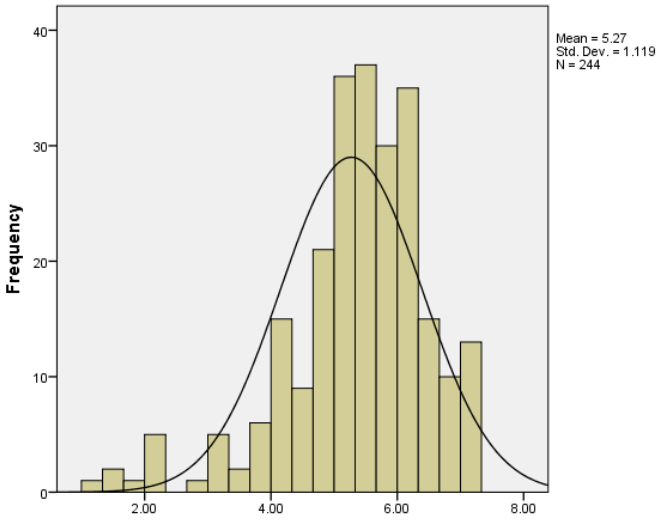


Figure 12. Histogram of Sustainable Development Goals

CREATIVE SELF-EFFICACY

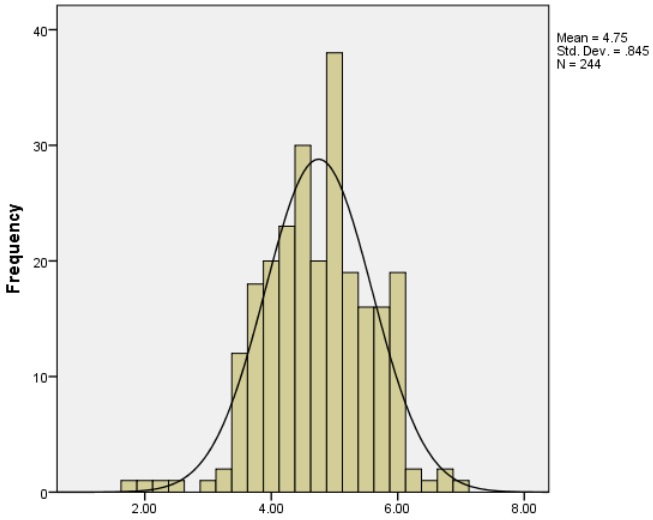


Figure 13. Histogram of Creative Self-Efficacy

INNOVATIVE WORKING BEHAVIOR

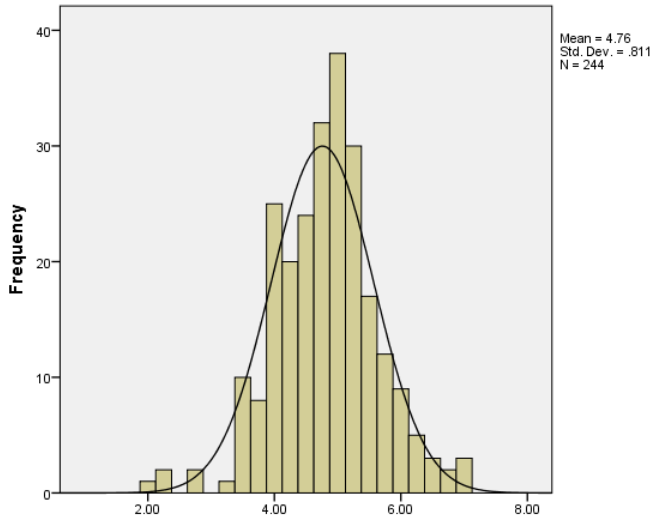


Figure 14. Histogram of Innovative Working Behavior

RIS_ORIGINAL

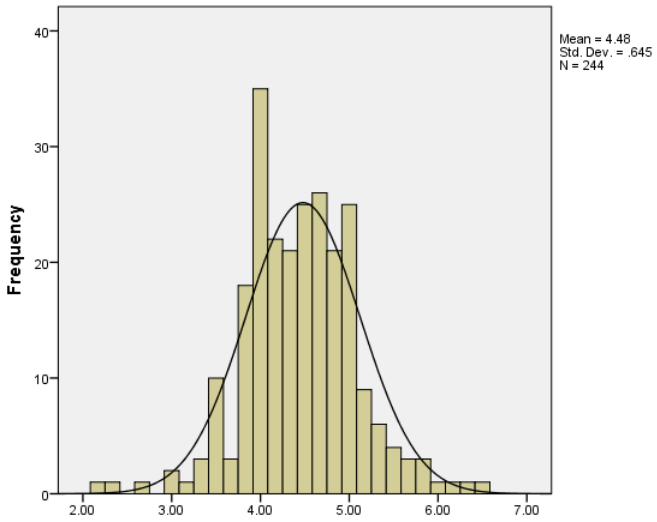


Figure 15. Histogram of Ris_Original

RIS_MODEL1

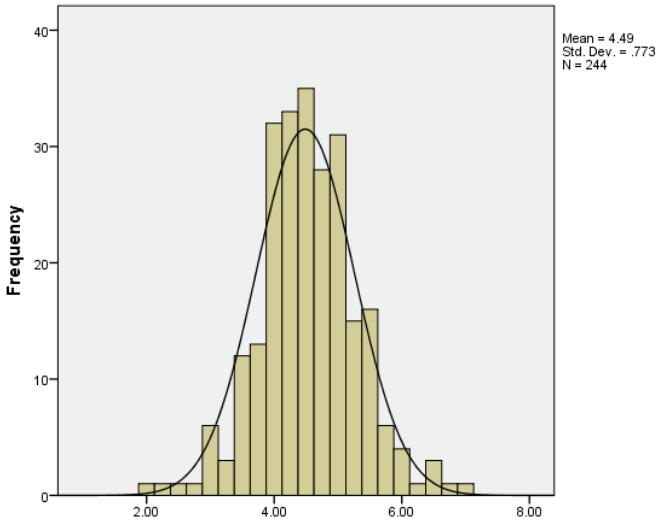
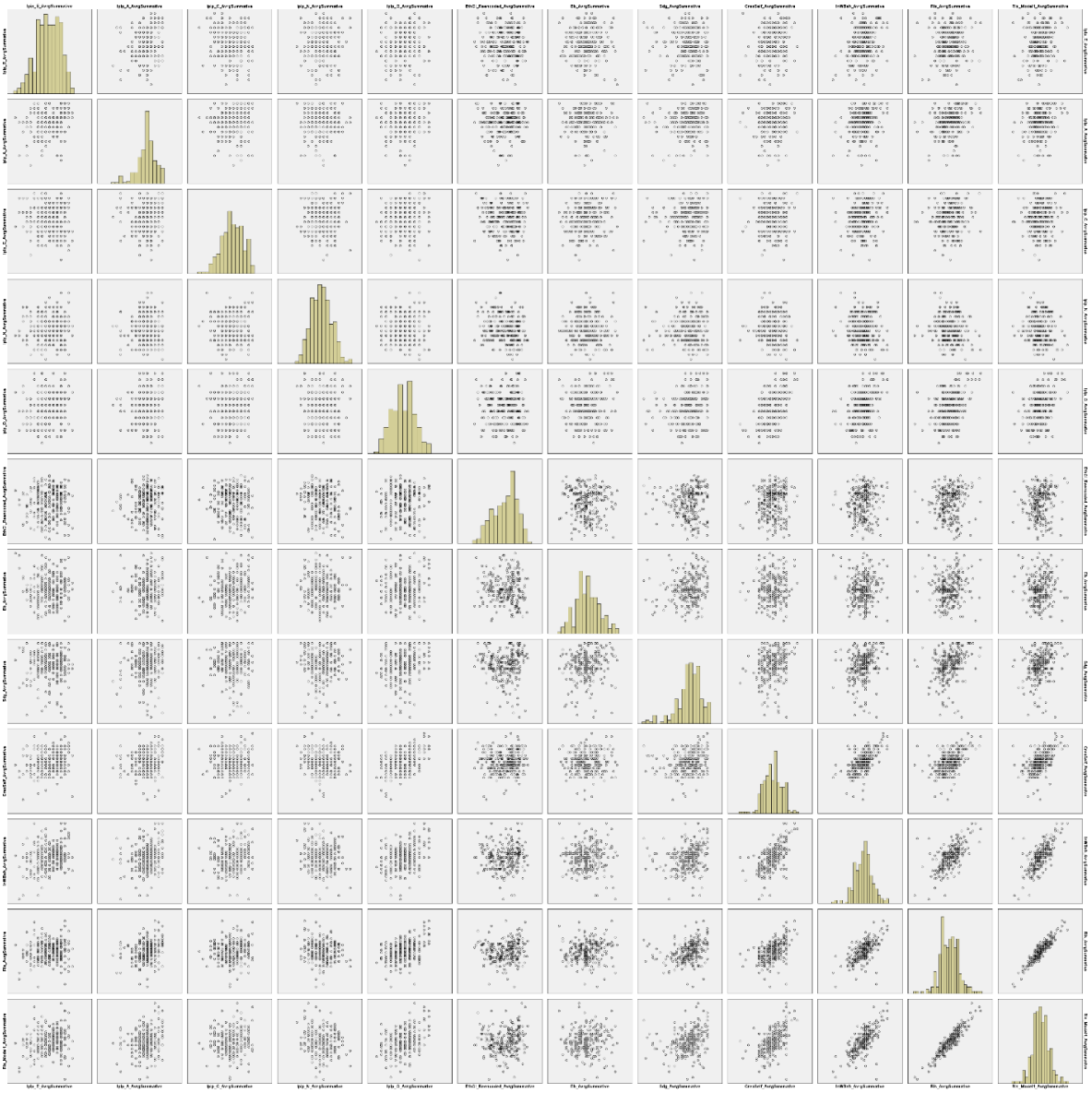


Figure 16. Histogram of Ris_Model1

APPENDIX 10

Scatter Plot



Note: from above to below

Extraversion	Openness	Creative Self-Efficacy
Agreeableness	Ethical Climate	Innovative Working Behavior.
Conscientiousness	Ethical Behavior	Ris_Original
Neuroticism	Sustainable Development Goals	Ris_Model11

Figure 17.Scatter Plot of scales in this study

APPENDIX 11

Initial Statistical Assumption Checking

The final step in the data examination processes is statistical assumption checking (Hair et al., 2014). Statistical assumptions consists of four parts: normality, homoscedasticity, linearity, and absence of correlated errors. Statistical assessment in this section reveals that the data meet all the statistical assumptions.

NORMALITY

Hair et al. (2014, p. 34) define normality is the "Degree to which the distribution of the sample data corresponds to a normal distribution." The normality of the data can be checked by using graphical and statistical assessment. The graphical approach will assess the skewness, kurtois, the histogram (see Appendix 9). The skewness and kurtois is assessed based the z-score as shown respectively in equations below (Ghasemi & Zahediasl, 2012). For the statistical approach, I will use Kolmogorov-Smirnov (Lilliefors, 1967; Massey Jr, 1951) and Shapiro-Wilk test (Öztuna, Elhan, & Tüccar, 2006; Razali & Wah, 2011). The result of these tests is respectively provided in Table 49 and Table 50.

$$z_{skewness} = \frac{skewness}{SE_{skewness}}$$

$$z_{kurtois} = \frac{kurtois}{SE_{kurotis}}$$

$$N: number\ of\ sample$$

$$\text{SE: standard error}$$

Table 49. Normality check based on graphical assessment (N=244)

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance	Skewness			Kurtosis			Histogram Normal?
					Statistic	Std. Error			Statistic	Std. Error	Z-score	Statistic	Std. Error	Z-score	
Extraversion	244	3.750	1.250	5.000	3.413	.049	.772	.597	-.284	.156	-1.811	-.469	.310	-1.511	Yes
Agreeableness	244	3.250	1.750	5.000	3.956	.039	.609	.371	-.835	.156	-5.327	1.363	.310	4.389	No
Conscientiousness	244	3.500	1.500	5.000	3.670	.045	.700	.489	-.249	.156	-1.590	-.305	.310	-.982	Yes
Neuroticism	244	3.500	1.000	4.500	2.610	.042	.663	.440	.187	.156	1.194	-.269	.310	-.865	Yes
Openness	244	2.750	2.250	5.000	3.656	.039	.604	.365	.041	.156	.260	-.567	.310	-1.827	Yes
Ethical Climate	244	4.200	2.000	6.200	4.418	.060	.940	.884	-.408	.156	-.043	-.661	.310	-2.129	No
Ethical Behavior	244	5.333	1.667	7.000	4.212	.068	1.064	1.133	.224	.156	-2.599	-.125	.310	-.401	Yes
Sustainable Development Goals	244	5.833	1.167	7.000	5.272	.072	1.119	1.251	-1.106	.156	1.426	1.859	.310	5.988	No
Creative Self-Efficacy	244	5.250	1.750	7.000	4.748	.054	.845	.714	-.253	.156	-7.051	.464	.310	1.495	Yes
Innovative Working Behavior	244	5.000	2.000	7.000	4.760	.052	.811	.658	-.104	.156	-1.612	.903	.310	2.909	Yes
Ris_Original	244	4.333	2.167	6.500	4.477	.041	.645	.416	-.052	.156	-.665	1.075	.310	3.461	Yes

Table 50. Normality check based on statistical assessment (N=244)

		Kolmogorov-Smirnov a				Shapiro-Wilk			
		Statistic	df	Sig.	Normal?	Statistic	df	Sig.	Normal?
1.	Extraversion	.096	244	.000	No	.977	244	.001	No
2.	Agreeableness	.172	244	.000	No	.933	244	.000	No
3.	Conscientiousness	.080	244	.001	No	.977	244	.001	No
4.	Neuroticism	.086	244	.000	No	.983	244	.005	No
5.	Openness	.113	244	.000	No	.976	244	.000	No
6.	Ethical Climate	.102	244	.000	No	.970	244	.000	No
7.	Ethical Behavior	.078	244	.001	No	.990	244	.080	Yes
8.	Sustainable Development Goals	.125	244	.000	No	.928	244	.000	No
9.	Creative Self-Efficacy	.084	244	.000	No	.980	244	.001	No
10.	Innovative Working Behavior	.069	244	.007	No	.985	244	.010	No
11.	Ris_Original	.066	244	.013	No	.986	244	.016	No

Note. a Lilliefors Significance Correction

In this point, Table 49 and Table 50 provide different results. Table 49 gives the absolute value of z_{skewness} is ranged between $.043$ until 7.051 and the absolute value of $z_{kurtois}$ is ranged between $.043$ until 7.051. Using $p < .05$, the skewness and kurtois are significant if it has the absolute value of more than 1.96. In addition, K-S Test shows that $D(244)$ is ranged between $.000$ until $.013$, $p < .05$, while, S-W Test shows that $D(244)$ is ranged between $.401$ until 5.988, $p < .05$.

Since these results cannot give a conclusion if the sample is significantly normal, I will follow Field (2009, p. 139) that explains that "If you have a large sample (200 or more) it is more important to look at the shape of the distribution visually and to look at the value of the skewness and kurtosis statistics rather than calculate their significance". In addition, Field (2009, p. 139) also states that "Significance tests of skew and kurtosis should not be used in large samples (because they are likely to be significant even when skew and kurtosis are not too different from normal)."

The sample in this study consists of 244 datasets. Therefore, following the above suggestion from Field (2009), I will use the visual approach (histogram in Appendix) to assess the normality of the data. The histogram (see Appendix 9) shows that three variables are not considered normal: Agreeableness, Ethical Climate, and Sustainable Development Goals. However, it is important to note that with large sample sizes (> 30 or 40), the violation of normality should not cause major impact (Ghasemi & Zahediasl, 2012). Following Elliott and Woodward (2007, p. 26), it implies that I "can invoke central limit theorem (CLT) to justify using parametric procedures even when the data are not normally distributed." This idea denotes that the sample data is reasonably normal.

HOMOSCEDASTICITY

The data is considered homoscedastic if "the variance of the error terms (e) appears constant over a range of predictor variables" (Hair et al., 2014, p. 33). In order to assess homoscedasticity, I will divide the sample based on gender type: male and female. After that, I will apply the most common used homoscedastic approach: Levene test (M. B. Brown & Forsythe, 1974). The result is shown in Table 51. This table shows that the variances are not significantly different for the male and female. In this case, $F(1, 242)$ is ranged between .116 until .831, p ($< .05$).

Table 51. Test of homoscedasticity of variance

	Levene Statistic	df1	df2	Sig.
Extraversion	1.954	1	242	.163
Agreeableness	.102	1	242	.749
Conscientiousness	.524	1	242	.470
Neuroticism	1.821	1	242	.178
Openness	1.179	1	242	.279
Ethical Climate	2.489	1	242	.116
Ethical Behavior	.482	1	242	.488
Sustainable Development Goals	1.004	1	242	.317
Creative Self-Efficacy	.295	1	242	.587
Innovative Working Behavior	.529	1	242	.468
Ris_Original	.046	1	242	.831

LINEARITY

Like the other assumptions, linearity can be assessed either by using the graphical or statistical approaches (Hair et al., 2014). Because most of the data is considered normal (see previous discussion), the statistical approach will be based on the Pearson correlation matrix. In this case, Ris_Summative will be the dependent variable. For the graphical assessment, the Scatter Plot interpretation will be examined. The Pearson correlation and the Scatterplot interpretation is provided respectively in Table 52 and Appendix 10. Table 52 shows that some variables do not significantly have linear correlation with Ris_Model1 (see row 11 in Table 52), the similar result also appears in the Scatter Plot checking. The resume of the linearity assumption is shown in Table 53.

.

Table 52. Pearson Correlation to check linearity

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	Extraversion	-										
2.	Agreeableness	0.249**	-									
3.	Conscientiousness	-0.025	0.021	-								
4.	Neuroticism	-0.030	0.005	0.011	-							
5.	Openness	0.177**	0.136*	0.109	-0.056	-						
6.	Ethical Climate	-0.001	0.056	-0.075	-0.172**	0.004	-					
7.	Ethical Behavior	-0.031	-0.010	0.149*	-0.049	0.067	-0.061	-				
8.	Sustainable Development Goals	-0.042	0.105	-0.021	0.014	0.20**	-0.011	0.141*	-			
9.	Creative Self-Efficacy	0.204**	0.102	0.018	-0.123	0.472**	0.081	0.037	0.217**	-		
10.	Innovative Working Behavior	0.263**	0.221**	0.122	-0.132*	0.332**	0.063	-0.006	0.181**	0.613**	-	
11.	Ris_Original	0.099	0.249**	0.095	-0.129*	0.354**	0.094	0.096	0.279**	0.508**	0.656**	-

Note. * p < .05 level, ** p < .01 level, two-tailed

Table 53. Summary of linear correlations

Variables	Pearson Correlation	Scatter Plot
Extraversion	Not significantly correlate	Not correlate
Agreeableness	Significanlty correlate	Correlate
Conscientiousness	Not significantly correlate	Not correlate
Neuroticism	Significanlty correlate	Correlate
Openness	Significanlty correlate	Correlate
Ethical Climate	Not significantly correlate	Not correlate
Ethical Behavior	Not significantly correlate	Not correlate
Sustainable Development Goals	Significanlty correlate	Correlate
Creative Self-Efficacy	Significanlty correlate	Correlate
Innovative Working Behavior	Significanlty correlate	Correlate

Note. Dependent variable: Ris_Original

ABSENCE OF CORRELATED ERRORS

The last assumption that is needed to check is the absence of correlated errors (Hair et al., 2014). The absence of correlated errors will be assessed using the Durbin-Watson method (Durbin & Watson, 1951). This method explains whether the independence of error is acceptable (Field, 2009). In order to meet the absence of correlated errors assumption, the rule of thumb says that the Durbin-Watson value should be close to 2. As the data has the Durbin-Watson value – 1.876 (Table 54), therefore, I can say that the data almost certainly meets the assumption of error independence.

Table 54. Regression to check the Durbin-Watson value.

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.711[a]	.506	.483	5.56469	.506	21.619	11	232	.000	1.876

APPENDIX 12

EFA Preliminary Analysis

OVERALL MEASURES OF INTER-CORRELATION

The first statistical assumption is the inter-correlation between variables. As suggested by Field (2009), I need to, at first, check the variables that have low inter-correlation (less than .30). It is likely that the variables with low inter-correlation might not represent the underlying factors. As shown in Table 55, two variables have correlation values less than |.30|: Ris03_Reencoded and Ris11_Reencoeded.

Besides the small score of bivariate-correlation, it is also important to check the significance of this correlation. Table 55 displays that Ris03_Reencoded and Ris11_Reencoded respectively have three and eight insignificant correlations with the other Ris' variables. Following the suggestion from Hair et al. (2014, p. 127),

"Although no limits are placed on what is too high or low, variables that have no significant correlations may not be part of any factor, and if a variable has a large number of correlations, it may be part of several factors. We can note these patterns and see how they are reflected as the analysis proceeds."

Based on this assessment, Ris03_Reencoded and Ris11_Reencoded are subject to be suspicious variables.

Table 55. Descriptive statistics and correlation in Ris variables (N = 244)

		M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Ris01	4.71	.974	-											
2.	Ris02	4.55	1.039	.615**	-										
3.	Ris03_Reencoded	3.95	1.410	-.214**	-.344**	-									
4.	Ris04	4.20	1.157	.264**	.246**	-.007	-								
5.	Ris05	4.25	1.153	.405**	.274**	-.142*	.475**	-							
6.	Ris06	4.43	1.118	.430**	.426**	-.159*	.470**	.670**	-						
7.	Ris07	4.36	1.134	.357**	.307**	-.040	.371**	.378**	.485**	-					
8.	Ris08	4.54	1.238	.239**	.197**	.197**	.542**	.362**	.437**	.396**	-				
9.	Ris09	4.58	1.209	.344**	.267**	-.109	.293**	.343**	.442**	.232**	.357**	-			
10.	Ris10	4.62	1.076	.433**	.360**	-.123	.359**	.470**	.568**	.420**	.381**	.539**	-		
11.	Ris11_Reencoded	4.58	1.399	-.032	-.030	.411**	.103	-.074	.003	-.085	.249**	.086	.018	-	
12.	Ris12	4.95	1.089	.331**	.343**	-.050	.306**	.302**	.374**	.242**	.387**	.458**	.359**	.199**	-

Note. * p < .05 level, ** p < .01 level, two-tailed

THE BARTLETT TEST

The next assessment check is to test if "the correlation matrix has significant correlations among at least some of the variables" (Hair et al., 2014, p. 102). This assumption can be checked using the Bartlett Test of sphericity (Hair et al., 2014). Bartlett Test will indicates the nonzero correlation between variables. In other words, it tells if the null hypothesis is true: the R-matrix is an identity matrix. As shown in Table 56, the Bartlett's Test show has a significance value ($p < .05$). From this result, I can conclude that the R-matrix is significantly different from an identity matrix. In other words, it implies that the correlations between variables are, in general, significantly different from zero. Therefore, it is appropriate to use factor analysis.

Table 56. Test of Sphericity and Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.830
Bartlett's Test of Sphericity	Approx. Chi-Square	1036.477
	df	66
	Sig.	.000

THE MEASURE OF SAMPLING ADEQUACY (MSA)

Next, I need to check the factorability of the overall set of variables and individual variables with the measure of sampling adequacy (MSA) (Hair et al., 2014). MSA can be checked for multiple and individual variables. The former one can be assessed using the KMO Test (Kaiser, 1974). Kaiser (1974) suggests that the KMO = .90s is marvelous, the KMO = .80s is meritorious, the KMO = .70s is middling, the KMO = .60s is mediocre, the KMO = .50s is miserable, and the KMO < .50 is unacceptable. Following this suggestion, KMO value (Table 56) indicates a great value (.830). Therefore, I am confident to say that the sample size is enough apply factor analysis.

The MSA assessment for the individual variables can be checked using the anti-image matrices (Hair et al., 2014). In this case, it is important to check the diagonal element of anti-image correlation matrix (Field, 2009). Again, I will follow suggestion from (Kaiser, 1974) to use the "threshold" value of .50. The anti-image matrices in Table 57 shows that none of the diagonal matrix has value less than .50. It means that the individual variables are acceptable to be used in the factor analysis. However, it is important to note that Ris03_Reencoded and Ris11_Reencoded respectively have value .601 and .552. With these values, KMO's Ris03_Reencoded and Ris11_Reencoded are considered miserable.

Table 57. Anti-image matrices

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Ris01	-											
2.	Ris02	-.484	-										
3.	Ris03_Reencoded	-.010	.284	-									
4.	Ris04	.030	-.042	.039	-								
5.	Ris05	-.184	.153	.032	-.219	-							
6.	Ris06	.042	-.182	.056	-.066	-.460	-						
7.	Ris07	-.110	-.047	-.086	-.089	.016	-.193	-					
8.	Ris08	.016	-.010	-.226	-.348	-.017	-.090	-.177	-				
9.	Ris09	-.090	.072	.079	.000	.023	-.113	.095	-.103	-			
10.	Ris10	-.109	-.035	.170	-.006	-.087	-.182	-.152	-.056	-.333	-		
11.	Ris11_Reencoded	.009	-.063	-.380	-.530	.118	-.041	.183	-.130	-.026	-.005	-	
12.	Ris12	-.042	-.141	.038	-.021	-.046	-.021	-.016	-.144	-.266	-.004	-.167	-

MULTICOLLINEARITY CHECKING

The next assessment is the multicollinearity checking (Hair et al., 2014). There are two approaches to check multicollinearity. The first one is by scanning the correlation matrix and see whether any correlation value that is more than .80 (Field, 2009). The correlation matrix in Table 55 shows that none of the variables has the inter-correlation more than .80 therefore, I can say that Ris' variables is free from multicollinearity.

The second approach is the Haitovsky Test. This test assesses the determinant, degree of freedom, and the number of variables in the data. As shown in the Table 55, the determinant of the data is .013. Based on Haitovsky's (1969) Test:

$$\text{Haitovsky's } \chi^2_H = \left[1 + \frac{(2\times12+5)}{6} - 244\right]\ln(1 - .013)$$

$$\chi^2_H = 3.116468$$

Next, I need to calculate the degree of freedom:

$$df = p(p-1)/2$$

$$df = 12(12-1)/2$$

$$df = 66$$

Based on the degree of freedom, $df = 66$, the critical value of the Haitovsky's Test is ranged between 79.08 ($df = 60$) and 90.53 ($df = 70$). In both cases, the observed chi-square is much smaller than these values. Therefore, the determinant is not significantly different from zero. In other words, Ris' variables is not significantly the subject of multicollinearity.

APPENDIX 13

Factor Structure Derivation

COEFFICIENT COMPARABILITY IN STEP 2

Table 58. Coefficient comparability of Step 2

Random No.	Coefficient Comparability						Finding
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	
1	.997	.980	.972	.959	.913	.918	
2	.983	.979	.942	.920	.940	.947	
3	.976	.955	.895	.911	.968	.950	a
4	.987	.878	.968	.940	.955	.922	b
5	.985	.840	.819	.819	.963	.626	a, c, d, e, f
6	.982	.942	.883	.937	.841	.843	a, f, g, h
7	.962	.948	.907	.881	.715	.604	d, e, f, h
8	.992	.961	.976	.990	.939	.977	
9	.984	.936	.965	.975	.951	.884	f
10	.989	.937	.950	.896	.884	.819	d, e, f, h
11	.990	.963	.913	.865	.597	.979	e, i
12	.979	.961	.987	.911	.860	.957	h
13	.970	.947	.940	.970	.904	.881	f
14	.974	.943	.938	.962	.945	.875	f
15	.973	.381	.942	.898	.935	.738	b, c, f, j, k
16	.968	.922	.901	.950	.884	.868	f, h
17	.925	.960	.900	.925	.955	.920	
18	.965	.654	.965	.943	.687	.828	b, c, f, h
19	.956	.871	.901	.827	.966	.530	b, c, e, l
20	.986	.958	.776	.937	.893	.927	a, f
21	.989	.995	.969	.811	.919	.919	d, e
22	.986	.928	.96	.977	.942	.817	f
23	.988	.986	.979	.979	.940	.913	
24	.992	.900	.877	.844	.864	.900	a, e, h, k
25	.776	.886	.837	.839	.895	.683	a, e, f, h, j, k, m, n, o
26	.858	.811	.922	.943	.891	.883	c, f, h, j, m, p
27	.989	.923	.906	.959	.920	.846	f
28	.973	.891	.932	.870	.965	.857	c, d, f, j
29	.962	.915	.893	.921	.914	.907	a
30	.948	.969	.911	.870	.876	.908	e, h, k
31	.974	.914	.956	.968	.952	.777	f
32	.979	.928	.924	.935	.894	.937	h

33	.989	.938	.980	.972	.973	.899	f
34	.911	.942	.940	.927	.908	.830	f
35	.948	.952	.857	.729	.955	.926	a, e, k
36	.984	.891	.768	.662	.446	.697	a, e, i, j, k, o
37	.982	.993	.843	.871	.583	.939	a, d, e, i
38	.975	.932	.990	.995	.980	.887	f
39	.981	.948	.884	.926	.956	.869	a, f
40	.969	.947	.931	.863	.943	.859	d, e, f
41	.989	.682	.986	.870	.570	.758	c, d, e, f, h, i, j
42	.918	.933	.959	.916	.663	.917	h
43	.989	.969	.988	.918	.855	.957	h
44	.965	.974	.928	.937	.958	.943	
45	.909	.966	.940	.909	.951	.887	f
46	.993	.895	.969	.953	.932	.936	c, j
47	.891	.495	.946	.917	.935	.855	f, j, o, q
48	.972	.971	.978	.994	.899	.950	h
49	.976	.987	.951	.924	.929	.917	
50	.985	.963	.974	.969	.949	.983	

Index

Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris07
Factor 6: Ris12

a: There is loading from other factor(s) that goes to Factor 3
b: There is loading from other factor(s) that goes to Factor 2
c: Ris10 (Factor 2) crossloads to the other factor(s)
d: Ris08 (Factor 4) crossloads to the other factor(s)
e: Ris04 (Factor 4) and Ris08 (Factor 4) do not belong to the same factor
f: There is loading from other factor(s) that goes to Factor 6
g: Ris06 (Factor 3) crossloads to the other factor(s)
h: There is loading from other factor(s) that goes to Factor 5
i: Ris07 (Factor 5) crossloads to the other factor(s)
j: Ris09 (Factor 2) and Ris10 (Factor 2) do not belong to the same factor
k: Ris04 (Factor 4) crossloads to the other factor(s)
l: Ris12 (Factor 6) crossloads to the other factor(s)
m: Ris02 (Factor 1) crossloads to the other factor(s)
n: Ris01 (Factor 1) and Ris02 (Factor 1) do not belong to the same factor
o: Ris09 (Factor 2) crossloads to the other factor(s)
p: There is loading from other factor(s) that goes to Factor 1
q: Ris2 (Factor 1) crossloads to the other factor(s)

COMMUNALITY IN STEP 2

Table 59. Communality in Step 2

	Mean	Std. Dev.	Max	Min
Ris01	.822	.039	.948	.743
Ris02	.875	.030	.943	.807
Ris04	.867	.050	.995	.759
Ris05	.884	.035	.947	.748

Ris06	.804	.031	.890	.688
Ris07	.926	.043	.997	.732
Ris08	.835	.057	.957	.687
Ris09	.866	.043	.981	.775
Ris10	.803	.040	.900	.706
Ris12	.931	.051	.993	.740

COEFFICIENT COMPARABILITY IN STEP 3

Table 60. Coefficient comparability of Step 3

Random No.	Coefficient Comparability					Finding
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	
1	.998	.978	.961	.968	.945	
2	.981	.970	.938	.961	.904	
3	.943	.985	.955	.925	.901	
4	.976	.975	.987	.996	.889	a
5	.954	.971	.900	.950	.958	
6	.963	.970	.867	.895	.943	b, c, d
7	.992	.976	.970	.906	.886	a
8	.992	.986	.960	.938	.968	
9	.986	.985	.914	.950	.942	
10	.989	.979	.953	.949	.953	
11	.989	.967	.959	.982	.919	
12	.948	.781	.722	.652	.545	a, b, c, d, e, f
13	.973	.978	.941	.882	.846	c, d, g
14	.967	.960	.781	.957	.969	b, h
15	.979	.993	.976	.977	.842	a
16	.927	.980	.882	.959	.959	b
17	.992	.974	.938	.979	.914	
18	.994	.969	.904	.963	.916	
19	.970	.979	.983	.982	.913	
20	.970	.979	.983	.913	.982	
21	.975	.982	.957	.974	.939	
22	.954	.974	.952	.963	.963	
23	.354	.961	.988	.841	.899	a, d, i, j, k, l
24	.963	.883	.901	.948	.757	a, f, m
25	.980	.982	.961	.922	.915	
26	.985	.983	.960	.923	.908	
27	.953	.963	.990	.977	.984	
28	.985	.995	.986	.496	.914	d, l
29	.984	.956	.973	.905	.944	
30	.997	.971	.929	.954	.938	
31	.990	.865	.932	.883	.976	d, l, m

32	.973	.748	.964	.660	.895	a, d, l, n
33	.966	.988	.977	.976	.834	a
34	.993	.965	.891	.862	.890	a, c, h, l, o
35	.952	.957	.952	.955	.922	
36	.968	.961	.933	.963	.870	a
37	.969	.972	.903	.966	.897	a
38	.995	.989	.916	.960	.956	
39	.966	.979	.976	.980	.982	
40	.996	.994	.984	.990	.993	
41	.948	.688	.974	.765	.744	a, d, e, l, n
42	.952	.959	.983	.993	.956	
43	.986	.964	.875	.907	.940	b
44	.976	.984	.976	.935	.916	
45	.979	.900	.953	.940	.870	a
46	.987	.982	.980	.977	.965	
47	.974	.970	.821	.932	.906	b
48	.993	.937	.972	.965	.980	
49	.959	.980	.871	.813	.909	b, d, l
50	.989	.897	.981	.927	.750	e, f, g

Index

Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris07
a: There is loading from other factor(s) that goes to Factor 5
b: There is loading from other factor(s) that goes to Factor 3
c: Ris04 (Factor 4) crossloads to the other factor(s)
d: Ris04 (Factor 4) and Ris08 (Factor 4) do not belong to the same factor
e: Ris09 (Factor 2) crossloads to the other factor(s)
f: Ris09 (Factor 2) and Ris10 (Factor 2) do not belong to the same factor
g: Ris07 (Factor 5) crossloads to the other factor(s)
h: Ris05 (Factor 3) and Ris06 (Factor 3) do not belong to the same factor
i: Ris01 (Factor 1) crossloads to the other factor(s)
j: Ris02 (Factor 2) crossloads to the other factor(s)
k: Ris01 (Factor 1) and Ris02 (Factor 1) do not belong to the same factor
l: Ris08 (Factor 4) crossloads to the other factor(s)
m: Ris10 (Factor 2) crossloads to the other factor(s)
n: There is loading from other factor(s) that goes to Factor 2
o: Ris05 (Factor 3) crossloads to the other factor(s)

COMMUNALITY IN STEP 3

Table 61. Communality in Step 3

	Mean	Std. Dev.	Max	Min
Ris01	.801	.038	.880	.710
Ris02	.860	.030	.939	.790
Ris04	.841	.049	.961	.701
Ris05	.884	.028	.951	.816

Ris06	.789	.036	.873	.708
Ris07	.926	.039	.995	.812
Ris08	.827	.056	.975	.640
Ris09	.876	.037	.977	.772
Ris10	.769	.039	.863	.664

COEFFICIENT COMPARABILITY IN STEP 4

Table 62.Coefficient comparability of Step 4

	Coefficient Comparability					
Random No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Finding
1	.938	.989	.962	.975	.873	a
2	.986	.953	.970	.967	.945	
3	.967	.941	.912	.974	.847	a
4	.983	.963	.961	.968	.95	
5	.985	.843	.921	.917	.883	a, b
6	.984	.690	.563	.943	.855	a, b, c, d, e, f
7	.973	.974	.987	.984	.842	a
8	.985	.750	.953	.935	.792	a, b, d
9	.970	.975	.918	.981	.926	
10	.977	.980	.964	.990	.933	
11	.987	.896	.938	.797	.421	a, c, d, g, h
12	.975	.918	.920	.827	.573	g, h, i
13	.956	.988	.955	.957	.913	
14	.984	.991	.964	.991	.958	
15	.996	.965	.975	.987	.938	
16	.996	.986	.970	.980	.870	a
17	.969	.959	.873	.886	.921	g, h, j
18	.954	.989	.991	.987	.960	
19	.955	.972	.942	.940	.913	
20	.995	.996	.936	.941	.966	
21	.976	.690	.972	.945	.905	b, c
22	.889	.825	.913	.962	.439	a, c, d, k, l
23	.969	.985	.969	.914	.841	a
24	.907	.758	.984	.978	.802	a, c, d
25	.970	.957	.929	.974	.933	
26	.969	.559	.990	.950	.679	a, b, d
27	.973	.851	.974	.972	.147	c, i, m
28	.986	.922	.976	.973	.876	a
29	.986	.409	.925	.890	.866	a, b, d, g, h, n
30	.967	.725	.940	.967	.926	c

31	.992	.982	.978	.973	.897	a
32	.993	.878	.929	.994	.916	c
33	.996	.762	.962	.938	.849	a, c, m
34	.864	.562	.969	.980	.825	a, c, d, k, l, o
35	.981	.951	.982	.987	.885	a
36	.973	.747	.389	.900	.640	a, b, c, d, e, f, p
37	.964	.949	.900	.946	.838	a
38	.972	.800	.976	.993	.897	a, c, d
39	.966	.896	.906	.973	.953	c, d
40	.986	.970	.982	.987	.921	
41	.980	.953	.942	.934	.849	a
42	.970	.970	.960	.988	.914	
43	.972	.957	.918	.989	.927	
44	.985	.866	.913	.950	.864	a, b, d
45	.998	.967	.936	.962	.973	
46	.967	.941	.926	.883	.836	a, g, h
47	.987	.846	.928	.977	.941	c, d
48	.962	.934	.928	.916	.880	a
49	.987	.968	.992	.987	.955	
50	.996	.784	.974	.854	.920	h, m, n

Index

Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
Factor 5: Ris12

a: There is loading from other factor(s) that goes to Factor 5
b: Ris09 (Factor 2) crossloads to the other factor(s)
c: Ris10 (Factor 2) crossloads to the other factor(s)
d: Ris09 (Factor 2) and Ris10 (Factor 2) do not belong to the same factor
e: Ris05 (Factor 3) crossloads to the other factor(s)
f: Ris06 (Factor 3) crossloads to the other factor(s)
g: Ris04 (Factor 4) crossloads to the other factor(s)
h: Ris04 (Factor 4) and Ris08 (Factor 4) do not belong to the same factor
i: Ris12 (Factor 5) crossloads to the other factor(s)
j: There is loading from other factor(s) that goes to Factor 3
k: Ris02 (Factor 1) crossloads to the other factor(s)
l: Ris01 (Factor 1) and Ris02 (Factor 1) do not belong to the same factor
m: There is loading from other factor(s) that goes to Factor 2
n: Ris08 (Factor 4) crossloads to the other factor(s)
o: Ris01 (Factor 1) crossloads to the other factor(s)
p: Ris05 (Factor 3) and Ris06 (Factor 3) do not belong to the same factor

COMMUNALITY IN STEP 4

Table 63. Communality in Step 4

	Mean	Std. Dev.	Max	Min
Ris01	.804	.040	.942	.716
Ris02	.858	.028	.968	.799

Ris04	.819	.054	.976	.686
Ris05	.872	.041	.947	.774
Ris06	.796	.036	.895	.704
Ris08	.843	.049	.968	.710
Ris09	.839	.044	.978	.733
Ris10	.800	.057	.925	.647
Ris12	.927	.045	.990	.728

COEFFICIENT COMPARABILITY IN STEP 5

Table 64.Coefficient comparability of Step 5

Random No.	Coefficient Comparability				Finding
	Factor 1	Factor 2	Factor 3	Factor 4	
1	.981	.968	.952	.986	
2	.986	.988	.944	.978	
3	.993	.958	.960	.978	
4	.922	.979	.719	.902	a, b
5	.995	.992	.985	.979	
6	.993	.974	.951	.993	
7	.985	.968	.992	.970	
8	.982	.989	.969	.948	
9	.988	.987	.990	.989	
10	.996	.982	.931	.974	
11	.988	.970	.892	.959	
12	.993	.981	.974	.981	
13	.988	.965	.960	.973	
14	.984	.933	.984	.984	
15	.982	.909	.912	.973	
16	.986	.991	.972	.977	
17	.989	.988	.975	.979	
18	.974	.959	.929	.991	
19	.997	.963	.975	.996	
20	.983	.980	.925	.826	c, d
21	.967	.994	.919	.820	c, d
22	.989	.969	.977	.976	
23	.997	.985	.979	.972	
24	.977	.981	.972	.961	
25	.987	.981	.931	.957	
26	.974	.965	.965	.992	
27	.980	.963	.984	.989	
28	.982	.978	.958	.970	

29	.984	.984	.963	.958	
30	.980	.977	.946	.990	
31	.978	.966	.993	.995	
32	.979	.988	.990	.986	
33	.995	.973	.939	.989	
34	.996	.978	.931	.930	
35	.985	.982	.954	.994	
36	.984	.959	.960	.965	
37	.977	.987	.966	.987	
38	.983	.958	.923	.952	
39	.996	.988	.975	.983	
40	.985	.993	.976	.972	
41	.992	.950	.944	.987	
42	.989	.980	.985	.989	
43	.986	.971	.989	.992	
44	.995	.994	.971	.976	
45	.986	.963	.849	.895	c, d, e
46	.966	.968	.883	.850	c, d, f
47	.989	.962	.974	.990	
48	.986	.969	.967	.984	
49	.955	.890	.913	.987	g
50	.981	.890	.881	.960	f, h, i

Index
Factor 1: Ris01 and Ris02
Factor 2: Ris09 and Ris10
Factor 3: Ris05 and Ris06
Factor 4: Ris04 and Ris08
a: Ris05 (Factor 3) crossloads to other factor(s)
b: Ris05 (Factor 6) crossloads to other factor(s)
c: Ris04 (Factor 4) crossloads to the other factor(s)
d: Ris04 (Factor 4) and Ris08 (Factor 4) do not belong to the same factor
e: Ris06 (Factor 3) crossloads to the other factor(s)
f: There is loading from other factor(s) that goes to Factor 3
g: Ris10 (Factor 2) crossloads to the other factor(s)
h: Ris09 (Factor 2) crossloads to the other factor(s)
i: Ris09 (Factor 2) and Ris10 (Factor 2) do not belong to the same factor

COMMUNALITY IN STEP 5

Table 65. Communality in Step 5

	Mean	Std. Dev.	Max	Min
Ris01	.788	.030	.858	.703
Ris02	.852	.030	.955	.769
Ris04	.791	.046	.887	.626
Ris05	.869	.034	.941	.732
Ris06	.780	.040	.865	.663
Ris08	.834	.054	.959	.659
Ris09	.857	.040	.944	.734
Ris10	.735	.033	.818	.655

APPENDIX 14

Cronbach's Alpha Ris_Original

Table 66. Cronbach's Alpha of Ris

Overall Cronbach's Alpha = .790

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Ris01	I am good at coming up with ideas that are novel, but also right	49.02	52.127	.483	.771
Ris02	I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	49.18	52.919	.388	.779
Ris03_ Reencoded	The originality of an idea is of much more interest to me than the ethical side of that idea	49.78	59.177	-.060	.830
Ris04	I have a knack for coming up with many ethical solutions to a problem	49.53	49.542	.552	.763
Ris05	Producing large numbers of solutions for a better future comes natural to me	49.48	49.773	.539	.764
Ris06	I am good at generating many ideas that capture the responsible side of innovation	49.30	48.324	.662	.752
Ris07	When generating ideas, I find it easy to explore a wide range of politically correct alternatives	49.36	50.908	.474	.771
Ris08	It is important to me to explore the various ethical aspects of my ideas	49.19	47.662	.624	.754
Ris09	Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	49.15	49.723	.509	.767
Ris10	I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	49.11	49.610	.600	.759
Ris11_ Reencoded	I have no particular interest in evaluating the moral aspects of my new ideas	49.15	54.818	.149	.808
Ris12	I like to contribute to the implementation of new ideas when these are appropriate to solving a meaningful problem	48.78	50.623	.520	.767

APPENDIX 15

CFA Model Evaluation

PARAMETER ESTIMATES EVALUATION

Parameter estimates consists of three assessments: feasibility of parameter estimates, appropriateness of standard errors, and statistical significance of the parameter estimates (Barbara, 2001). Feasibility of parameter estimates refers to an assessment to check the input to the hypothesized model. Appropriateness of standard error indicates the extreme large or small standard errors. Excessive large standard error indicates that the parameter cannot be determined (Jöreskog & Sörbom, 1993), while standard error that is nearly zero implies that the parameter cannot be defined using statistical tests (Bentler & Wu, 2005). However, standard error does not have a definite principle regarding to the "low" or "large" level of standard error (Barbara, 2001; Fornell & Larcker, 1981).

Statistical significance of parameter estimates provides a value of critical ratio (CR). CR "represents the parameter estimate divided by its standard error" (Barbara, 2001, p. 68). In this case, CR operates like z-statistics. Thus, the null hypothesis says that the estimates is not statistically different from zero.

Table 67. Regression weights of Ris_Model1

			Estimate	SE	CR	P
Ris10	<---	Factor2	1.000			
Ris09	<---	Factor2	.883	.102	8.636	***
Ris06	<---	Factor3	1.000			
Ris05	<---	Factor3	.888	.075	11.779	***
Ris02	<---	Factor1	1.000			
Ris01	<---	Factor1	1.089	.133	8.164	***
Ris08	<---	Factor4	1.000			
Ris04	<---	Factor4	1.003	.127	7.906	***

Note. ***: probability < .000

Table 68. Covariances of Ris_Model1

			Estimate	SE	CR	P
Factor2	<-->	Factor3	.668	.088	7.634	***
Factor2	<-->	Factor1	.410	.071	5.737	***
Factor4	<-->	Factor2	.482	.087	5.552	***
Factor3	<-->	Factor1	.445	.078	5.723	***
Factor4	<-->	Factor3	.618	.094	6.574	***
Factor4	<-->	Factor1	.271	.067	4.049	***

Note. ***: probability < .000

Table 69. Variances of Ris_Model1

	Estimate	SE	CR	P
Factor2	.791	.123	6.423	***
Factor3	.969	.126	7.712	***
Factor1	.569	.105	5.422	***
Factor4	.771	.147	5.250	***
e10	.362	.080	4.522	***
e09	.839	.095	8.830	***
e06	.277	.065	4.242	***
e05	.560	.070	8.049	***
e02	.506	.076	6.682	***
e01	.269	.075	3.567	***
e08	.756	.109	6.965	***
e04	.557	.099	5.652	***

Note. ***: probability < .000

OVERALL MODEL EVALUATION

The overall model evaluation consists of three parts: model fit, construct validity, and model misspecification (Barbara, 2001; Hair et al., 2014; Schreiber et al., 2006; Schumacker & Lomax, 2004).

Model Fit

- Model Fit Summary

Model summary is assessed based on overall Chi-square value (χ^2), its degree of freedom, and probability value (Barbara, 2001; Hair et al., 2014; Schumacker & Lomax, 2004). In Structural Equation Modelling (SEM), χ^2 is used to test if the null hypothesis (the hypothesized model fits in the population) is true.

Table 70. Model fit summary of Ris_Model1

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	30	20.870	14	0.105	1.491
Saturated model	44	0.000	0		
Independence model	16	732.810	28	0.000	26.172

Scholars argue that there should be more approach to assess the model fit besides using the statistical significance (Cohen, 1995; F. L. Schmidt, 1996; J. E. H. F. L. Schmidt et al., 1997; Thompson, 1995). In particular, χ^2 is affected by the sample size: $\chi^2 = (n-1)F_{ML}$, in which F_{ML} indicates the maximum likelihood (ML) fit function (Schumacker & Lomax, 2004). In this case, the low sample size (generally less than 100) is likely to decrease the significant probability level, while the large sample (generally more than 200) tends to increase significant probability level.

Related to this, other indices were also applied to assess the model fit.

- Root Mean Square Residual (RMR)

RMR is "the square root of the mean-squared differences between matrix elements in S and Σ."(Schumacker & Lomax, 2004, p. 87); S: sample data, Σ: hypothesized model. However, RMR is difficult to interpret because it is relative to the sizes of variance and covariance matrix. The alternative approach is then developed: standardized RMR. It is "the average value across all standardized residuals" (Barbara, 2001, p. 77).

Table 71. Standardized residual covariance

	Ris04	Ris08	Ris01	Ris02	Ris05	Ris06	Ris09	Ris10
Ris04	.000							
Ris08	.000	.000						
Ris01	.009	-.092	.000					
Ris02	.295	-.220	.000	.000				
Ris05	.876	-.338	.286	-.850	.000			
Ris06	-.152	-.152	-.241	.602	.000	.000		
Ris09	-.209	1.063	.115	-.335	-.510	.056	.000	
Ris10	-.460	.257	.080	-.110	-.150	.135	.000	.000

Table 72. Factor loadings of Ris_Model1

Factor1	--->	Ris02	.728
Factor1	--->	Ris01	.846
Factor2	--->	Ris10	.829
Factor2	--->	Ris09	.651
Factor3	--->	Ris06	.882
Factor3	--->	Ris05	.760
Factor4	--->	Ris08	.711
Factor4	--->	Ris04	.763

- Incremental (Baseline, Relative, or Comparison) Fit Indices: NFI, RFI, IFI, TLI, CFI

Incremental fit indices are "a group of indices that do not use the chi-square in its raw form but compare the chisquare value to a baseline model." (Hooper, Coughlan, & Mullen, 2008, p. 55). The null model is the most typically used for baseline model (Bentler & Bonett, 1980). The null model implies that all variables are uncorrelated (McDonald & Ho, 2002). In this case, incremental fit indices compare the hypothesized model with the null model. If the hypothesized model is perfectly different with the null model, it has the incremental fit indices value of 1. In contrast, if the hypothesized model perfectly the same with the null model, it indicates poor fit the value of 0.

Incremental fit indices consists of several measures. L.-t. Hu and Bentler (1998) divide the incremental fit indices into three types. The first one is the normed indices (Meade, Johnson, & Braddy, 2008) . It consists of Normed Fit Index (NFI) (Bentler & Bonett, 1980) and the Relative Fit Indices (RFI) (Bollen, 1986). Study from (Mulaik et al., 1989) and (Bentler, 1990) suggest that NFI is less sensitive appropriate to use when the sample size is larger than 200. L.-t. Hu and Bentler (1998) find that NFI is closely related with the RFI. Following this view, I will use NFI and to assess the fitness of the model.

The second type of incremental fit indices consists of Incremental Index of Fit (IFI) (Bollen, 1989) and Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973). These indices are considered non-normed because they are not restricted to have value between 0 and 1 (Bentler & Bonett, 1980; L.-t. Hu & Bentler, 1998). IFI is suggested to use as it addresses the parsimony and sample size issues (Barbara, 2001; Marsh, Balla, & McDonald, 1988). TLI is also called Non-Normed Fit Index (NNFI) (Hooper et al., 2008). McDonald and Ho (2002) state that TLI is frequently used by researcher and especially is recommend if the factor loading is higher than .50 (Sharma, Mukherjee, Kumar, & Dillon, 2005). As shown in Table 72, all of factor loadings in the Ris_Model1 (Figure 3) are more than .50. Related to this, I will use IFI and TLI to measure the model fit.

The third type of incremental fit indices is the Comparative Fit Indices (CFI) (Bentler, 1990). CFI is among the fit indices that are "the least sensitive to sample size" (Fan, Thompson, & Wang, 1999, p. 73). Related to this, CFI is "one of the most popularly reported fit indices" (Hooper et al., 2008, p. 55). Regarding to this, I will use CFI to assess the fitness of the model.

Table 73. Baseline comparison of Ris_Model1

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.943	.990	.981	.990	.990
Saturated model		1.000		1.000	1.000
Independence model	.000	.000	.000	.000	.000

- Model Parsimony: PRATIO, PNFI, PCFI

The other parameter of model fit is the model parsimony (Barbara, 2001; Hair et al., 2014). Schumacker and Lomax (2004, p. 89) define parsimony as "the number of estimated parameters required to achieve a specific level of model fit". Parsimony is used because "simplicity is not gauged by the number of parameter in the equation but by the paucity of parameters that must be estimated or, inversely, by the number of degrees of freedom by which the equation may be tested" (Mulaik et al., 1989, p. 439). In this case, parsimony represents the goodness of model because more parameters (degree of freedom) are freed up (L. J. Williams & Holahan, 1994).

Table 74. Parsimony values of Ris_Model1

Model	PRATIO	PNFI	PCFI
Default model	.500	.486	.495
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

Another parameter regarding to the model parsimony is the Akaike's Information Criterion (AIC) (Akaike, 1987). It is used to measure the parsimony in the model fit. A study from L. J. Williams and Holahan (1994) finds that AIC performs the best among the other parsimony indices. Related to the AIC is the Brown Cudeck's AIC (Browne & Cudeck, 1989).

Table 75. AIC of Ris_Model1

Model	AIC	BCC
Default model	80.870	83.178
Saturated model	88.000	91.385
Independence model	764.810	766.041

- Population Discrepancy: Non-centrality Parameter Estimates (NCP), Minimum Discrepancy Function (FMIN), Root Mean Square Error of Approximation (RMSEA), Hoelter's Critical N

As mentioned before, CFA works based on SEM. SEM approaches is complicated because it has to deal with the statistical power and sample size. In other words, "The power to reject a null hypothesis and sample size impacts the decision of whether sample data fit a theoretical model (Schumacker & Lomax, 2004, p. 94)." In SEM, besides certain assumptions that have to be met, the model is said to comply with the population if the sample (N) is large and the sample statistical values are distributed in a central χ^2 with sufficient degrees freedom (df). A central χ^2 has a Non-Centrality Parameter (NCP) value of 0 (Bentler, 1990). Based on this view, NCP measures the population discrepancy: "the model misfit in the population"(Widaman & Thompson, 2003, p. 22). In other words, good model has a small NCP value, while the bad model has a large NCP value (Steiger, 1990).

Table 76. NCP of Ris_Model1

Model	NCP	LO 90	HI 90
Default model	6.870	.000	23.254
Saturated model	.000	.000	.000
Independence model	704.81	620.278	796.754

Another measure to assess the population discrepancy is the minimum discrepancy function (F_{MIN}) (Schumacker & Lomax, 2004)

Table 77. FMIN of Ris_Model1

Model	FMIN	F0	LO 90	HI 90
Default model	.086	.028	.000	.096
Saturated model	.000	. 000	.000	.000
Independence model	3.016	2.900	2.553	3.279

Another measure to assess the population discrepancy is the Root Means Square Error of Approximation (RMSEA) (Steiger, 1990; Steiger & Fouladi, 1997). MacCallum and Austin (2000) suggest to use RMSEA because it is sufficiently sensitive to model misspecification, gives appropriate conclusion of the model quality, and allows the confidence interval calculation.

Table 78. RMSEA of Ris_Model1

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.045	.000	.083	.541
Independence model	.322	.302	.342	.000

Another measure of model fit is the Hoelter's Critical N (CN) (Hoelter, 1983). Unlike previous measures, CN is used to assess the sample size. In other words, it is used to measure "the sample size necessary for statistical acceptance of a given model" (Hoelter, 1983, p. 339).

Table 79. Critical N (CN) of Ris_Model1

Model	HOELTER	
	.05	.01
Default model	276	340
Independence model	14	17

- Model Validation: Expected Cross-Validation Index (ECVI)

Another parameter to check the model fit is the Expected Cross-Validated Index (ECVI). It is used to assess if the model can cross-validate to other similar sample size from the same population (Browne & Cudeck, 1989). ECVI does not have a determined acceptable range. Thus, in order to assess the model fit, it is suggested to compare the value of hypothesized model with its saturated and independence model.

Table 80. ECVI of Ris_Model1

Model	ECVI	LO 90	HI 90	MECVI
Default model	.333	.305	.400	.342
Saturated model	.362	.362	.362	.376
Independence model	3.147	2.799	3.526	3.152

Construct Validity

- Convergent Validity: Factor Loadings, Average Variance Extracted, Reliability

Table 81. Factor loadings of Ris_Model1

Responsible Idea Generation	--->	Ris02	.728
Responsible Idea Generation	--->	Ris01	.846
Responsible Idea Realization	--->	Ris10	.829
Responsible Idea Realization	--->	Ris09	.651
Responsible Fluency	--->	Ris06	.882
Responsible Fluency	--->	Ris05	.760
Responsible Flexibility	--->	Ris08	.711
Responsible Flexibility	--->	Ris04	.763

Table 82. Cronbach's Alpha in overall Ris_Model1

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I am good at coming up with ideas that are novel, but also right	31.18	31.265	.549	.825
I find it easy to generate original solutions that reflect how the problem at hand ought to be solved	31.33	31.647	.468	.834
I have a knack for coming up with many ethical solutions to a problem	31.68	29.921	.548	.825
Producing large numbers of solutions for a better future comes natural to me	31.64	29.145	.620	.816
I am good at generating many ideas that capture the responsible side of innovation	31.45	28.298	.726	.802
It is important to me to explore the various ethical aspects of my ideas	31.35	29.693	.516	.830
Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	31.30	29.809	.524	.829
I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements	31.26	29.478	.647	.813

Table 83. Cronbach's Alpha of every Ris_Model1 factors in full sample

		Cronbach's Alpha	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Responsible Idea Generation	I am good at coming up with ideas that are novel, but also right	.761	4.55	1.079	.615	-
	I find it easy to generate original solutions that reflect how the problem at hand ought to be solved		4.71	.948	.615	
Responsible Idea Realization	Transforming new ideas into useful applications (such as new products, services or business models that make the world a better place) means a lot to me	.698	4.62	1.158	.539	-
	I am good at introducing responsible solutions to a meaningful problem into new organizational arrangements		4.58	1.462	.539	
Responsible Fluency	Producing large numbers of solutions for a better future comes natural to me	.802	4.43	1.251	.670	-
	I am good at generating many ideas that capture the responsible side of innovation		4.25	1.330	.670	
Responsible Flexibility	I have a knack for coming up with many ethical solutions to a problem	.702	4.54	1.534	.542	-
	It is important to me to explore the various ethical aspects of my ideas		4.20	1.338	.542	

Table 84. Convergent validity of Ris_Model1

	Responsible Idea Generation	Responsible Idea Realization	Responsible Fluency	Responsible Flexibility
Factor Loadings				
Ris01	.846			
Ris02	.728			
Ris09		.651		
Ris10		.829		
Ris05			.760	
Ris06			.882	
Ris04				.763
Ris08				.711
AVE	.787	.740	.821	.737
Construct Reliability	.761	.698	.802	.702

- Discriminant Validity

Hair et al. (2014, p. 619) define discriminant validity "as the extent to which a construct is truly distinct from other constructs." In order to measure discriminant validity, I will follow the suggestion from him: comparing the AVE estimates for every construct (factor) with its squared inter-construct correlations. For a construct, the discriminant validity holds if the inter-construct square correlation in that construct is less than its AVE.

Table 85. Inter-construct correlation, square inter-construct correlation, and AVE of the Ris_Model1

	1.	2	3.	4.
1. Responsible Idea Generation	1.000	.372	.360	.167
2. Responsible Idea Realization	.610	1.000	.582	.382
3. Responsible Fluency	.600	.763	1.000	.511
4. Responsible Flexibility	.408	.618	.715	1.000
AVE	.787	0.740	.821	.737

Note: Values below the diagonal are correlation estimates among constructs, diagonal elements are construct variances, and values above the diagonal are squared correlations.

Model Misspecification

- Standardized Residuals

The standardized residuals is shown in Table 86. Following suggestion from Hair, the good model has a standardized residual more than |2.5|.

Table 86. Standardized residuals of Ris_Model1

	Ris04	Ris08	Ris01	Ris02	Ris05	Ris06	Ris09	Ris10
Ris04	.000							
Ris08	.000	.000						
Ris01	.009	-.092	.000					
Ris02	.295	-.220	.000	.000				
Ris05	.876	-.338	.286	-.850	.000			
Ris06	-.152	-.152	-.241	.602	.000	.000		
Ris09	-.209	1.063	.115	-.335	-.510	.056	.000	
Ris10	-.460	.257	.080	-.110	-.150	.135	.000	.000

- Modification Indices

Modification indices (MI) describes "The extent to which the hypothesized model is appropriately described"(Barbara, 2001, p. 86). MI can be conceptualized as a χ^2 statistics with one degree of freedom $(d.f.)$. In this case, Jöreskog and Sörbom (1993, p. 26) explain that M.I. is related with the "estimate or prediction of the decrease chi-square that will be obtained if that particular path is introduced in the model". Although M.I. can be represented by the decrease χ^2, Saris, Satorra, and Sörbom (1987) explain that the actual differences between MI and the decrease χ^2 can be large. Therefore, they suggest to use an Expected Parameter Change (EPC). Regarding to this, I will use both the MI and EPC to evaluate the model. This view is following D. Kaplan (1991, p. 311) who suggests for "the combination of the MI and EPC for engaging in model evaluation and modification".

Table 87. Covariance MI and EPC of Ris_Model1

			MI	EPC
e05	<-->	e04	4.815	.106
e05	<-->	e02	6.284	-.107
e06	<-->	e02	5.970	.091

APPENDIX 16

Questionnaires

MINI IPIP QUESTIONNAIRE

Mini IPIP scale uses a 5-likert scale:

1 = Very inaccurate, 2 = Somewhat inaccurate, 3 = Neither inaccurate nore accurate, 4 = Somewhat accurate, 5 = Very accurate

Table 88.Mini IPIP questionnaire

Big Five	Variables	Questions
Extraversion	Ipip01	Am the life of the party
Altruism	Ipip02	Sympatize with others' feelings
Conscientiousness	Ipip03	Get chores done right away
Neuroticism	Ipip04	Have frequent mood swings
Openness	Ipip05	Have a vivid imagination
Extraversion	Ipip06*	Don't talk a lot
Altruism	Ipip07*	Am not interested in other people's problems
Conscientiousness	Ipip08*	Often forget to put things back in their proper place
Neuroticism	Ipip09*	Am relaxed most of the time
Openness	Ipip10*	Am not interested in abstract ideas
Extraversion	Ipip11	Talk to a lot of different people at parties
Altruism	Ipip12	Feel others' emotions

Note. *Reencoded

ETHICAL CLIMATE QUESTIONNAIRE

Ethical Climate is measured using a 7-Likert scale (1 = strongly agree, . . . , 7 = strongly disagree) and consists of 15 questions as shown in Table 89.

Table 89. Ethical Climate questionnaire

Variables	Questions
EthCl01*	Employees comply with the company's ethical instruction when contacting customers
EthCl02*	The most efficient manner for finishing work is 'to do the right thing'
EthCl03*	Employees take care of each other in the company
EthCl04*	Employees strictly obey the company's policies
EthCl05*	The major concern is always to do what is best for the other person
EthCl06*	Successful employees in this company go by the book
EthCl07*	Employees can decide for themselves what is right and wrong

EthCl08*	Employees are expected to follow their own personal and moral beliefs
EthCl09*	Employees are guided by their own independence
EthCl10*	Employees' opinions are valued
EthCl11*	Employees are expected to strictly follow legal or professional standards
EthCl12*	Employees are expected to comply with the law and professional standards over and above other considerations
EthCl13*	The law or ethical code of their profession is the major consideration
EthCl14*	The most important concern is the good of all the people as a whole
EthCl15*	What is best for everyone is the major consideration here

Note. *Reencode

ETHICAL BEHAVIOR

Ethical Behavior is measured using a set of questions (Table 90) based on a 7-Likert scale (1 = strongly agree, . . . , 7 = strongly disagree) and applies six questions as shown in Table 90.

Table 90. Ethical Behavior scale

Variables	Questions
Eb01	In my job I sometimes compromise my beliefs to do my job the best way the company wants me to do it
Eb02	Sometimes I report only part of the truth to my boss
Eb03	Sometimes I have to alter things (documents, time cards, etc.) in order to please the company
Eb04	Sometimes I have to break company policy to do what's necessary
Eb05	Sometimes I say one thing even though I know I must do something else
Eb06	Sometimes I claim to have done something when I have not

SUSTAINABLE DEVELOPMENT GOALS

Sdg uses a 7-Likert scale (1 = opposed to my values, . . . , 7 = of supreme importance) and applies six questions as shown in Table 91.

Table 91. Sustainable Development Goals questionnaire

Variables	Questions
Sdg01	Thriving lives and livelihoods
Sdg02	Sustainable food security
Sdg03	Sustainable water security
Sdg04	Universal clean energy
Sdg05	Healthy and productive ecosystems
Sdg06	Governance for sustainable societies

CREATIVE SELF-EFFICACY

Creative Self-Efficacy is measured using a set of questions uses a 7-Likert scale (1 = very strongly disagree, . . . , 7 = very strongly agree) and applies 4 questions as shown in Table 92.

Table 92. Creative Self-Efficacy questionnaire

Variables	Questions
CreaSelf01	I feel I am good at generating novel ideas
CreaSelf02	I have confidence in my ability to solve problems creatively
CreaSelf03	I have a knack for further developing the ideas of others
CreaSelf04	I am good at finding creative ways to solve problems

INNOVATIVE WORK BEHAVIOR

Innovative Work Behavior uses a 7-Likert sacle (1 = never, . . . , 7 = always) and apply nine question as shown in Table 93.

Table 93. Innovative Work and Behavior questionnaire

Variables	Questions
InWBeh01	Creates new ideas for difficult issues
InWBeh02	Searches out new working methods, techniques, or instruments
InWBeh03	Generates original solutions for problems
InWBeh04	Mobilizes support for innovative ideas
InWBeh05	Acquires approval for innovative ideas
InWBeh06	Makes important organizational members enthusiastic for innovative ideas
InWBeh07	Transforms innovative ideas into useful applications
InWBeh08	Introduces innovative ideas into the work environment in a systematic way
InWBeh09	Evaluates the utility of innovative ideas

APPENDIX 17

MRA Assessment

RIS_MODEL1 VS. IPIP SCALES

Assessing Model Fits

- Outliers Checking

In order to answer if the regression model is an accurate representation of the data, Field (2009) suggest to look at the outliers and the influential cases. Field (2009) explains that the outlier can be assessed by looking at cases in which the model inaccurately predicts. The difference between the value that the model predicts and the value of the observed data is called as residuals. In the good model, it is expected that 95% of the cases to have standardized residuals within |2| (Field, 2009). Result in Table 94 shows that there are three cases that have standardized residual value of more than |2.58|. However, they only represent 1.230% (less than 5.00%) of the overall sample. Therefore, I can say that the regression model conform to what expected as a fairly accurate model.

Table 94. Outliers checking of Ris_Model1 vs. IPIP Scale

Case Number	Standardized Residual
47	-2.956
211	-3.729
235	-2.781

- Influential Case Checking

The regression model fit can also be assessed by looking at particular cases that have excessive influence over the parameters of the model (Field, 2009). This influential case indicates if the regression model is stable across the sample or if it is merely influenced by certain cases. The result in Table 95 and Table 96 show that there is only one case that does not meet the recommended value. Therefore, I can safely assume that the regression model is fit based on influential case checking.

Table 95. Standardized DFBETA a of Ris_Model1 vs. IPIP Scale

Standardized DFBETA Intercept	Standardized DFBETA Extraversion	Standardized DFBETA Agreeableness	Standardized DFBETA Conscientiousness	Standardized DFBETA Neuroticism	Standardized DFBETA Openness	Standardized DFFIT
(none)	(none)	(none)	(none)	(none)	(none)	(none)

Note. Counted if the absolute value > 1

Table 96. Covratio a, Cook's Distanc b, Mahalanobis Distance c, Centered Leverage Value d of Ris_Model1 vs. IPIP Scale

COVRATIO[a]	Cook's Distance[b]	Mahalanobis Distance[c]	Centered Leverage Value[d]
Case 211: .724	(none)	(none)	(none)

Note:
a: counted if the value is more than the upper threshold = 1+3*(5+1)/244 = 1.221; or if the value is lower than the lower threshold lower value = 1-3*(5+1)/244 = .779 (Stevens, 2012)
b: counted if the absolute value > 1
c. counted if the value > 25
d: counted if the value > .074 -> 3*(5+1)/244 (Stevens, 2012)

Assessing Assumptions

- Z Residual vs. Z Prediction Plot

At the final stage, I will assess if the regression model fits the certain assumptions. At first, I should assess the Scatter Plot between the z-score of the predicted value and the z-score of the regression residual (Figure 18). That figure shows that the points are randomly and evenly dispersed throughout the plot. Thus, I can say that the regression model meets the linearity and homoscedasticity assumptions (Field, 2009; Hair et al., 2014).

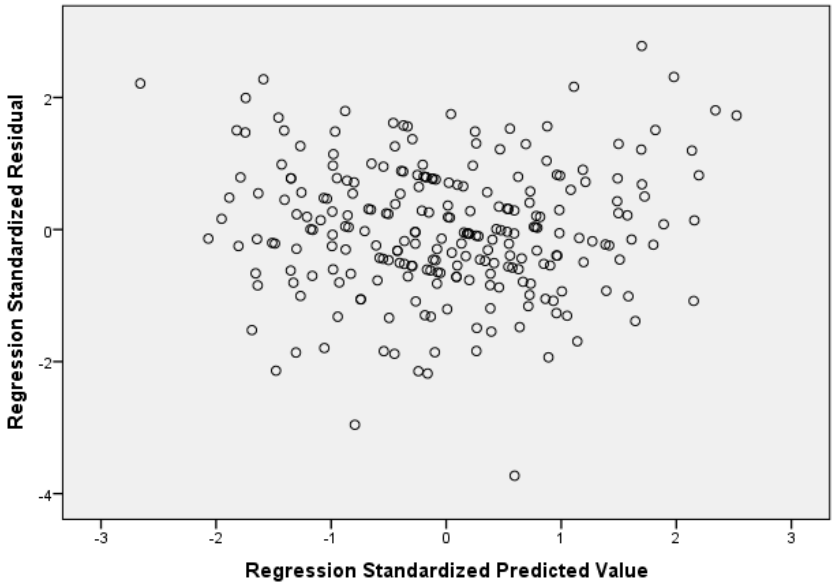


Figure 18. Z Ris_Model1_Model1 vs. IPIP Scale: Residual vs. Z Prediction Plot

- Histogram and P-P Plot of Z residual

Next, I need to assess the normality of the residual. Such assessment requires us to check the histogram and P-P Plot of the residual. Figure 19 and Figure 20 show that the regression model meets the normality assumption (Field, 2009; Hair et al., 2014).

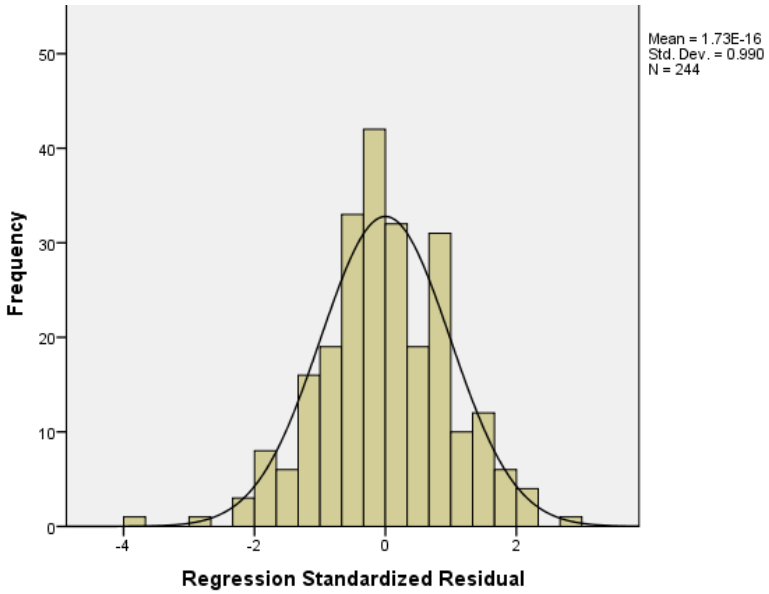


Figure 19. Histogram Z residual of dependent variable of Ris_Model1 vs. IPIP Scale

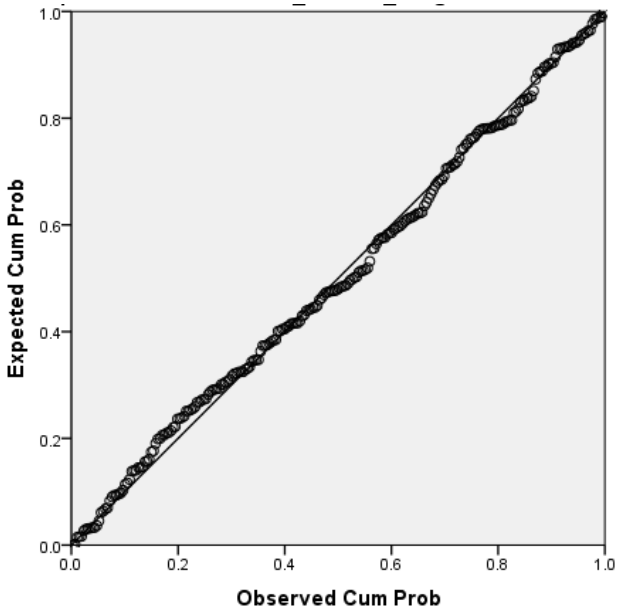


Figure 20. P-P Plot Z residual of dependent variable Ris_Model1 vs. IPIP Scale

RIS_MODEL1 VS. NON IPIP SCALES

Assessing Model Fits

- Outliers Checking

In order to answer if the regression model is an accurate representation of the data, Field (2009) suggest to look at the outliers and the influential cases. Field (2009) explains that the outlier can be assessed by looking at cases in which the model inaccurately predicts. The difference between the value that the model predicts

and the value of the observed data is called as residuals. In the good model, it is expected that 95% of the cases to have standardized residuals within |2| (Field, 2009). Result in Table 99 shows that there are six cases that have standardized residual value of more than |2.58|. However, they only represent 2.460% (less than 5.00%) of the overall sample. Therefore, I can say that the regression model conform to what expected as a fairly accurate model.

Table 97. Outliers checking Ris_Model1 vs. Non IPIP Scales

Case Number	Standardized Residual
19	2.616
30	-2.961
75	-2.730
203	-2.618
211	-6.234
216	-4.054

- Influential Case Checking

The regression model fit can also be assessed by looking at particular cases that have excessive influence over the parameters of the model (Field, 2009). This influential case indicates if the regression model is stable across the sample or if it is merely influenced by certain cases. The result in Table 98 and Table 99 show that there is only very small of variables that have do not meet the recommended value. Therefore, I can safely assume that the regression model is fit based on influential case checking.

Table 98. Standardized DFBETA a of Ris_Model1 vs. Non IPIP scales

Standardized DFBETA Intercept	Standardized DFBETA Extraversion	Standardized DFBETA Agreeableness	Standardized DFBETA Conscientiousness	Standardized DFBETA Neuroticism	Standardized DFBETA Openness	Standardized DFFIT
(none)	(none)	(none)	(none)	(none)	(none)	(none)

Note. Counted if the absolute value > 1

Table 99. Covratio a, Cook's Distanc b, Mahalanobis Distance c, Centered Leverage Value d of Ris_Model1 vs. Non IPIP Scales

COVRATIO[a]	Cook's Distance[b]	Mahalanobis Distance[c]	Centered Leverage Value[d]
Case 211: .350	(none)	(none)	Case 180: .083
Case 216: .682			Case 193: .918
			Case 199: .876
			Case 209: .923

Note:
a: counted if the value is more than the upper threshold = 1+3*(5+1)/244 = 1.221; or if the value is lower than the lower threshold lower value = 1-3*(5+1)/244 = .779. (Stevens, 2012)
b: counted if the absolute value > 1
c. counted if the value > 25
d: counted if the value > .074 -> 3*(5+1)/244 (Stevens, 2012)

Assessing Assumptions

- Z Residual vs. Z Prediction Plot

At the final stage, I will assess if the regression model fits the certain assumptions. At first, I should assess the Scatter Plot between the z-score of the predicted value and the z-score of the regression residual (Figure 21). That figure shows that the points are randomly and evenly dispersed throughout the plot. Thus, I can say that the regression model meets the linearity and homoscedasticity assumptions (Field, 2009; Hair et al., 2014).

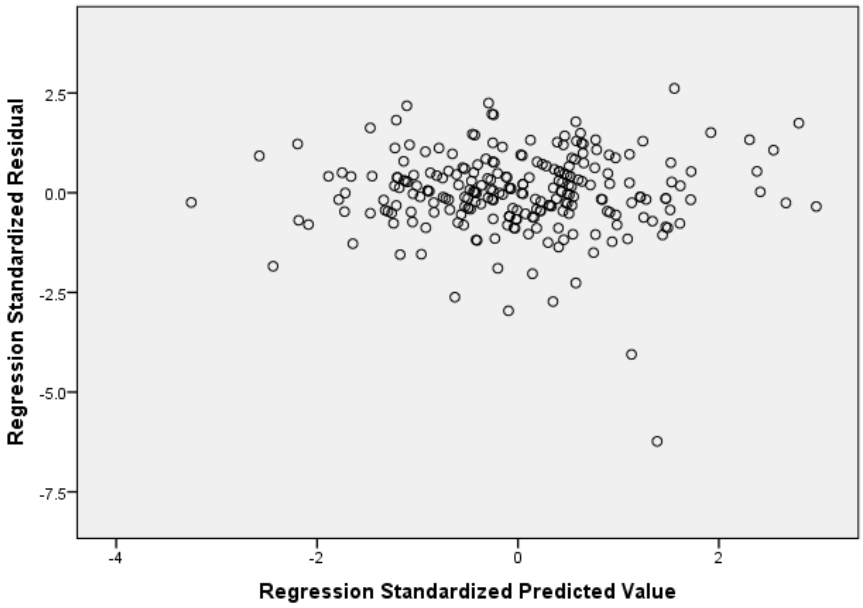


Figure 21. Z Residual vs. Z Prediction Plot of Ris_Model1 vs. Non IPIP Scales

- Histogram and P-P Plot of Z residual

Next, I need to assess the normality of the residual. Such assessment requires us to check the histogram and P-P Plot of the residual. Figure 22 and Figure 23 show that the regression model meets the normality assumption (Field, 2009; Hair et al., 2014).

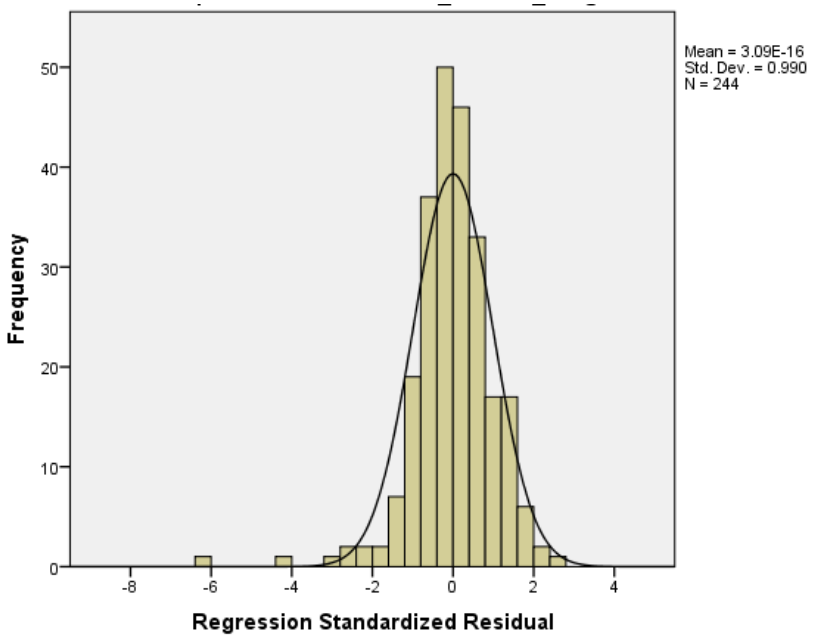


Figure 22. Histogram Z residual of dependent variable of Ris_Model1 vs. Non IPIP Scales

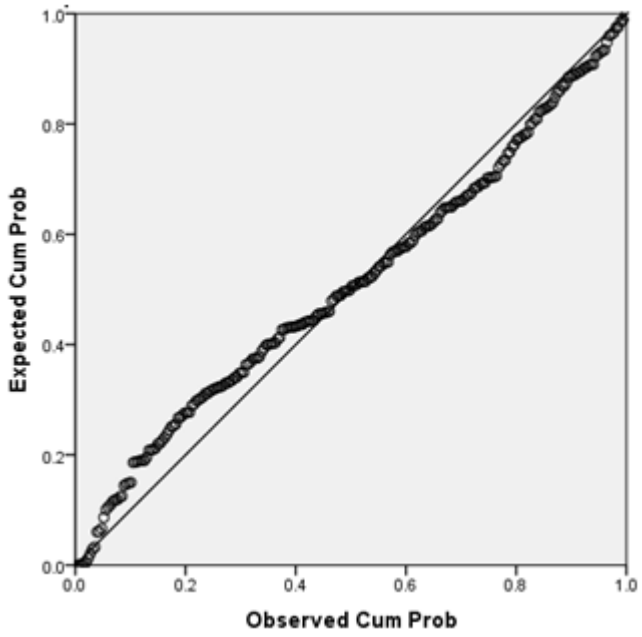


Figure 23. P-P Plot Z residual of dependent variable of Ris_Model1 vs. Non IPIP Scales