

# **The slack-radical innovation relationship: A configurational analysis of KIS SMEs**

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## **Résumé :**

The slack-innovation relationship is complex. Indeed, diverse conflicting relationships have been established by previous findings. This ambiguity and non-congruity from previous findings are due to various inconsistencies.

Indeed, it is firstly due to the lack of distinction between the different innovation types. Innovation is a complex multidimensional concept and needs to be decoupled into a more particular innovation context. Secondly, this inconsistency also stems from the variety of firms studied. Innovative firms are too heterogeneous to coherently establish a relationship among all firms. Thus, the need to identify a homogeneous population, a framework, thanks to which we can more clearly and precisely analyze the relationship. Lastly, the relationship is not necessarily symmetrical or linear. Yet most authors that have studied the relationship used a linear methodology. We must take into consideration not only the collective impact of multiple types of slack on firm innovation but also analyze the relationship between slack and a specific type of innovation in relation to other determining conditions.

We propose, through a configurational analysis and more precisely a Crisp set Qualitative Comparative analysis, to study the slack-radical innovation relationship in Knowledge Intensive Services (KIS) SMEs in a context of conditions relevant to the radical innovation (cooperation, external source of knowledge, market competition intensity, state support) as to integrate the elements of contingency and obtain a clearer and more precise overview of the relationship between slack-radical innovation. We use data extracted from the French Community Innovation Survey (CIS), as well as the FARE and FICUS (accounting) databases using a sample of 1 118 KIS SMEs.

## 1. Introduction

Innovation is a crucial factor in creating competitive advantages and has been studied from different angles, one of them examining the slack innovation relationship. The strategic management literature, and more precisely the Behavioral Theory of the Firm (BTF), introduced the slack-innovation relationship; Slack defining a “cushion of actual or potential resources that allows an organization to adapt successfully to internal pressures for adjustments to external pressures for policy change, and to initiate changes in strategy concerning the external environment” (Bourgeois, 1981: 30). Literature establishes diverse complex relationships regarding slack and innovation (Nohria and Gulati, 1996; Cyert and March, 1963; Simon, 1957). Such relationships are ambiguous, and not congruent because of the lack of distinction between the different types of innovation in previous studies. Our goal in this paper is to study the slack innovation relationship more precisely and deeply in order to obtain a clearer and more precise overview of the relationship regarding a specific type of innovation in specific types of firms.

Indeed, innovation is a complex multidimensional concept (Bigliardi, Colacino, and Dormio, 2011). Yet, most authors studying the slack innovation relationship have mobilized innovation as a sole concept. Authors such as Suzuki (2018) have now started to take into consideration innovation as a complex multidimensional concept by emphasizing the need for distinction between different types of innovation. Indeed, the type of innovation and its degree (ranging from incremental to radical) could affect very different aspects of the firm’s business (Otero-Neira, Lindman, Scozzi, 2008; Bigliardi et al., 2011). The relationship between slack and incremental innovation or radical innovation must not be the same depending on the kind of innovation sought. Hence, the need to focus on a particular type of innovation instead.

The management of the incremental innovation process is much more understood than the radical innovation process (McDerMott and O’Connor, 2002). Uncertainty, risks, and potentially higher rewards are commonplace in a radical context (Gobble, 2016; Lauren and Salter, 2006). Firms targeting radical innovation face various challenges regarding their development; hence, the probability of a radical innovation failing becomes significantly greater (Cooper, 2011; Sandberg and Aarikka-Stenroos, 2014) than for incremental innovation. Indeed, firms are forced to deal with a number of challenges, obstacles, and impediments throughout the radical innovation process. The importance of radical innovation is widely acknowledged and many firms regard radical innovations as essential to their subsistence as they lay the groundwork for future products or services (McDerMott and O’Connor, 2002). Indeed, managers and academics must understand how to successfully innovate radically, hence enclosing our scope of research to radical innovation.

Moreover, the ambiguity of the relationship also stems from the variety of the firms studied. Innovative firms are highly heterogeneous in their innovation processes, characteristics, outcome, and kind (whether the innovation is radical or incremental) (Miles, 2008; Uppenberg and Strauss, 2010). Nevertheless, studies regarding slack in relation to innovation have attempted to explain innovation using all types of firms. Finding relationships regarding innovation that do hold across all organizations is hardly possible. Indeed, to develop a better

understanding of firms (and in our case of the slack innovation relationship within firms) we need to identify a distinct, internally consistent set of firms (Ketchen, Thomas, and Snow, 1993), not all firms follow the same innovation process and hence innovate the same way. As a result, we focus our research on a more homogeneous population where innovation is less studied but not less present. Indeed, innovation responds to a more similar process in a more homogeneous population; Utilizing such a population will allow us to obtain clearer, more homogeneous relationships leading to radical innovation. Moreover, innovation is not frequent in all sectors; Thus, it is more interesting to focus on sectors where innovation is crucial for sustaining a competitive advantage.

Academics have been interested in SMEs' innovation activities (Motwani, Dandridge, Jiang, and Soderquist, 1999; Oliver, Dewberry, and Dostaler, 2000; Oke, Burke, and Myers, 2007). Meanwhile, studies on SMEs are few in comparison to similar studies on large firms (Cagliano and Spina, 2002; De Toni and Nassimbeni, 2003; Mosey, 2005; Oke, Burke, and Myers, 2007). Previous research has found that SMEs, by nature, are more able to undertake radical innovation than large corporations and that introducing innovation and pioneering products is an important activity for their survival (Kanter, 1985; Simon, Elango, Houghton, and Savelli, 2002; Oke, Burke, and Myers, 2007). Hence our decision to focalize on SMEs. Furthermore, as Knowledge Intensive firms are lead innovation producers. (Hertog, 2000; Miles, 2008; Uppenberg and Strauss, 2010; Torugsa, Arundel, and Robertson, 2018) we bound our research to KIS SMEs. The high rate of overall innovation in KIS and the tendency to innovate radically in SMEs allows us to obtain a homogeneous population that is suitable for our search. KIS firms offer various essential services which are crucial intermediate inputs in their clients' production or product processes. Different from manufacturing firms by the type of product they supply, they allow clients to adjust to current economic and structural changes (Windrum, and Tomlinson, 1999). Knowledge intensiveness refers to how knowledge is produced and delivered with high intellectual value added. KIS are services that involve activities that are intended to result in the creation, accumulation, or dissemination of knowledge (Miles et al., 1995). Indeed, KIS firms produce highly intangible knowledge and are often identified as innovative.

By focusing on a particular type of innovation (radical innovation) and a particular type of firm (KIS SMEs), we wish to provide a framework for studying the slack innovation relationship in greater depth. But even within this restricted framework, the conditions that can impact, alone or collectively, the slack innovation relationship remain numerous. Indeed, while the relationship should be simplified and elucidated in greater depth as a result of the emphasis on SME KIS and radical innovation, It does not exhaust the relationship's complexity in particular because of the many contingency elements but also of the asymmetric nature of the relationship. The slack innovation relationship is complex and more intricate than previously suggested. Multiple elements of contingency are to be taken into account.

The relationship is not necessarily symmetrical or linear as we can conclude from all the arguments presented. Most authors have considered slack as a systematic determinant of innovation rather than as a condition, more or less crucial in a specific causal environment for a particular category of innovation in specific types of firms. Too many paths lead to innovation. Trying to find a unique solution to such a complex issue is ineffectual. Indeed, a linear structure seems not the best fit, given the diversity of situations and possible interactions. If we wish to deepen and have a clearer and more accurate understanding of the relationship in this specific bounded context, we need a more precise, more granular analysis of the relationship. We must take into consideration not only the collective impact of multiple types of slack on firm innovation (as Marlin and Geiger(2015) did), but also, and most importantly, analyze the

relationship between slack and a specific type of innovation (radical innovation in this study) in relation to other determining conditions of the slack-radical innovation relationship in a specific context. We propose to integrate the different bundles of slack into a determining context of relevant conditions that contribute to a specific type of innovation, radical innovation. Indeed, It is possible to identify, in addition to slack, conditions of radical innovation. Therefore, this first contribution to the theme remains exploratory in nature.

Indeed, through exploratory analysis, we draw from current knowledge of radical innovation, to bring out relevant conditions that could, in relation to slack, increase the propensity to innovate radically in KIS SMEs. Indeed, we use slack (its three components (available, recoverable, and potential)), cooperation, external source of information, market intensity competition, and state support as the relevant conditions. Using a sample of 1 118 french KIS SMEs to test this model we implement a configurational analysis, a Crisp set Qualitative Comparative Analysis (CsQCA) focusing on radical innovation. The literature regarding the impact of these specific conditions on KIS SMEs firms using a configurational analysis has not yet been studied.

Furthermore, although literature finds a positive correlation between each of these conditions and radical innovation, all joint conditions may not be correlated with radical innovation. In light of this contradiction, we cannot predict a priori how these various conditions will collectively affect the process of obtaining radical innovation in KIS SMEs firms.

In the following sections, we will first present the behavioral perspective regarding the slack-innovation relationship as well as an entrepreneurial perspective. This first section will allow us to define the concepts and show how complex and ambiguous the relationship between slack and innovation is. We then describe more in detail how the conditions previously mentioned are related to radical innovation We present the method, the data, and the results and lastly we discuss and present the limits of this paper.

## **2. Literature Review**

### *Section 2.1.. What is slack?*

As suggested previously, slack is resources in excess of what is required for the operationalization of an organization; It is a pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output (Nohria and Gulatti, 1996).

The slack concept can be broken down into three components: available, recoverable, and potential slack, its components. The different components are classified depending on how absorbed, available, and re-deployable the slack is for the firm.

Available slack is defined as an internal flexible, highly re-deployable resource. Characterized as highly discretionary, it is non-absorbed by the firm's activities and immediately available for various uses (Sideshmukh, Voss, and Voss 2008). It is defined as "resources that are currently uncommitted and that can be re-deployed easily within the organization" (Sharfman et al., 1988; Tan and Peng, 2003). This component reflects to which extent the firm detains resources that are unused and readily available (Geiger and Cashen, 2002).

Recoverable slack is a surplus of resources invested in exploitation operations. Less rapidly available, excess costs or inventories integrated within the firm could be reduced and recovered during advert times (Bourgeois and Singh, 1983). These resources are absorbed into the firm in the form of expenses greater than those needed by the firm (Geiger and Cashen, 2002). This component reflects how much embedded and integrated resources into the firm could be recovered in difficult financial times (Bourgeois and Singh, 1983).

Lastly, potential slack relies solely on external resources within the firm's environment. It relies on "the capacity of the organization to generate extra resources from the environment" (Bourgeois and Singh, 1983). It represents the firm's ability to secure resources using debt financing (Geiger and Cashen, 2002).

### *Section 2.2. The behavioral theory perspective on the slack innovation relationship*

As mentioned previously, in the literature, the concept of slack entertains diverse relationships with innovation. We describe these relationships in the following section.

On the one hand, the BTF argues that slack is beneficial for the firm as it can be utilized as a buffer in case of funds scarcity. Such slack encourages creative behaviors and increases the innovative potential of firms (Bourgeois, 1981; Cyert and March, 1963). As slack increases, the organization can afford to experiment (Hambrick and Snow, 1977; Bourgeois, 1981). Cyert and March (1963) have relied on the concept of slack to explain why successful firms introduce innovations. Slack acts as a source of funding for innovation and allows projects that would be otherwise rejected (in case of funds scarcity) to be approved and accepted - the firm worries less about the risk of failure or the uncertainty related to experimental projects. Indeed, one of the strategic functions of organizational slack is to provide resources for creative and innovative experimentation (Bourgeois, 1981: 35).

On the other hand, it is argued that slack also has an indirect negative impact on innovation. Slack increases relaxation - as all projects become possible to carry out (become feasible), projects are less scrutinized, and less attention is brought to alternative scanning. Successful projects (projects that do lead to innovations), in this case, could be outnumbered by unsuccessful projects (projects that do not lead to innovations) (Simon, 1957; Nohria and Gulati, 1996). The negative impact of slack described also ensues from agents' incentives within the firm. Indeed, from an agency theory perspective (Jensen and Meckling, 1976), slack is an object of conflict between principals and agents (Nohria and Gulati, 1996; Geiger and Cashen, 2002). When slack is present, agents can use information asymmetry to their advantage (Williamson, 1964); Such agents do not always have the incentive to behave in the firm's best interest (Geiger and Cashen, 2002). Principals do not have perfect information at all times to monitor agents. Thus, managers could presumably use slack resources to maximize their wealth and follow their interests (Jensen, 1986) instead of investing slack resources in innovation (Geiger and Cashen, 2002).

Finally, it is also argued that the relationship is instead curvilinear (Nohria and Gulati, 1996). Slack could be a blessing or a curse depending on the slack's level within the firm. Hence, slack should be present at a relatively moderate level to impact innovation positively, as, at certain thresholds (too much or too low), slack could hurt and negatively impact innovation.

### *Section 2.2. An entrepreneurial perspective: When less is more?*

Another perspective, external to the behavioral literature, mentions instances where teams innovate by "making do with what is available" (e.g., Baker and Nelson, 2005; Garud and Karnoe, 2003; Hoegl, Gibbert, and Mazursky, 2008). The entrepreneurial perspective uses a

different standpoint of the concept of slack, focusing more generally on the impact of resources on the behavior of managers and executives. It contends that, on a managerial level, slack, and more precisely, available slack, is not an advantage for the firm. Studying the impact of resources on entrepreneurial management, they consider that resources may influence how entrepreneurial members of the firm behave and take decisions. Indeed, being entrepreneurial is described as being: innovative, flexible, dynamic, a risk-taker, and creative; Terms that describe innovation-oriented organizations.

Because of their current resource position, firms with excess capacity have limited incentives to experiment (Sinclair, Keppler, and Cohen, 2000). Substantial access to resources makes managers more complacent, inward-looking, and risk-averse as they protect what they already have as to keep their current positions (Stevenson, 1983; Stevenson and Gumpert, 1985; Stevenson and Jarillo, 1990; Bradley, Wiklund and Sheperd, 2011). Consequently, as they try to keep such a position they usually don't orient themselves toward new opportunities that generate stronger uncertainty (Derick and Cool, 1989).

Firms with low financial slack, under a certain target level, become more risk tolerant as they attempt to meet their own aspiration, their own goals (Bowman, 1982). Indeed, in their quest to meet prior aspiration levels, with the potential to improve their current position, managers will become less concerned with downside risk and more open to novel approaches. These firms are forced to work with limited resources; Hence, adopting a more entrepreneurial strategy by acting on opportunities through the recombination of their existing resources, and through the search for external opportunities (Mosakowski, 2002). Such firms tend to support experimentation and creative processes (Lumpkin and Dess, 1996). Their process differs from firms with excess resources. Instead of developing new ideas to match the current resources available to use with excess resources, firms with no slack search for opportunities and later on ask themselves what resources they will need. Slack under this lens is not a requirement nor a criterion that should be part of the decision process. This perspective promotes innovative market-oriented entrepreneurs rather than resource-oriented administrators obsessed with keeping their current position (Stevenson and Gumpert, 1985).

In the face of this perspective, slack is related to non-innovation. In fact, it pushes managers to become resource-oriented, giving them incentives to keep their current position, and deterring them from innovating.

### **3. Cooperation, External information source, Market competition intensity, and State support: relevant conditions of radical innovation**

From a theoretical standpoint, we can note that the relationship is not necessarily unique. It is a complex relationship because many elements from the theory appear as contingency elements, further complexifying the relationship.

Drawing on theories regarding radical innovation, we mobilize seven conditions that could influence the propensity of a KIS firm to introduce radical innovation. We constrain the number of attributes to seven to limit the complexity of the QCA model and the difficulty of interpreting

configurations (Misangyi et al., 2017), the seven attributes including the three components of slack (available (TRE), recoverable(RDA), and potential (TDE)), the firm's cooperation (has the firm cooperated with other actors) (CO), the source of information (did the firm get external information)(SPH), the reception of state support(FuN) and Competition intensity(CR4).

### ***Cooperation (CO) and external source of information (SPH)***

Innovation often results from the recombination of knowledge (Kogut and Zander, 1992; Leponen and Helfat, 2009). A larger number of complementary knowledge resources could improve the probability of successful innovation. A greater breadth of knowledge sources is associated with greater innovation success (Leponen and Helfat, 2009).

Because of their limited resources, SMEs do not have access to all of the resources required for innovation. Hence to address this issue they establish relationships with other companies and exchange resources with partners (Poorkavoos et al., 2016).

Radical innovation means introducing an innovation that is "new to the market". It is not only new for the firm (i.e., more likely incremental) but also 'new to the market (i.e., radical). Radical innovation will likely require more significant inputs and involve greater market uncertainty. Firms engaged in higher levels of innovation are more likely to have cooperative arrangements for innovation (Fritsch and Lukas, 2001). Indeed, Tether (2002) found that firms interested in radical innovation are more likely to form collaborative relationships than other firms. Innovation occurs over time and is influenced by a variety of factors. Because of this complexity, businesses almost never innovate in isolation, but rather collaborate with other organizations to acquire, develop, and exchange various types of knowledge, information, and other resources (Edquist, and Zabala-Iturriagagoitia, 2012). Thus, utilizing cooperation (CO) and external source of information (SPH) as relevant conditions of radical innovation.

### ***State support (FuN)***

As mentioned previously, the process of radical innovation is inherently uncertain. Indeed, firms and investors are unable to predict not only the probability of outcomes but also the form that the possible outcomes will take (Knight, 1921). The unpredictable, unforeseeable, and uncertain nature of innovation makes evaluating the potential of innovative projects difficult for financiers, especially if the innovation is radical. Indeed, developing radical innovation entails seeking new knowledge, new products, and new markets. Exploratory innovations are radical innovations that are designed to meet the needs of customers and markets (Benner and Tushman, 2003: 243; Danneels, 2002) by developing new designs, markets, and distribution channels. (Abernathy and Clark, 1985)

Public support for innovation is portrayed as a mechanism aimed at correcting such market imperfections and stimulating innovation. In a radical context, market imperfections are magnified, emphasizing the importance of state intervention.

Indeed, according to Mazzucato (2018), the state's role extends beyond correcting market failures. Investing in risky but potentially profitable activity and incurring high costs of uncertain research increases the attractiveness of innovations that would not have come to market without sunk costs covered by public funds. Indeed, It means that the state identifies winners—new industry branches—by de-risking some fields of scientific interest (Pohulak-Zoledowska, and Zabinski, 2014) . The role of the state extends beyond innovation support.

Accessing external funding becomes even more difficult in a more radical context. Indeed, firms targeting radical innovation experience adverse shocks related to the availability and to the cost of external financing. State support, hence, in such a context, becomes essential.

#### ***Market competition intensity (CR4)***

Market competition has an ambiguous impact on innovation. Early studies suggested that increased competition leads to lower levels of innovation (Hamberg, 1964; Mansfield, 1968). However, the opposite has been later supported (Hashmi, 2013; Romer, 1990). Furthermore, Aghion et al., (2005) also affirmed that the relationship is a U-inverted shape.

Previous research indicates that a variety of environmental factors influence the innovation process (Kuznets, 1962; Utterback, 1994). It is possible that such conflicting empirical results may be caused by other contingencies factors. Just as slack there is a need for more precision regarding the kind of innovation and the scope of firms studied. Based on these previous findings, we find it important to integrate market competition intensity in our studies. It does influence the innovation outcome hence appearing as an explanatory condition of innovation. As a result, we include such a condition in our model (CR4).

## **4. Methodology: Crisp set Qualitative Comparative Analysis**

Qualitative comparative analysis is a research strategy that emphasizes a dialogue of ideas and evidence while analyzing data and looking for explicit connections. These relationships are asymmetrical. Indeed, conditions "found to be causally related in one configuration may be unrelated or even inversely related in another" (Meyer, Allen, and Smith, 1993, p1178). Such a method evaluates subset relations in terms of necessity or sufficiency and allows us to verify the equifinality of the various paths, as various scenarios may lead (or not) to radical innovation.

QCA seeks to determine the root causes of outcomes. Indeed, causal complexity is central to configurational theory (Misangyi et al., 2018). Allowing for not only asymmetry but also conjunctural causation (the theory that an outcome rarely has a single cause but rather results from the interdependence of multiple conditions) and equifinality (a scenario in which alternative factors can produce the same outcome) (Schneider and Wagemann, 2012).

These three aspects of causal complexity are not present in traditional correlation-based approaches. Indeed, through a correlational-based approach, the attributes are examined in isolation or in terms of net additive effects. A method like this employs unifinality, with the search leading to a single best solution and mobilizes linear causal symmetry (Fiss, 2007; Misangyi et al., 2018).

The majority of authors have used a linear methodology, failing to test and identify how various conditions interact to produce an outcome. This exploratory study employs configurational theory and crisp-set QCA, a tool capable of capturing causal complexity (Fiss, 2007; Torugsa, 2017), to identify various combinations of conditions associated with the production of radical innovation in KIS SMEs. The method enables us to identify the various possible paths to radical innovation in KIS SMEs.



Crisp set QCA uses Boolean algebra to identify all possible combinations that reflect an outcome's sufficient or necessary conditions (Fiss,2007; Ragin,2000). The method combines qualitative reasoning (analyzing data in terms of cases rather than variables) and quantitative testing (the expression is reduced to the shortest causal term) (Ragin, 2000).

After identifying causal conditions related to radical innovation. We calibrate the conditions by determining a threshold above which the condition will be considered present. We perform separate analyses for necessity and sufficiency. We construct the truth table, then minimize the relevant configurations that do lead to radical innovation to obtain the parsimonious solution.. Three possible solutions are available for QCA. However, according to Baumgartner, only the parsimonious solution should be used to make causal inferences as any conditions can appear causally relevant in the presence of limited diversity in the cases being studied (Baumgartner, 2015). Finally, we interpret and describe the obtained configuration.

## 5. Data

To translate the conditions into a configurational analysis, we have used the 2016 French Community Innovation Survey (CIS). We merged this survey with FARE and FICUS databases (accounting databases) to measure the different components of slack and the market competition intensity (CR4). The sample from the CIS provided us with a large case number (1 118 SMEs from the KIS sectors), resulting in a more robust test (Greckhamer et al., 2013; Thomann and Magetti, 2017). The CIS sample is drawn from a sampling frame constructed from the Sirius directory according to a simple random sample design stratified by activity, size range, and region where possible. We then selected SMEs from the KIS sectors resulting in our final sample of 1 118 firms.

Table 1 provides the questionnaire definition of all variables utilized in this study. All conditions have been made dichotomous, taking the value of either 1 (the condition is present) or 0 (the condition is absent). Table 2 presents the mean and standard deviation of these conditions.

## 6. Results

After conducting a necessity and then a sufficiency analysis we can deduce that none of the conditions are necessary nor sufficient on their own; highlighting the need for combinations of conditions, INUS conditions, to result in radical innovation.

Indeed, A condition is necessary if the outcome is never present without the condition. Hence, conditions with a consistency above 0.9 (Schneider and Wagemann, 2012). None of the seven conditions is necessary for radical innovation (the consistency levels are 0.346 for TRE, 0.408 for RDA, 0.327 for TDE, 0.668 for CR4, 0.700 for SPH, 0.670 for FuN, 0.436 for CO).

A condition is sufficient if, “whenever it is present across cases, the outcome is also present”. (Schneider and Wagemann, 2012). The conditions are neither necessary nor sufficient; they are INUS conditions: “insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result” (Mahoney, 2008; Schneider and Wagemann, 2012))

We find that the market competition intensity (CR4) does not matter in radical innovation for KIS SMEs. Although present in the complex solution, the condition does not appear relevant in the parsimonious solution. We have left the condition in table 3 to show that has been integrated into the model tested even if it does not appear as relevant in the parsimonious solution after minimization.

The minimization process reveals seven configurations of conditions at the origin of radical innovation in KIS SMEs. All configurations have a consistency level above 0.70 (70% of cases of each solution is a subset of the outcome), and the combined solution coverage accounts for 64% of cases reporting a radical innovation in KIS SMEs. (cf Table 3, The black points reflect the presence of a condition, and a square shows the absence of a condition in the configuration. Blank cells signify that the condition is irrelevant; it does not matter for the outcome in the specific configuration.)

The solution coverage is 0.64 which indicates that the solution explains a quite large proportion of radical innovation (Ragin, 2008). In terms of raw coverage, the higher the raw coverage, the larger the proportion of the radical innovation the configuration explains.

### *6.1. Configurations*

Configuration 1 shows that state support and Cooperation can lead to radical innovation. This suggests a key role of state support and cooperation for radical innovation.

Configuration 2 (which has the highest raw coverage) suggest that state support and external source of innovation can also lead to radical innovation whether the other conditions are present or absent.

Configuration 3 shows that State support and having potential slack can lead to innovation if there is no recoverable slack. If the firm receives support from the state and has a low debt ratio, hence has the capacity to find external funds it should fully utilize its assets in order to achieve radical innovation.

Configuration 4 suggests that to innovate radically a firm that do not have any external information source should have potential slack and cooperate.

Configuration 5 suggests that if there is available slack and no potential slack the firm must cooperate and utilize an external information source in order to radically innovate. In the absence of potential slack, available slack in relation to cooperation and information source replace the role established previously.

Configuration 6 shows that state support, cooperation, available slack, and recoverable slack can lead to radical innovation

Configuration 7 shows that available slack, potential slack, and state support can also lead to radical innovation.

### *6.2. Interpretation*

From configurations 1 and 2 (which cover the larger proportion of radical innovation), we can deduce that what is truly important in KIS SMEs is state support in association with cooperation

(configuration 1), or external sources of information(configuration 2). Indeed, through state support, the firm is able to overcome market imperfections but also to receive guidance that makes slack irrelevant. The combination of state support with cooperation or external information source in a firm allows the firm to innovate radically may the firm have excess resources or not. The firm is able to innovate radically from the knowledge acquired through these means.

Available slack becomes a relevant INUS condition only

- Firstly, if the firm does not have potential slack, went for an external source of information and is cooperating (Configuration 5)
- Secondly, if there is recoverable slack meaning that the firm is not effectively and efficiently using its assets, hence assets are under-exploited and could recover cash, has support from the state and cooperates. (Configuration 6)
- Finally, if there is potential slack meaning that the firm could still borrow and state support. (Configuration 7)

In all configurations where available slack is beneficial for radical innovation, there is a need for the presence or the absence of another type of slack as well as an external point of view; Whether it is through state support or cooperation and external information source. While cash is available to finance radical innovation in these three configurations it is not sufficient. It is most certainly due to the negative effect mentioned by Simon (1957). As slack increases relaxation - as all projects become possible to carry out (become feasible), projects are less scrutinized, and less attention is brought to alternative scanning. Successful projects (projects that do lead to innovations), in this case, could be outnumbered by unsuccessful projects (projects that do not lead to innovations) (Simon, 1957; Nohria and Gulati, 1996).

However, the external viewpoint whether it is from the bank in configuration 5, the state and cooperation configuration 6, or the state support configuration 7 increases the scanning process and validates a radical innovation project, suppressing or reducing the bias introduced by too much slack, especially in the case of such a discretionary slack. It seems that slack becomes beneficial if there is an external point of view that reduces the potential for wasting resources on unsuccessful projects.

## **7. Discussion and Limits**

This research is the first to analyze the slack-radical innovation relationship in KIS SMEs in association with cooperation, external source of information, market competition intensity and state support. Based on diverse theoretical considerations, a number of conditions are identified as determinants of radical innovation in KIS SMEs. The CSQCA approach enables us to understand what combinations of these determinants lead to radical innovation.

While, the present analysis represents the first step, from this first effort, limitations appear and point to possible new extensions for further research.

Indeed, from our findings, we cannot determine if the state chooses the right projects or if the state provides financial and cognitive support that allows the firm to innovate successfully.

In fact, The state could have the ability to assess and recognize successful projects, choosing projects that are inherently successful. Alternatively, they could also lead the firm towards completing the project and achieving radical innovation due to their guidance.

Either way, the state sends a signal by choosing a firm. The firm, if chosen by the state, is more likely to achieve radical innovation in the case of KIS SMEs. While the current results lean towards the second argument, a study could be devoted to uncovering more precisely the role of state support in innovation. We can clearly identify that state support is a crucial condition for innovation in KIS. It could be interesting, to articulate future research around public support as a form of creative slack. The condition "public support" seems to be a non-sufficient condition on its own but a crucial part of practically all INUS configurations leading to radical innovation in Knowledge-intensive services (KIS) SMEs. The results also show that the other types of slacks are in some configurations relevant conditions but more often are negative or irrelevant. Public innovation supports are resources that are not needed by the firm for its operationalization meaning it is very close to the concept of slack. Now the issue resides in finding what makes public innovation support a more important condition than other types of slacks and a positive condition in nearly all INUS conditions leading to radical innovation.

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**Table 1: Variable definition**

Variable name	Definition
<b>Outcome:</b>	
Radical Innovation [MKT]	1 if the firm introduced a product or service new for the market (not=0)
<b>Conditions</b>	
Available slack [TRE]	1 if the firm has a net cash position above its own sector net cash position mean ; 0 if not  <i>Net Cash Position = (Cash and cash equivalents (disponibilités)+Marketable securities(Valeurs mobilières de Placement)-Bank overdraft (Concours Bancaire Courant))</i>
Recoverable Slack [RDA]	1 if the firm has an asset turnover below its own sector mean asset turnover; 0 if not  <i>Asset Turnover = (Sales Revenue / Total assets)</i>
Potential slack [TDE]	0 if the firm's debt ratio is above its own sector mean debt ratio; 1 if not  <i>Debt ratio=Long term financial liabilities/ equity</i>
Market competition intensity [CR4]	A low value of the index represents a larger competition level while a high value (close to 100) represents oligopoly. If CR4 <40, the industry is considered competitive.  1 if the firm sector has a CR4 below 40 ; 0 if not  <i>CR4= The four-firm concentration ratio =S1+S2+S3+S4</i> <i>S the nth largest market share</i>
Information Source [SPH]	1 if the firm used an external information source; 0 if not
State Support [FuN]	1 if the firm received support from the state; 0 if not
Cooperation [CO]	1 if the firm cooperated; 0 if not

**Table 2: Descriptive Statistics**

<b>Conditions</b>	<b>Mean</b>	<b>Standard Deviation</b>
<b>Radical Innovation MKT</b>	0.24	0.43
<b>Available slack TRE</b>	0.31	0.33
<b>Recoverable slack RDA</b>	0.40	0.29
<b>Potential slack TDE</b>	0.31	0.33
<b>Market Competition Intensity CR4</b>	0.88	0.15
<b>External Information Source SPH</b>	0.46	0.41
<b>State support FuN</b>	0.23	0.42
<b>Cooperation CO</b>	0.14	0.35

**Table 3. Recipes for radical innovation**

Configuration Model (Solution)	Available Slack	Recoverable Slack	Potential Slack	Market competition intensity	Information Source	State Support	Cooperation	Coverage		Consistency
	TRE	RDA	TDE	CR4	SPH	FuN	CO	Raw	Unique	
1						●	●	0.330	0.075	0.811
2					●	●		0.506	0.154	0.742
3		□	●			●		0.169	0.007	0.738
4			●		□		●	0.046	0.009	0.769
5	●		□		●		●	0.114	0.024	0.738
6	●	●				●	●	0.116	0.004	0.719
7	●		●			●		0.076	0.002	0.711

**Solution coverage: 0.646**

**Solution consistency:0.740**

Notes: Frequency cut off = 0.7 ; Consistency cut off =0.6. Black circles “●” indicate the presence of a condition. Squares “□” indicate the absence of a condition. Blank cells indicate an irrelevant condition