

Article

The Resilience of a Small Company and the Grounds of Capitalism: Thriving on *Non-Knowledgeable* Ground

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Abstract: A case about a small company in Portugal enables an analysis of the resilience of small companies undergoing open innovation environments. Successfully facing *non-knowledgeable* grounds—which means insecurity, likelihood of disruption risk and uncertainty—is only possible through constant adaptation, by which a company can thrive and, through rational thinking, enable continuity. This study shows that open innovation achieved through agile partnerships can provide the resources and synergies necessary for the continued adaptation of small businesses to environments of high uncertainty. An ability to innovatively adapt is a central characteristic of resilient companies.

Keywords: small companies; open innovation; resilience; Max Weber; *non-knowledgeable* grounds

1. Introduction

The present work aims to understand openness and the success of interactions throughout the innovation process, among small companies (Small and Medium-sized Enterprises or SME, and micro-companies), made in order to ensure their organizational resilience; this process challenges the grounds of a contextual lack of knowledge, enabling knowledge tracking available in specific flows. Practitioners are businesspeople in innovative companies of small or very small size. The research described in this paper seeks to understand how relevant and complementary such collaboration processes are. Most of the companies included in this study began as micro-companies, continued as micro-companies, or had relevant micro-partners (e.g., some companies have one manager and one employee). We considered that a study of these kinds of companies was critical because of its relevance for the global economy, and in particular for the Portuguese economy, since they represent a substantial percentage of businesses: “In all countries, between 70% and 95% of all companies are micro-enterprises” [1]. In Portugal, 40% of jobs are in micro-companies [1]. The resilience of small and micro-companies is a critical issue to the global economic structure [2]. However, despite being so significant, half of these companies tend to fail in the first five years, and even surviving the first year is not a guarantee of survival [1].

Considering this, the research question guiding the study described in this paper is:

“How does open innovation achieved through agile partnerships provide the resources and synergies necessary for the continued adaptation of small businesses to high uncertainty environments?”

This paper presents the results of a case study about a small company, GTM (anonymized). The company works in engineering, software engineering, energy management and automation, and was chosen because it engages in systematic open innovation practices and continuous adaptation

strategies. Open innovation is found to be an essential framework to enable small companies not only to thrive, but also to grow and break through new markets, enduring the continuing crisis [2,3] and increasing their resilience.

2. Insecurity, Likelihood of Disruption, Risk and Uncertainty

The world is unstable in many dimensions. Human societies are constantly threatened by natural disasters caused or aggravated by environmental change due to human action [4,5], by wars and threats of war in strategic areas for access and distribution of crucial resources [6,7], resources which become more and more decisive globally [8,9]. The large-scale expenditure of energy and water resources implies competences including “resourcefulness, adaptive capacity and resilience” [10]. Populations are aging in developed and developing countries [11]; there is an extreme dependence on emerging information technology that is still poorly understood in terms of social impacts [12]; some financial as well as business practices are found to be questionable [13]; companies have to deal with fast market changes resulting in drastic modifications in technology [14]. This implies, as Innerarity says, that we are surrounded by “insecurity, likelihood of disruption, risk and uncertainty” [15]. Social institutions and particularly enterprises that need knowledge to thrive, such as the innovative ones, are aware of this uncertainty [2], so some, such as the small companies referred to in this work, must indeed learn to manage these various manifestations of *non-knowledge* [2,15,16]. The challenges posed by uncertainty, insecurity and high risk conditions call for resilient organizations—more so if they are innovative. After all, “resilience is not only about being persistent or robust to disturbance. It is also about the opportunities that disturbance opens up” [17]. Conditions of uncertainty bring with them new difficulties as well as opportunities.

2.1. Challenges for Resilient Organizations

An inspiring note on resilience comes from Weber, in *The Protestant Ethic and the Spirit of Capitalism* [18] Through a thorough, and in some ways controversial, analysis of Benjamin Franklin's thoughts, Weber seems to address the relevance of resilience for the capitalist society, specifically the resilience of the capitalist enterprise:

“Unlimited greed for gain is not in the least identical with capitalism, and is still less its spirit. Capitalism may even be identical with the restraint, or at least a rational tempering, of this irrational impulse. But capitalism is identical with the pursuit of profit, and forever renewed profit, by means of continuous, rational, capitalistic enterprise.” [18]

This definition calls for persistence and robustness [19] *versus* disruption. But it also calls for dynamic capabilities, which include seizing opportunities, anticipating threats, maintaining competitiveness [20] and “continuous development” [17], and gives clues to what are some key words for the present work: renewal, continuity, and rationality—even reinvention—through innovation [4,21].

Resilience can be considered as much the pursuit of success under adverse conditions as the ability to survive to crisis [2,22–25]. A resilient system displays the following major characteristics [26,27]:

- (1) The ability to respond adaptively to a unsettling event in order to avoid losses (related to resistance);
- (2) The ability to recover rapidly and within acceptable costs (recovery);
- (3) The ability to self-organize, learn and adapt to ensure the continuity of operation, achieving the system's objectives and retaining control over its structure and overall functioning (control over vulnerability, as in Limnios *et al.* [28]).

From this definition of organizational resilience results the identification of four main areas of competence: (i) to anticipate potentially disrupting events [29,30]; (ii) to avoid or prevent their occurrence; (iii) to strategically plan and prepare for disruption in order to protect the organization;

and, if necessary, (iv) to recover to a new fully functional state, assuring continued operations (for instance ensuring increased redundancy, as referred by Sheffi and Rice [30]). Our research provides evidence that open innovation is a critical strategy to develop resilience capabilities.

“Society is more and more conscious of the generalized lack of knowledge and proceeds not to be more knowledgeable, but to increase its capacity of managing the various manifestations of non-knowledge: insecurity, likelihood of disruption, risk, uncertainty.” [15]

A resilient organization aligns strategy, in this case an openness strategy, through its operations, management of systems and structures that support decision-making; all is driven in order to anticipate and adjust the organization to continuous changes by considering relevant risks, coping with business disruptions, and aiming at gaining advantage over less adaptive competitors.

The principles guiding the design of a resilient organization include:

- (1) Organizing for action, security and business continuity, implying a “strategically integrated view of business continuity” [26]: A resilient organization is realistic about the dangers it can face and is prepared to react; it understands that the consequences of a shock can be reduced and that the recovery time can be fast.
- (2) Vulnerability assessment: All vulnerabilities must be assessed and all possible events that can take advantage of them must be determined—sensitivity [22]—as well as their severity and probability—exposure [22]. Measures must be taken to prevent that most threatening vulnerabilities are exploited, and, in case that happens, measures must be taken to reduce the potential impact—capacity of response [22]. The continuous effort to identify and reduce most critical vulnerabilities becomes the measure of resilience of an organization [22,31].
- (3) Reducing the likelihood of disruptions: Early detection of disruptions to the normal business operation can allow implementing adequate corrective actions and reduce impact time. Continuous effort to reduce the likelihood of disruptions can be worked out through innovation. Or, as Teixeira and Werther call it, “serial” innovation [21]. Crisis anticipation has a direct impact on reputation because, as Koronis and Ponis state, “a crisis constitutes a disruption with potential asymmetrical results on reputation” [26], originating the need to compensate trust on stakeholders or customers.
- (4) Collaboration for safety: People who make up the organization form its sensory system. Employees who are aware of potential threats and share that information in the right channels of communication and decision can ensure more time to implement measures and reduce the impact of disturbing events. Collaboration enables the “mix of expertise, opportunism, creativity and decisiveness” [24].
- (5) Building redundancy: Duplication of resources, taking into account a decreasing order of their importance for maintaining normal business operation, may prove crucial to cope with unexpected events.
- (6) Creating resilient supply chains: Resiliency is created by (i) developing and maintaining effective and efficient relationships with suppliers during normal operations so that the organization is prepared for disturbances; and (ii) maintaining relationships with multiple vendors or store critical components so a reserve of materials is ensured to deal with a potential interruption of the supply chain [28,32].
- (7) Investing in training: Training employees is essential to the proper functioning of the organization [24]. The organization must train its employees so that they understand the risks and their adequate management. Employees should be encouraged to make suggestions about how best to manage the risks and to report what is wrong with the activities they perform. Adequate training increases “the ability to provide an acceptable level of service during disruptions” [33].

The resilience of an organization is an ongoing effort that often requires inducing change in organizational culture [26] and sharp attention to external conditions. In fact, everyone in a resilient

organization induces openness as a way to monitor external conditions [34]. Hamel and Valikangas [29] address five main challenge areas:

Cognitive challenge: Organization members must be “free of denial, nostalgia and arrogance” [29]. They must be intensely aware of what is changing and consider how these changes affect their performance. Past successes should not create collective blindness [35] to present difficulties or future threats.

Strategic challenge: Resilience requires alternatives and awareness, *i.e.*, the ability to create a multitude of new and convincing alternatives to those strategies that prove ineffective. As stated by Boin and Van Eeten, “the idea of resilience offers the promise of an intuitively plausible, attractive and seemingly attainable strategy to prepare for and deal with various types of adversity” [36]. In fact, behavioral elements must ensure that “companies take the actions needed to turn competitive potential into realized strategy” [24].

Technological challenge: Technological infrastructures of the organization, formalized in the equipment used or informally incorporated in organizational routines, are at the root of business resilience and agility [24]. Information Technologies (IT) are enablers and supporters of the technological infrastructures of organizations. Thus, organizations must adjust technological infrastructures to the strategic goals defined to promote resilience and be able to ensure the resilience of the technological infrastructures that are critical to maintain business continuity.

Policy challenge: The organization must be able to divert resources from old processes to new processes [19], *i.e.*, with the existing capital and talent, the organization must be able to reinvent its capabilities where necessary and independently of vested interests. As Folke states, “implication for policy is profound and requires a shift in mental models” [17].

Ideological challenge: Optimization alone is not enough. Organizations must strongly and continually seek excellence and perfection as collective ideals that motivate their members to find creative solutions to the problems they face and to create visions of a future that mobilizes their energy and talent.

2.2. Access to Knowledge

Giddens’ interpretation of Weber integrates the above mentioned challenges: “A rationalized capitalistic enterprise implies two things: a disciplined labor force, and the regularized investment of capital.” [37].

Beyond these two factors mentioned by Giddens, one idea has been the basis for these needs, SME and micro-companies have to access and invest in knowledge capital in order to succeed in changing contexts. If they are too small to have it inside, they can only gain access through open innovation, intrinsically associated to globalization. Why? Because open innovation connects companies to a huge amount of knowledge globally disseminated and circulating through knowledge flows [38–40]. However, Innerarity’s *non-knowledgeable* grounds identify critical elements related to the concept, such as associated risk (on intellectual property or the companies’ competitive knowledge, for instance) or even the mere condition of openness being a good starting point to a human resources policy (enabling the management of some uncertainty related to recruitment, for example). Anne-Laure Mention analyzes innovation as “a cornerstone of performance at company-level” [41] and acknowledges from the literature basically two dimensions to innovation, both process and outcome. But, as Chesbrough states, the change from closed to open innovation is framed by a mind-set change, as the latter is not limited by an organization’s boundaries [42,43]. Thus, this lack of boundaries represents a dose of increased insecurity, risk and uncertainty.

This perspective implies that companies not only share knowledge through open innovation, but they also have to apply the design principles for resilience to successfully implement it, which entails considering vulnerabilities, risks, drawbacks and redundancies, and ensuring the company can go on through it. The question rather becomes how these small companies enable their continuity as described by Weber in his master work. Assuming the same *non-knowledgeable* grounds, our study

shows that this can occur through a process of knowledge-mapping in a rather topological way, which implies finding the knowledge paths that enable innovation and profit, as well as the continuity of the enterprise itself, not singularly, but in alliance with others (socially). These knowledge paths come either from the adoption of different strategies, or the development of a series of

“(. . .) distributed innovation process(es) based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization business model” [44].

Thus, open innovation enables SME and micro-companies to survive, to continue, and to thrive in a collaborative way, allied with other companies.

Open innovation (OI) has been stabilized as a research area within innovation management and strategy, based on the concept defined by Henry Chesbrough, which originally described OI as

“(. . .) the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that companies can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology.” [45]

Chesbrough together with Bogers [44] recently proposed considering the way companies get, incorporate and commercialize external innovations, combined with the interaction between the company as a whole and each one of its members [44]. The flow perspective across organizational boundaries [43] becomes the most relevant issue for our study, since this is also how small companies establish and nurture relationships with their environment, integrate knowledge networks or, in a wider sense, build their contexts of belonging. Openness is considered an indispensable asset to these innovative industrial companies, given their need to develop innovative outputs at acceptable costs. In that sense, open innovation is a rational choice, framed “as a set of practices for profiting from innovation, and also a cognitive model for creating, interpreting and researching those practices” [34]. It is also an expression of the innovation concept itself, as this could be understood as networked multi-actor processes transposing organizational boundaries [41].

This paper presents one case, which is part of a set of cases collected in Portuguese SME and micro-companies, as a doctoral work. It departs from the understanding of resilience presented above to describe how these small Portuguese companies have implemented open innovation strategies to ensure their resilience. What follows is a description of the methodology used to study such companies, a presentation of the results of the study’s last case, and finally a discussion of the results in light of the organizational resilience concept, drawing some insights on the resilience capabilities that small companies could strive to develop.

3. The Study of Resilient Small and Micro Businesses: Research Methodology

The present research was performed applying the case study methodology [46–48]. Selected cases are chosen through a snowball approach, in order to both facilitate contacts and keep some detachment to participants.

This paper is framed by doctoral research which aims to understand how identity strategies define the success of interactions among innovation practitioners in small companies (SME and micro-companies) throughout the open innovation process, ensuring their success over context [15].

The results presented in this paper answer the following research question: How does open innovation achieved through agile partnerships provide the resources and synergies necessary for the continued adaptation of small businesses to high uncertainty environments?

By answering this question the study presents evidence for a central characteristic of resilient companies: the innovative adaptation ability.

Businesses addressed in the study are all from industrial and engineering sectors, namely sectors such as the waste management industry, bio-fuels and agricultural consultancy, water management

consultancy, engineering structures, aerospace and defense sectors, energy management, software engineering and automation. Sectors were chosen considering their relevance to the industrial recovery not only in Portugal, but also in other contexts.

Studied cases throughout the work show networks, or at least collaboration partnerships, of SME and micro companies, which can include research institutions as partners, other companies as partners—that can be associates or rather informal partners in business—or even developers included for specific innovative products. As a way to collect the deepest information possible on each case, due to the fact that we knew we were dealing with rich knowledge actors, we chose to mix semi-structured and long unstructured interviews, according to the time and psychological availability of each interviewee. In fact, some were interviewed more than once with both approaches (the DaFrm case, for instances [49]).

As an initial exploratory pilot for the whole research work, we studied the Rvolta case [50]. The Rvolta case includes a set of companies and micro-companies, and also some research institutions. Research institutions did not agree to participate, probably due to intellectual property safeguard issues: Even if intellectual property rights (IPR) are shared, they are shared with both the institution and the private companies with which the collaboration is established, so in fact any testimony retrieval from the studied companies was subject to confidentiality safeguards.

The Rvolta exploratory case was methodologically encapsulated, meaning that the case provides categories and, in general, drivers for the whole study; however, no common analysis is to be done about information content retrieved with the case, and the following cases, as the exploratory case was purposefully not subject to anonymity. Being a qualitative approach, any association could bring a new attribution of sense previously established to content. The choice on anonymity in subsequent cases was made due to publishing rules, and under the agreement of the interviewees. Rvolta was a test for the whole methodology, including the semi-structured and long unstructured interview approaches, which were followed in other cases. Information retrieved was subject to discourse analysis, including discourse structure analysis, categorical analysis [48] and also illustrative storytelling [51–53]. These techniques were applied to the following case, DaFrm, which has already been published under anonymity [49]. On the whole, five cases were collected, which correspond to more than nine companies organized in partnerships—some of them interviewed more than once. For the present case, both the discourse structure and categories were mapped (see Appendix); however, contrary to what happened in other cases, no story was collected for storytelling purposes. For the semi-structured interview, some (but not all) of the discourse dimensions were defined previously by the interviewer as an outcome of the snowball process and previous cases' collection and analysis (drivers mentioned before).

After a transcription supported by Twiline 0.0.5 was completed, discourse analysis was structured with MS Excel 2007, which turned out to be quite comfortable enabling categories' refinement and control of some categorization inconsistencies. Discourse was analyzed per discourse units (DU), sequentially, and corresponding to specific categories and dimension frames.

Mindjet 2012 was used to rearrange discourse categories according to relevant dimensions in the interview, resulting in discourse mapping (see Appendix). The map layout was chosen in order to enable the reader to apprehend the degree of freedom given to the interviewee, reinforcing that, in essence, an interview is first of all a conversation.

All participants authorized sound recording and gave specific authorization to the publication, as is the case presently. It is debatable that this second authorization is required once the agents agreed to participate in the study, accepted the sound recording, and were anonymized (and know it). Yet, we considered it a pre-requisite, as we are dealing with information about strategic innovation.

As in the present case, all interviews were done in Portuguese, between a Portuguese interviewer and, most of the time, a Portuguese interviewee (with one exception in another case), so every piece of discourse was translated to English and simultaneously categorized. This is a complex exercise. Furthermore, it also implies a double jeopardy on the authors' interpreting intervention.

4. Implementation of Open Innovation to Enhance Resilience: Insights from a Small Company

Discourse is organized in a number of dimensions explicitly addressed by the semi-structured interview guide, including the company starting point, strategy, risks, reputation, flow of control, customer relation management (CRM), integration of business challenges into strategy and operations, innovation and new markets, collaboration and partnerships, openness, and quality management (see Appendix).

A starting point. GTM was established after a friendly split from a multinational corporation well-known in Portugal: “after some years working with (them), in this same area of energy management, I developed the will to have my own project” (DU2), says GTM founder and manager, “I thought . . . ‘I’ve been here for ten years and I have enough know-how, this can be the right moment to leave’” (DU3).

A company variable in shape. The company adopted a small and flexible shape: “We are flexible enough as a small company and that kept us growing, handling all sorts of difficulties along the time, some twelve years ago from now” (DU12). Discourse expresses not only flexibility, but also persistence and robustness [17,54], framing the capacity to keep the overall structure of the company. But how small is GTM? Well, “from 2001, we grew and became stable with about 12 to 13 workers, occasionally a group of 20 workers; something between 1 and 2 million euro business inflows, so we became a small company but not exactly a micro-firm anymore” (DU17, 18).

Addressing organizational resilience development through human resource management, Lengnick-Hall, Beck and Lengnick-Hall [24] refer that contextual conditions supporting organizational resilience include: (1) psychological safety; (2) high social capital facilitating the exchange of intellectual capital—“intangible resources and capabilities” [41]; and (3) “diffuse power and accountability” [24], implying an organizational management that is not strictly hierarchical [43] but includes a degree of accountability shared by the whole group. This seems to be critically reinforced through open innovation once the hierarchical governance is reduced to enable border crossing, thus requiring the accountability of all involved.

Partners. First things first, a partner joined the company: As “things started moving, I got a partner that is still my partner in the company, he came from the pharmaceutical industry and together we established the grounds for this company (. . .)” (DU5). Although GTM and the multinational corporation were in good terms to collaborate, a partnership would require a quality certification first: “(We got certified ISO 9001) and we became partners within my original corporation, as well as (to other significant companies in Germany and Canada) (. . .)” (DU7). In Europe, by implementing open innovation the company found support and models for the kind of organizational and work structure it was looking for: “We share more with them . . . I mean, considering technical and business structural choices, we are more comfortable with them . . . because this openness philosophy, information sharing, protocols, technology, all this coincides with their way of thinking” (DU172).

As an expression of dynamic capabilities [20], the company’s vision points to a high performing organization that integrates this value in its strategic view: “Our vision was that of a very well prepared and structured business, each next step very solid, somehow we even tried to anticipate the distant future, even steps we weren’t yet working on” (DU8). Quality certification granted access to bigger projects, such as “hospitals, stadiums, malls, all due to our solid internal structure and procedures” (DU11).

Critical artifact. One critical innovative artifact (EBZ (anonymized)) is a product of the work with a partner company, EAN (anonymized): “We are business partners and we collaborate in many projects, the EBZ case is also due to our collaboration with EAN, because . . . shall we say, we have the energy know-how and EAN has the software development know-how. After all, this was a competence joint venture . . . ” (DU134). EBZ “works from data collected in the field . . . data can originate from water meters, energy meters; if we are monitoring other data it can be from temperature sensors, humidity sensors, indoor air quality sensors, machine alarms . . . We can relate these alarms to high temperatures, for instance . . . so we can develop the EBZ and present graphics as preferred by each customer . . . and

we can compare the consumptions” (DU101). But what exactly is EBZ? Well, “(we are either talking about an energy management system or an energy monitoring system) . . . Shall we say that EBZ is, by definition, a monitoring system, but it is more from the moment we can manage energy in a building with the support of EBZ, meaning the building manager can use the system to manage energy . . . let me give you an example: we have customers that buy EBZ and establish a consumption baseline for that year . . . every day (. . .), they can compare their consumption with the baseline, and from that moment on we are surely talking about energy management . . . ” (DU115). The EBZ was very appropriate for the Angolan market due to its features: “(The Angolan market reaction) was very good . . . the first project we installed EBZ on . . . Well, the customer just wanted to separate each neighbour’s consumptions of energy and water in the building (something previously impossible to achieve) . . . We already installed meters in that building, and it was only too easy to collect the data . . . and create (a) table for the data to be readable . . . so the EBZ was kind of a supplementary add-on that left the customer surprised . . . ” (DU119).

Resourceful networks or structures of partnership among co-innovators, such as the one which produced EBZ, are decisive, given the information and knowledge flows among them which enable the potential to innovate in the partnership. Human resources’ cognitive, behavioral and contextual dimensions frame a set of personal conditions favorable to an organizational resilience strategy [24].

Strategy. Issues come out openly from the discourse of GTM’s manager: a significant one is undoubtedly a permanent adaptation strategy, more than entering a new market or facing new competitors. This adaptation strategy starts from the company’s very beginning: “an engineering consultancy company, though... we felt very adequate as a project and hardware company too . . . ” (DU28). However, adaptation also gets articulated through collaboration and the company’s set up, as technology integrators: “We started as (big corporation’s) technology integrators (. . .) equipment and software which are afterwards customized to match each solution . . . we are talking about automation, more specifically building automation” (DU30).

However, everything about the company’s action, articulated in the interview, has a strategic expression. This means critical Weberian factors such as renewal, continuity and rational accomplishment [4,21]:

- (1) Ethics and reputation: “We have this very own choice of ours, based on ethics, social responsibility, something we do not give away . . . so a part of our path must be followed based on those principles, and this facilitates some opportunities that I would not classify as mere luck, but are not exactly planned either” (DU22). Weber quotes Benjamin Franklin expressively on this matter: “After industry and frugality, nothing contributes more to the raising of a young man in the world than punctuality and justice in all his dealings (. . .)” [18]. Trust is a critical issue that has been a driver since the first exploratory case of this work, Rvolta [50]. In this case, trust works as a mediator for business, ensuring the visibility of products, customer visibility and EBZ promotion “the second customer had to see it working to trust us . . . You know, sometimes the Angolan market is like this, sales are made, but the business commitment is not accomplished up to its very end, so customers had to see if what they were buying was what they would be getting (. . .), and we have to be grateful for the first customers that allowed us to show EBZ working . . . ” (DU124). Koronis and Ponis [26] address organizational reputation as key to support resilience against crisis, particularly reputation continuity—very much an expression of the Weberian principle, as it were, joining business continuity and corporate reputation. It seems in any case that reputation becomes a rather incontrollable issue, as it is based on stakeholder’s perceptions, relations and interests; frequently targeted as a manipulation strategy when it corresponds to the convenience of a given agenda, often related to issues such as risk, fear, or other critical elements. Reputation is “built within stakeholder groups, which observe a number of organizational action dimensions, including quality, employment, innovation and leadership” [26], and this is the reason why authors argue for the need to keep trust links with stakeholders to keep social capital (in this case reputational capital);

- (2) Integrating challenges into strategy and business. “(. . .) About building automation, when we started our company, our business was more about consulting, energy management on buildings and industry, and we started developing the complete pack, meaning automation, programming and so on, as an answer to a challenge from my former employer” (DU23). Successfully addressing challenges requires cognitive, strategic and technological abilities associated with business resilience and agility [24]. Additionally, successfully responding to a policy challenge may require that the organization is capable of reconverting its resources to new processes and demands [19];
- (3) Openness as a strategic choice to face competitors. GTM chose to make use of BACnet, a “data communication protocol for building automation and control networks”. They explain the purpose: “(Companies) work and make their (automation) equipment available in specific protocols . . . We have the BACnet protocol, which was produced in ASHRAE, an American (public utility) association related to energy and air conditioned” (DU42). This becomes a resource to face competitors and also a marketing resource: “There are always manufacturers trying to prevent access somehow . . . but working with BACnet became a relevant marketing strategy, too” (DU52); in fact, openness goes further including technology integration through standard protocols, making the partnership viable: “For example, the (automation control company) we also work with is Canadian; they are totally transparent about what they send, the products they manufacture, for the BACnet . . . ” (DU58); in any case, standard protocols enable common grounds for competition: “(If other) protocols were successful, other manufacturers could adhere, and its use would grow, yet there was never anything like the BACnet (. . .)”. They decided “No, we are going to develop this protocol from scratch, as if it was a ‘road’, and then invite manufacturers to drive their ‘cars’ on this road (. . .)” (DU50). Besides product or process innovation [41], standards do enable the expression of an openness mind-set;
- (4) Furthermore, this enables the company’s performance as innovative bricoleurs, those that “when situations unravel, (. . .) muddle through, imagining possibilities where others are confounded” [55]. Some factors can influence openness, such as technology availability, strategy and deliberate choices made by companies, the organization’s core—and not even that core—business and competencies (meaning those which, for some reason, become available to third parties) [56]: “We also integrate other protocols in BACnet... because it is possible, of course... For example, an energy meter or a water meter, can be bought in the market with BACnet support, but it is quite expensive... so more common and cheaper meters have other protocols we then make interoperable within a network . . . It is not possible to buy very expensive meters—only if it is one or two, but not more—yet if we need 200 . . . we can connect meters in a given network, there is one protocol for it, the m-bus, the meter bus which was developed for counting, so (afterwards) we integrate everything” (DU68). This approach includes data and information sharing through openness (interoperable and standard systems), and also shows information flows resulting from energy flows; innovativeness and interoperability become elements of an openness strategy. It also implies, integrated in the sheer definition of a *bricoleur* [55], resourcefulness and efficiency, as well as the capacity to adapt and control vulnerability [28];
- (5) Social and cultural adaptation as a groundwork for possible business. “Cultural aspects, from a social perspective, are something we care about. When we go to a different market, a different country, the first thing we do is to develop cultural activities and sensitiveness as much as we can . . . ” (DU151). This can be antecedent, or rather, frame a given business development process, an inside-out process—as with the Angolan market where the company has been working: “(On the motorbike travel done by the interviewee with a business partner, crossing the Angolan territory, North to South) . . . I can tell you these motorbike journeys (giving out goods collected in Portugal, on a voluntary basis) . . . They all happened before my first work assignment there . . . When I got to Angola to work, I was already used to the country, (because) in a journey you

have to talk to everybody (. . .) These journeys through Africa were rather important for me . . . at least the Angolan journeys helped a lot to make us more at ease afterwards" (DU153). External conditions and their internal appropriation are significant [34], and can ease the understanding of mental models [17];

- (6) Critical flows and redundancy. In a context of uncertainty, specific infrastructure and flows must be strategically secured, and information flows are on top: "Information is a rather important asset for us, I mean . . . our IT must be very disseminated, if one of our employees is in Angola, and depending on the level of connectivity (which nowadays is better) . . . well, he must have access to all information" (DU187). Client's data support critical flows: "our systems are hyper redundant; we can keep our client data quite safe" (DU191);
- (7) Markets as challenges. Angola was first of all a strategic choice: "One choice which was much planned was our entry in Angola, something we planned in a very structured manner" (DU9). Angola became the main market for the company: "Our main external market is the Angolan . . . We decided to go there because here (in Portugal) the big projects became scarce years ago, and this type of (automation) system, say, is appropriate for big buildings; the bigger the building, the more consuming, more effective these systems are . . . " (DU81). As Weick and Sutcliffe state, "reliable systems spend time improving their capacity to (. . .) imagine detailed next steps and to recombine fragments of potentially relevant past experience" [35]. The biggest challenge found in the Angolan market was to "measure to manage (. . .) When we are about to interfere in a building or an industry, we usually have scarce measurement information that can be manageable and that can enable an action plan." (DU97). As in other cases, this is a question of lack of "information available in a rather flexible and objective way, suitable to each customer's requisites (. . .)" (DU99), meaning customized or customizable, and this is part of the EBZ solution. Factors that make adaptation easier are very different from Angola to Germany or Europe in general: In fact, in Angola, previous socialization and adventure seem to make market and cultural knowledge easier to develop; in Germany, the relationship is established considering a shared structural approach, not related to efficiency and measurement but instead to openness, transparency and quality; both markets demand high quality and creativity: "On Germany.... we also have a very good impression, our DC partners, the company we work with in Germany, are different, but say (. . .) we like that frame of rigor, excellence, competence, the best we can do . . . and German customers and partners like that too; when we arrive in Germany, we change our attitude accordingly, we have to adapt . . . " (DU161);
- (8) As for constrains affecting strategy, two are classical but still reveal some difficulties to be controlled: "time and availability to start other projects . . . We have been developing new solutions framed by our business needs, so when we have resources, either financial or human resources, to dedicate to a certain project . . . We have much more ideas than things we can really develop, you know . . . so sometimes we just have to wait for the right time . . . This has not been happening, fortunately, (but it might happen that) the precise moment when we have time to develop a certain project (is) just too late" (DU146). Another constrain seems to relate to the open nature of business, including the acceptance of projects which were not defined at GTM: "For us, finishing a job well done is a strict obligation (. . .) delivering exactly what the client asked for . . . because often we are hired to undertake projects which were not exactly well defined, missing details and so . . . and the final output of the project could be influenced by that" (DU165). This ambiguity also shows when the client does not know exactly what he/she wants: "What does it mean, to finish a project? Well, in the face of some ambiguity from the client's wishes, we just have to get what he wants and deliver accordingly, and afterwards we have to be by the client's side to help with the solution we delivered." (DU166). Risks, on the other hand are diffuse and less clear, except for investment, which shows from the very beginning: "I took some (financial) risks and immediately started some big projects (. . .) in Lisbon or Algarve" (DU4).

Figure 1 systematizes the strategic actions that the CEO of GTM formulated as those that underlie the success and growth of the company, relating them to the principles that guide the design of resilient organizations. The table allows for a first list of strategic actions aimed at building the resilience of small businesses by ensuring continuous adaptation to external conditions. This list of actions can be tested and complemented in other micro and small businesses' cases.

Principles guiding the design of a resilient organization	GTM's strategic actions
Organizing for action, security and business continuity	<ul style="list-style-type: none"> • Detection of business and know-how opportunities • Flexible and flat structure • Quality certification • Risk management
Vulnerability assessment	<ul style="list-style-type: none"> • Identification of business challenges • Integrating challenges into strategy
Reducing the likelihood of disruptions	<ul style="list-style-type: none"> • Maintaining persistence • Implement innovative bricolage • Protecting information critical flows
Collaboration for safety	<ul style="list-style-type: none"> • Adhere to resourceful networks • Establish innovation partnerships • Nurturing trust
Building of redundancy	<ul style="list-style-type: none"> • Ensuring redundancy of information systems
Creating resilient supply chains	<ul style="list-style-type: none"> • Access to global markets • Effective management of successful products • Ensuring reputation continuity • Seeking technology integration and interoperability
Investment in culture and training	<ul style="list-style-type: none"> • Permanent adaptation to markets • Nurturing an openness mindset • Continuous transformation of mental models

Figure 1. Resilience principles inscribed in the GTM's strategy.

5. Conclusions

The main contribution of the work described in this paper is to present a perspective on the role of open innovation to build resilience in small businesses. We present the way strategic actions articulate with the context of partnerships for innovation, specifically GTM's. These strategic actions have the potential to implement the fundamental principles of the design of resilient organizations. But, besides the principles, the case facilitates other productive insights, illustrating characteristics of a resilient system, competences needed, as well as the challenging areas for a resilient organization.

Do certain organizational profiles (vision, strategy and structure) and their specific interactions enable the development of open innovation processes? As we can see, GTM's organizational profile favors an adaptation strategy which clearly benefits from open innovation: The company is variable in shape, enabling the possibility of reinvention through innovation, either in Angolan or European markets, showing persistence and robustness while facing disruptive times. This reinforces critical characteristics, such as the ability to self-organize, as well as the competence for anticipating disruptive events, through social and cultural adaptation.

Is the need for continuous adaptation the reason why certain structures (like partnerships) of open collaboration emerge and work? In the present case, the partnership between GTM and EAN establishes a continuous flow of knowledge collaboration, supported by principles of customization, CRM, and business follow up, all of which must be tackled together by both companies in order

to successfully address the challenges of new markets. Among its characteristics as a resilient organization, the one that stands out in our study is the ability to respond adaptively, while focusing on technological challenges, such as those represented by the development of critical artifacts.

Finally, do innovation partnerships support the resilience of small innovative companies? Action and decision of these small companies are limited by the shortage of skills and internal resources. However, they are less constrained by complex and rigid organizational structures. Thus, open innovation partnerships and external knowledge integration strategies may be easier to implement for small businesses. Therefore, their ability to (1) respond adaptively to disturbing events; (2) recover rapidly and within acceptable costs; and (3) self-organize, learn and adapt to ensure the continuity of operation, is enhanced.

Boin and Van Eeten state that, although it is hard to see resilience in action, “the idea of resilience offers the promise of an intuitively plausible, attractive and seemingly attainable strategy to prepare for and deal with various types of adversity.” [36]. Chesbrough establishes that “if you were trying to develop mechanisms to access useful knowledge today, you would start by surveying the surrounding knowledge landscape” [42]. This paper departs from the assumption that adversity is much more common and permanent—or, as Hamel and Valikangas state, there is a resilience gap: “The world is becoming turbulent faster than organizations are becoming resilient” [29]. The world’s turbulence brings with it insecurity, a likelihood of disruption, risk and uncertainty [15], the pillars of the *non-knowledgeable* contexts of companies. Despite the threats, companies such as GTM find their knowledge path(s), enabling innovation, profit, and continuity. The company’s experience is integrated in its vision, ethics and reputation as a symbolic profile. Open innovation is the strategy by which partnerships allow the emergence of successful management of successive challenges—often including *bricolage* approaches [55] and enabling reinvention. Some flows become critical, such as those of information, knowledge or technology [38]. However, they are framed by insecurity, a likelihood of disruption, risk and uncertainty. Companies such as GTM are continuously defying the odds, finding ways to thrive and renew previous contexts, increasing their readiness and making their capacity of response more robust.

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Appendix

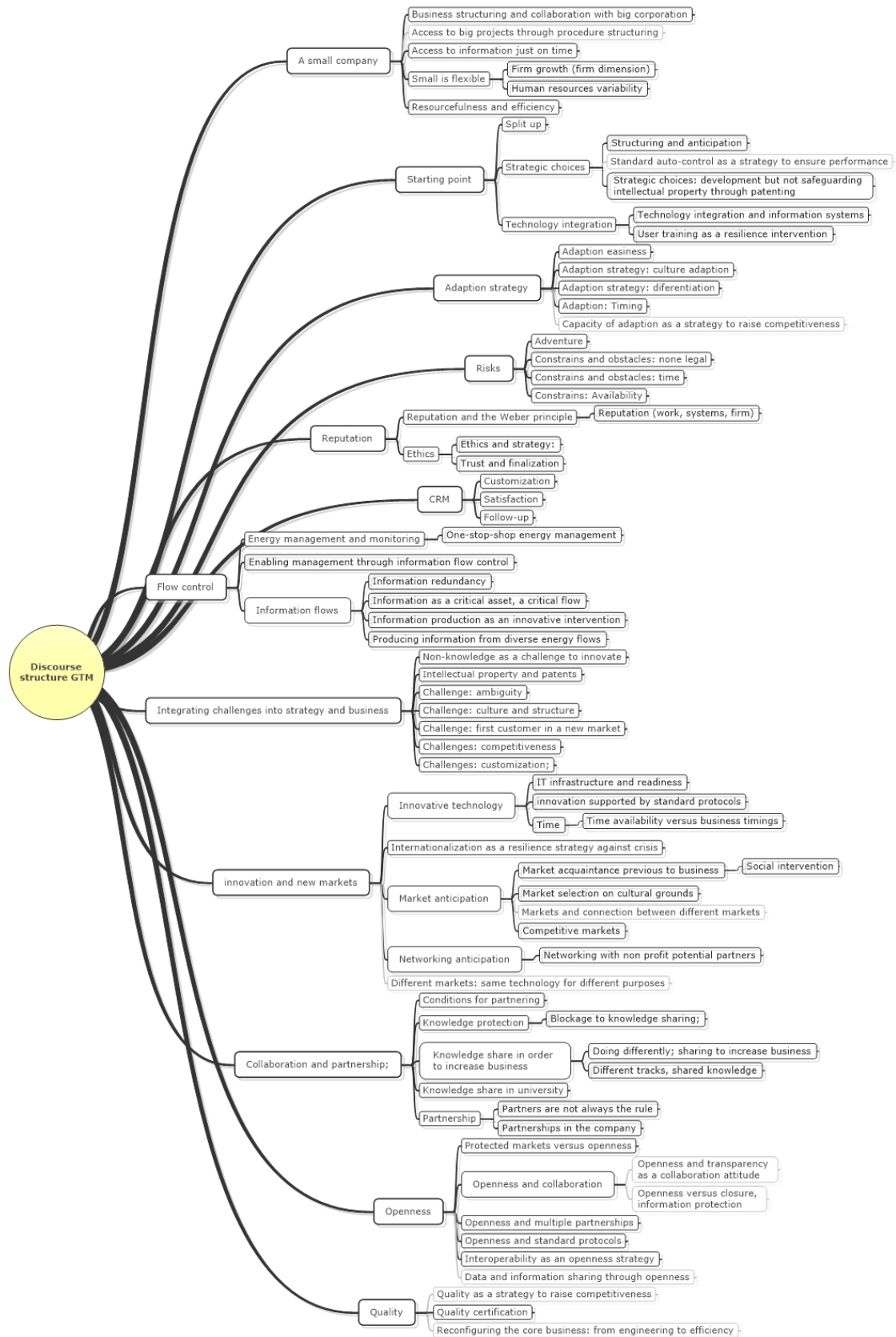


Figure A1. Interview with GTM manager. Discourse structure.

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