The Effect of Team Diversity on New Product Development: A Case Study

José Pedro Teixeira Duarte

Supervisor: Aurora A.C. Teixeira

July 2015
Bio

José Pedro Teixeira Duarte was born in Felgueiras, Portugal, on February 1st, 1984. He worked as a Process engineer for a company from automotive industry and since 2008 he is Product Engineer in a company that make medical equipment. In the last years he have been involved in several New Product Development Projects, coordinating all the steps of new products industrialization.
Acknowledgments

I would like to deeply thank firstly to my supervisor Professor Aurora Teixeira, the full availability, priceless comments and for all the support, always motivating me to accomplish this goal successfully. Thank you for the patience, for clarifying doubts, and for knowledge sharing. Thank you for being a friend to me, supporting me in the difficult times.

I want to thank Binteractive and his founder, Narciso, who provided me the data that allowed me to do this thesis.

I want to thank my wife, Maryline Brochado, who was always there for me, believing and pushing me in difficult times, giving me the strength to finish this dissertation with success.
Abstract

Team diversity has been considered an important issue when firms seek to create a new product development team. There are studies on the different dimensions of team diversity, including competencies diversity, specialization or diverse expertize. The empirical analyses on the effect of these disparate dimensions of team diversity on new product development and firm’s performance have not provided clear-cut results. Additionally, evidence on small, young start-ups, covering the evolution of the impact and interactions of team diversity (though hiring and subcontracting) with New Product Development (NPD) performance has not yet been fully explored.

Through an in-depth case study, focusing a small and young firm from computing industry, the present dissertation investigated, adopting a longitudinal and dynamic perspective, how the diversity of NPD team influenced the process of product innovation and firm’s performance. With such longitudinal study it was possible to analyse the evolution of the NPD team, its diversity, and how the growing familiarity between team members resulted in higher levels of performance both at the financial, and non-financial (notoriety and clients’ attraction) outcomes.

Over the process of hiring and NPD diversity evolution, the team leader acted as a significant moderate factor for the success of the projects at the financial, clients’ attraction and public notoriety levels. We further found that team diversity was not always related to a purposeful recruitment policy or business strategy. Often, the diversity was forced by (was a reaction to) the necessity in a given project for having a specific expertise that did not yet existed in the firm.

Previous subcontracting, instead of full and direct integration of collaborators, revealed a rather successful human resource approach for Binteractive. Indeed, such approach enhanced trust and familiarity between the founder, the extant and the future team members which constituted major moderate factors between the diversity of NPD team and NPD performance. The increasing familiarity between team members resulted in larger interchange of ideas regarding the work flow process and division of specific tasks because everybody knew which tasks and competencies each one had.

Interestingly, we found that team diversity in new product development had larger and positive impact on larger projects where the required creativity level was higher than on smaller projects characterized by the necessity of higher technical content and simpler execution.

Finally, a note regarding the relevance of the work space layout - the absence of physical barriers where everybody works in the same space and everybody knows in real time what team members are doing, enabled to enhance the sharing of information and fastened the decision process.

Keywords: Team diversity; new product development team; new product development performance.
Index of Contents

Bio.............................................................................................................................................. ii
Acknowledgments........................................................................................................................ iii
Abstract ......................................................................................................................................... iv
Index of Tables ............................................................................................................................ vii
Index of Figures ........................................................................................................................... viii

1. Introduction ................................................................................................................................. 1

2. Literature review .......................................................................................................................... 3

2.1. Key concepts: team diversity and new product development performance ......................... 3

2.1.1. Team diversity .................................................................................................................. 3

2.1.2. New Product Development (NPD) Performance ............................................................. 4

2.2. The relation between team diversity and NPD performance: an account of the empirical literature .......................................................................................................................... 5

3. Methodological considerations .................................................................................................... 9

4. How does team diversity influence and interact with NPD? A longitudinal and in depth account of BInteractive ......................................................................................................................... 11

4.1. BInteractive: a brief description ............................................................................................ 11

4.1.1. The business .................................................................................................................... 11

4.1.2. The promoter .................................................................................................................. 11

4.1.3. The birth of BInteractive .............................................................................................. 13

4.1.4. Entry into the UPTEC .................................................................................................... 13

4.1.5. The Services ................................................................................................................... 14

4.1.6. Human Resources ........................................................................................................... 14

4.2. New Product Development: main projects of BInteractive..................................................... 17

4.2.1. Criteria for selecting the projects .................................................................................... 17

4.2.2. Description of the projects ............................................................................................ 17

Project 1: Impetus – CatWalk (03/2012-06/2012) ..................................................................... 17
Project 2: Walkys (09/2013-01/2014) ....................................................................................... 20
Project 3: Rock in Rio interactive game (01/2014-05/2014) ..................................................... 21
Project 5 – Leopoldina - Missão Sorriso 2014 (09/2014-12/2014) ........................................... 24
4.3. The interaction of new team hiring and NPD performance ................................. 26
  Project 1: Impetus – CatWalk (03/2012-06/2012) .................................................. 26
  Project 2: Walkys (09/2013-01/2014) ...................................................................... 27
  Project 3: Rock in Rio interactive game (01/2014-05/2014) ......................................... 28
  Project 4 – Museu do Douro – Interactive multi-touch tables (07/2014-07/2015) ...... 29
  Project 5 – Leopoldina - Missão Sorriso 2014 (09/2014-12/2014) ....................... 30

5. Discussion and conclusions ...................................................................................... 32

References .................................................................................................................... 36
Index of Tables

Table 1: Observed effects of team diversity on New Product Development performance .......... 6
Table 2: Methodologies used by extant empirical literature on team diversity and NPD .......... 9
Table 3: NPD Team Members characteristics........................................................................ 15
Index of Figures

Figure 1: Theoretical framework – relation between recruitment policies, NPD and business strategy ................................................................. 8
Figure 2: Blasted Mechanism 2009 CD ................................................................. 12
Figure 3: Futurescope TMN 2010 ................................................................. 12
Figure 4: BInteractive Logo ................................................................. 13
Figure 5: Room implantation where Binteractive is located ........................................... 16
Figure 6: Comparison of revenues for each project ........................................... 17
Figure 7: IMPETUS Catwalk app ................................................................. 18
Figure 8: Impetus Augmented Reality app ................................................................. 19
Figure 9: Human resources and NPD ................................................................. 19
Figure 10: Walkys allow seeing virtually, how shoes fit in the feet ................................... 20
Figure 11: Human resources and NPD ................................................................. 21
Figure 12: Space and hardware of interactive game in Continente stand in Rock in Rio 2014 ................................................................. 21
Figure 13: Visitors playing with interactive game in Continente stand in Rock in Rio 2014 ................................................................. 21
Figure 14: Wall with pictures of players of the Rock in Rio interactive game ................................................................. 22
Figure 15: Human resources and NPD ................................................................. 22
Figure 16: Multi-touch table with Douro valley routes ................................................................. 23
Figure 17: Multi-touch table with municipality’s information ................................................................. 23
Figure 18: Human resources and NPD ................................................................. 24
Figure 19: Leopoldina board game with augmented reality application ................................................................. 25
Figure 20: Augmented reality application in smartphone and tablet ................................................................. 25
Figure 21: Human resources and NPD ................................................................. 25
Figure 22: Team diversity dimensions and NPD performance present in Catwalk project ................................................................. 26
Figure 23: Team diversity dimensions and NPD performance present in Walkys project ................................................................. 28
Figure 24: Team diversity dimensions and NPD performance present in Rock in Rio project ................................................................. 29
Figure 25: Team diversity dimensions and NPD performance present in Museu do Douro project ................................................................. 30
Figure 26: Team diversity dimensions and NPD performance present in Leopoldina project ................................................................. 31
Figure 27: Theoretical framework – relation between recruitment policies and business strategy ................................................................. 33
1. Introduction

Research on new product development processes, best practices and management methodologies have revealed a lot of interest in the implementation of cross-functional teams to the product success and have been theme of deep study over the last decades (Marion et al., 2012).

Although cross-functional development teams are chosen by the vast majority of firms aiming at improving new product performance, and some research have found a positive impact of cross-functional teams on new product development (NPD), extant empirical studies on these matters evidence ambiguous results (Sarin et al., 2003; Akgün et al., 2008; Haon et al., 2009; Hall and Ellis, 2010; McNally et al., 2011; Marion et al., 2012;). Specifically, Haon et al. (2009) demonstrate that team diversity has no direct impact on NPD; only when team familiarity is taken into account as intermediate variable, a positive and significant effect of team diversity on NPD performance emerges (Haon et al., 2009).

The literature points out different dimensions of team diversity, including competencies diversity (Haon et al., 2009), specialization and diverse expertise (Hirunyawipada et al., 2013), cognitive capacity (intelligence) (Akgün et al., 2006), cross-functional knowledge, functional specialization (Hall and Ellis, 2010), absorptive capacity (Moedas et al., 2008), team creativity (Leenders et al., 2003), diverse personality (Reilly et al., 2002). In general, those dimensions have been measured inquiring the NPD team managers about their perception on the diversity of team members (Haon et al., 2009).

Most of the extant literature on team diversity and NPD performance analyses large firms or firms that are structured in departments, having exclusive committed teams/personnel to NPD (Marion et al., 2012). However, it is expected that start-ups have different functioning compared to larger, well established firms, regarding to NPD (Marion et al., 2012). Indeed, whereas large firms tend have full-time dedicated people to the projects, in start-ups the founders have to play multiple roles during development of a product/service, including, finance, sales or design and work in a setting without functional departments or external personnel (Marion et al., 2012).

Additionally, extant empirical literature tend to focus on the impact of team diversity on firm performance using sets of cross section observations in a given point of time (Sarin et al., 2003; Akgün et al., 2006; Akgün et al., 2008; McNally et al., 2011; Marion et al.,
The longitudinal perspective of how the evolution of team diversity impacts on and interacts with firms’ performance dynamics has been rather neglected by existing empirical studies.

In the present dissertation we aim at contributing to fill in the above mentioned gaps by exploring how team diversity dynamics impacts on and interacts with the NPD performance resorting to an in-depth, longitudinal case study analysis of a young and small firm from the computing industry.

Computing industry firms are relevant case studies as they tend to work on a project basis (particularly when they provide tangible products), permitting to identify the precise moments of the starting up of a new product development and the eventual new personnel hiring. The youth of the firm and the fact that the owner/founder is still in charge enable the researcher to have an updated, longitudinal and truthful account on the reasons and circumstances of the new hiring and assess the extent to which these relate with NPD.

In order to accomplish the research tasks, an in-depth investigation is performed over a chronological evolution of one early-stage firm. Qualitative research methodology was chosen as a way to intimately understand the ‘hows’ (Yin, 2009) and the extent to which environment and other relevant factors affect NPD within a firm, most notably how, over time, newly hired collaborators impacted on and interacted with new products/projects success.

The present dissertation is structured as follows. The next section reviews the literature on team diversity and NPD performance. Then the methodology is detailed in Section 3. In Section 4 several key projects are described and it is explained how team diversity have influenced and interacted with NPD in the selected small start-up company. Finally, in Conclusions the main outcomes of the research are put forward and the scientific and managerial implications discussed.
2. Literature review

2.1. Key concepts: team diversity and new product development performance

2.1.1. Team diversity

There are different types of definitions and measures of team diversity. Team diversity can be evaluated relating competencies diversity (Haon et al., 2009), specialization and diverse expertize (Hirunyawipada et al., 2013), functional diversity (Leenders et al., 2003; Sarin and McDermott, 2003; Akgün et al., 2008; McNally et al., 2011; Marion et al., 2012), cognitive capacity (intelligence) (Akgün et al., 2006), cross-functional knowledge, functional specialization (Hall and Ellis, 2010), absorptive capacity (Moedas et al., 2008), team creativity (Leenders et al., 2003), diverse personality (Reilly et al., 2002).

Usually functional diversity serves as a proxy to measure competence diversity. It is thus assumed that team members from diverse firm’s departments have different competencies. However, even within a same department we can have team members with cross-functional diversity as “competences are cross-functional by nature” (Haon et al., 2009: 77). Competence diversity can further be measured by educational background combined with functional background (Haon et al., 2009).

Team intelligence is the driving force of team information-processing impacting positively on the success of new product projects (Akgün et al., 2006). According to Akgün et al. (2008) successful NPD projects tend to be developed by groups of people with disparate talents that work together.

Cognitive diversity in the team context is defined as the degree to which team members differ in terms of expertise, experiences, and perspectives (Horwitz et al., 2007). Team diversity has a positive impact on performance because of unique cognitive attributes that members bring to the team (Akgün et al., 2006). Ultimately, cognitive diversity among heterogeneous members promotes creativity, innovation, and problem solving, and thus results in superior performance relative to cognitively homogeneous teams (Leenders et al., 2003; Horwitz et al., 2007; Hall and Hellis, 2010).

However, there have been arguments against the effects of team diversity as postulated by the cognitive diversity perspective. Most notably, researchers taking either the personality (Reilly et al., 2002) or familiarity (Haon et al., 2009) in examining
teamwork often conclude that member heterogeneity has not a direct impact on team outcomes. Varying member characteristics such as age, ethnicity, and expertise can be easily categorized by individual members and are negatively associated with team outcomes (Horwitz et al., 2007). Particularly, the similarity–attraction perspective has argued that given the opportunity to select another member to interact within a group, individuals have a proclivity to select persons who are similar to themselves (Horwitz et al., 2007). Furthermore, homogeneous teams work well together because of their shared characteristics, thereby increasing team cohesion and performance (Horwitz et al., 2007).

Rather than subscribing a single perspective, we reflect on the propositions of both perspectives and further integrate them to form a basis for understanding the complex nature of team diversity. In investigating the relationship between team diversity and performance, much of the theoretical underpinning in this dissertation is grounded in the cognitive diversity hypothesis while balancing this with the counterarguments presented by the similarity–attraction paradigm in examining the potential impact of team diversity on social integration. We, therefore, conceptualize various characteristics of team diversity as a parsimonious categorization in investigating its potential effects on team outcomes (Horwitz et al., 2007).

2.1.2. New Product Development (NPD) Performance

New product development is described as being the transformation of a market’s need and a set of product technology characteristics into a product available for sale (Krishnan and Ulrich, 2001).

According to Marion et al. (2012: 639), “[t]he NPD process is arguably the most important dynamic capability within a firm”. Indeed, in today’s competition between companies and products, product innovation is crucial for a sustainable growth of the most firms, being NPD the relevant process (Leenders et al., 2003; Kleinsmann et al., 2010; MacNally et al., 2011; Marion et al., 2012). Some factors that contributes to new product success have been target of research, not only because successful new products are a major source of improved financial and market performance, but also because they may point to previously undiscovered business opportunities (Sarin and McDermott, 2003; Haon et al., 2009; Kleinsmann et al., 2010; MacNally et al., 2011). There are
significant different researcher’s perspectives of wish are the influences on NPD performance.

In this research we focus on the literature that emphasize the influence of NPD teams and how managing NPD teams improves new product development success.

### 2.2. The relation between team diversity and NPD performance: an account of the empirical literature

Empirical research shows a positive impact of team diversity on new product development performance, but the results are heterogeneous (Sarin and McDermott, 2003; Haon et al., 2009). Most of team diversity dimensions only have real effect if moderated with some characteristic or intervening. Functional diversity is the most studied dimension by authors, “97% of firms choose cross-functional development teams” (Haon et al., 2009: 75), teams members from different departments of the company that work together in the same project. Functional diversity has no direct impact on NPD success, but some authors empirically demonstrated that it does good effects if complemented with some factors. McNally et al. (2011) revels the influence of two factors to the NPD performance, namely speed to market and product quality. Speed to market has more influence on the product profitably and internal and external cross-functional integration has a good impact (McNally et al., 2011).

Team leader is a key moderator of team diversity in different dimensions, the importance of team’s leader behavior is a crucial aspect to take in account. Most literature refers the importance of team leader when mediate the communication and tasks between team members (Leenders et al., 2003), fixing goal constraints (Hirunyawipada and Paswan, 2013) in addiction, moderating different perspectives (Akgün et al., 2006 and 2008; Sarin and McDermott, 2003) and different personalities (Reilly et al., 2002) of team members. The level and mix of personality on a team should be an important factor in new product development (NPD) success (Reilly et al., 2002).

These capacities of team leader have a great influence on NPD performance and product profitability (Sarin and McDermott, 2003).

Haon et al. (2009) found in literature heterogeneous results of functional diversity (diverse specialization and expertise) but empirical findings showed the mediating effect of the instrumental use of information. Familiarity among team members
moderates the relationship between competence diversity and the instrumental use of information (Haon et al., 2009).

Table 1: Observed effects of team diversity on New Product Development performance

<table>
<thead>
<tr>
<th>Team Diversity Dimensions</th>
<th>Moderating characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>Communication</td>
</tr>
<tr>
<td>Functional diversity</td>
<td>Product Quality</td>
</tr>
<tr>
<td>Cognitive capacity</td>
<td>Absorptive capacity</td>
</tr>
<tr>
<td>Diverse specialization</td>
<td>Recipient team’s prior knowledge</td>
</tr>
<tr>
<td>Diverse personality</td>
<td>Goal Constraint</td>
</tr>
<tr>
<td>Cross-functional knowledge</td>
<td>Team Leader</td>
</tr>
</tbody>
</table>

Table 1: Observed effects of team diversity on New Product Development performance

- Strong and direct impact
- Medium and indirect impact
- Weak and indirect impact
When teams interact among its members, each member benefit of all ideas or arguments that are shared, the team become more productive in their creative output, through consultation and interaction, team members can prevent and anticipate problems in diverse solutions. Creativity is not a product of each person’s knowledge, but a result of interactions between all. Communication assumes here an important facilitator to increase creativity and fomenting the contribution of people to share ideas form different perspectives (Leenders et al., 2003).

From literature reviewed cross-functional knowledge and cognitive capacity (intelligence) have a direct impact in NPD performance. Hall and Ellis (2010) refer three dimensions of knowledge that influences directly NPD performance: supplier knowledge, supply market knowledge, technical knowledge. Knowledge is critical for cross-functional integration, facilitating communication, knowledge transfers and information processing, providing a platform of interaction through diverse functions (Hall and Ellis, 2010).

2.3. The relation between team diversity and NPD performance in a small start-up: the theoretical framework

In an early-stage firms the NPD best practices are different from large, established firms. (Marion et al., 2012). Adding new research on NPD in new ventures or early-stage firms this study analyses how one small firm implement the best practices in new product development (NPD).

Unlike a static analysis, we use a dynamic analysis of business performance, by linking the recruiting policies to strategic management, following the evolution of creation new products (see Figure 1).

The extant literature (e.g., Marion et al., 2012) only compare statically the results of similar early-stage firms. There is no evidence how the diversity in NPD team, influences the creation of new products or change the strategy in terms of business. Specifically, we still have not an answer for the following questions:

- How much influence has the diversity of team members in the success of NPD?
- How the new team members are involved with and impact on the performance of NPD?
- How much influence has a new team member in the business strategy of the company?
Figure 1: Theoretical framework – relation between recruitment policies, NPD and business strategy
3. Methodological considerations

The objective of this research is to undertake a qualitative analysis of NPD practices in one early-stage firm, by evidencing, through a longitudinal study, how the diversity of team members influences on and interacts with the NPD performance.

Table 2: Methodologies used by extant empirical literature on team diversity and NPD

<table>
<thead>
<tr>
<th>Study (authors, year)</th>
<th>Research question</th>
<th>Type (large/small) and number of firms analyzed</th>
<th>Methodology (qualitative/quantitative)</th>
<th>Type of analysis (cross-section; longitudinal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akgün et al. (2008)</td>
<td>How cross-functional NPD project teams enhanced their information processing and responsiveness capabilities and the impact of them on NPD project outcomes?</td>
<td>Large/1250</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Hirunwiapada et al. (2013)</td>
<td>What are the effects of ideation team’s cognitive depth (specialization) and breadth (diverse expertise) as well as goal constraint on the generation of new product ideas</td>
<td>Large/195</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Akgün et al. (2006)</td>
<td>Which is the effect of the learning process on team performance in NPD teams?</td>
<td>Large/56</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Hall and Ellis (2010)</td>
<td>What is the effect of buyer-product engineer cross-functional integration on both new product design and direct material sourcing performance?</td>
<td>Large/&gt;50</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Leenders et al. (2003)</td>
<td>From which manner the communication network of NPD team members affects NPD team level creativity and how team creativity can be managed virtually?</td>
<td>Large / 11</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>McNally et al. (2011)</td>
<td>This research attempts to reconcile conflicting results regarding the speed to market–product quality relationship, their joint impact on product profitability, and their mediation role in the effects of development expenses and cross-functional integration on product profitability</td>
<td>Large / 7</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Haon et al. (2009)</td>
<td>Which is the effect of functional diversity on new product performance</td>
<td>Large/&gt;1</td>
<td>Quantitative (structural equations)</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Hall and Ellis (2010)</td>
<td>What are the causal linkages amongst knowledge, cross-functional integration, and process performance between material buyers and product engineers</td>
<td>Large/&gt;1</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Sarin et al. (2003)</td>
<td>How leadership characteristics in NPD teams affect the learning, knowledge application and the performance of these teams?</td>
<td>Large/4</td>
<td>Quantitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Moedas et al. (2008)</td>
<td>Which is the effect of the external knowledge sourced from outside the organization and the process through which it is used by the recipient firm on NPD performance</td>
<td>Large/25</td>
<td>Qualitative</td>
<td>Cross-section</td>
</tr>
<tr>
<td>Marion et al. (2012)</td>
<td>What do Cooper’s fundamentals and associated “methods and best practices” mean for the small new venture? What is their relevance to efficient and effective outcomes in this space?</td>
<td>Small/2</td>
<td>Qualitative</td>
<td>Longitudinal</td>
</tr>
</tbody>
</table>
The research methodology flows closely to qualitative work of Marion et al. (2012), who focused on early-stage firms to analyse the NPD practices. From the literature we find little research with qualitative methodology and less through a longitudinal analysis (see Table 2). This study comprises longitudinal and in-depth analyses of the most important projects since the genesis of firm up to July 2015, encompassing a detailed analysis of the recruitment policies and business strategy, aiming to find the impact of team diversity on NDP performance.

The firm (BIntercative) was deliberately selected. This firm is an early-stage firm, created in 2011, with a fast growing process in just 4 years. It commercialises interactive products with very complex computing applications whose development implies expertise and knowledge background in programming, 3D modelling and design.

The researcher was allowed to access to development and managerial meetings and detailed financial data. The chronological data relating recruitment policies was collected through multiple interviews with the founder and team members.

We made five interviews with the founder (Narciso) of BInteractive between March and June 2015. Each meeting lasted about 4 hours where the founder provided data and information about the projects, human resources, and business strategy.
4. How does team diversity influence and interact with NPD? A longitudinal and in-depth account of BInteractive

4.1. BInteractive: a brief description

4.1.1. The business

BInteractive is a company engaged in the areas of computer vision, augmented reality, multimedia, programming, mobile applications, web and custom hardware. It has developed projects in these areas to companies from sectors like automotive industry, retail or marketing, from small businesses to large multinational groups.

4.1.2. The promoter

Narciso Melo, founder of BInteractive Company, is 33 years old, has an undergraduate degree in Computer Engineering at the Polytechnic Institute of Bragança, with a postgraduate degree in Technology and Digital Art at the University of Minho.

After finishing his training in 2007, he began working as a researcher in computer programming at the University of Minho. Then, in August 2008, acted as a consultant in Prologica providing services in the Ministry of Justice in IT / database management. In January 2010, as teacher at the Escola Universitária das Artes de Coimbra, he lectured programming classes.

In 2009, former course colleagues employed in a creative resources company contacted Narciso due to their need to develop a project for a Portuguese music band Blasted Mechanism. At that time, as a freelancer, Narciso integrated a team that created a pioneering product in Portugal, an interactive CD cover with Augmented Reality technology application (Figure 2). His expertise was acquired as a researcher at the University of Minho, so when it came the chance to use this technology in the project of Blasted Mechanism, Narciso was at a cornerstone of development. This was one of the first achievements and marked the genesis of BInteractive.

---

1 Blasted Mechanism are an Portuguese alternative rock band, composed of members Guishtu (voice), Valdiju (bambuleco, kalachakra, banjobandola), Ary (bass), Syncron (drums), Winga (percussion, didgeridoo) and Zymon (guitar, electric sitar, keys). While focusing on rock, his music uses many electronic elements.
Figure 2: Blasted Mechanism 2009 CD

Note: Investigation and development of two augmented reality computer apps to be used with both Windows and Mac. The apps were part of Blasted Mechanism music CD cover and allowed the buyers to visualize augmented reality 3D digital holograms which represented the band members, while interacting with sound contents in real time.

After the completion of this project, and also as a freelancer, Narciso participated in 2010, in the development, among other works, of one augmented reality application to promote summer festival Marés Vivas (Figure 3).

Figure 3: Futurescope TMN 2010

Note: Creation, investigation, development and implementation of an innovative way to promote the brand TMN by using: augmented reality software with customized video recognition; software which allows draws determined by the visualization’s cycle and gives prizes (connected to the augmented reality software); and a hardware system embedded in a glass fiber structure that represented a futuristic telescope. All of this travelled around Porto and Vila Nova de Gaia on top of a pick-up truck and allowed the people to visualize augmented reality digital holograms representing the music bands that would be present on the TMN Marés Vivas Music Festival.

In developing his work in the Ministry of Justice and after lecturing classes, Narciso ambitioned a more creative and dynamic work with different challenges and thus, given his experience as a freelancer and with the knowledge acquired by contact with a family
business, he decided, in January 2011, to create his own business and move forward with his ideas.

At that time the competition from companies located in Portugal in this area was virtually non-existent since the specialization in Augmented Reality was a still embryonic technology in the country.

4.1.3. The birth of BInteractive

After the contract with University of Coimbra ended in December 2010, Narciso decided to found his own company. BInteractive was born in January 2011 operating in two industry categories: Computer Programming Activities and Vocational Training (with CAE's 62010 and 85591, respectively).

Its formal and legal creation was made by Empresa na Hora (Instant Company) platform, emerging as the only difficulty at that time the choice of the name for the company. The Binteractive name was the result of a process of selection and rejection since there were names, graphically and phonetically similar (Figure 4).

To start the company involved about 30,000 euros, and Narciso managed to get this amount of money without outside help, using personal funds, accumulated in the year that worked as professor at the University of Coimbra.

![BInteractive Logo](image)

Figure 4: BInteractive Logo

4.1.4. Entry into the UPTEC

At the begin Narciso ran his business from home. The need to work directly with industry required an appropriated physical space for the development of the business. In October 2012 BInteractive started to operate in the Technological Hub of UPTEC. The choice of settling in UPTEC resulted from an interconnected set of factors: the possibility of establishing a partnership with the University of Porto (UPorto), creating
links with young entrepreneurs (networking) and the possibility to integrate students from UPorto students in the firm’s projects by offering curricular and professional internships.

4.1.5. The Services

BInteractive is a pioneer in the use of augmented reality providing various services such as computer vision, multimedia, programming, mobile applications, web and custom hardware.

The company develops a consulting service working as a producer of technology, software and hardware to other companies and thus is not directly in contact with the end user. Thus, this company is often the creator of a "raw material" likely to be applied to various activity sectors.

The company's services are required as new needs arise, so do not occur according to a formalized plan. In BInteractive each project is unique and the means necessary for the production of a project’s final result might be coincident with other projects already carried out or that are fully created.

Customers of this start-up are various, including some firms that have great influence in the market, such as Sonae®, the TMN®, Coca-Cola®, Pages Amarelas® and Luís other Figo® Foundation, as well as local football associations. These latter have a much modest impact than larger firms on the dissemination of BInteractive, however, they are equally important to its growth.

4.1.6. Human Resources

Currently the company employs eight full collaborators, resorting to external accounting services, creative resources, marketing, as well as research(ers) from several universities.

The integration and interaction with these collaborators is essential not only to attract new customers, but also to increase the company's ability to meet the challenges posed by customers.

Narciso has a collaborator, Dani who accompanies him since January 2012 and who has been assisting him directly in the development of the business plan and strategies. When he created the company, Narciso did not take as priority the performance of market
research due to its success in previous work as a freelancer. Today Dani, graduated in management, is a major influencer in the strategic vision of the company.

Narciso and Dani make all the managing work. Dani is the responsible for economic and financial issues. More specifically, he is an expert doing the applications to European fund programs from where they get investment for some projects. Narciso leads the development team in all projects and make all the commercial work, such as meetings with new clients and technical meetings with clients during the project development process.

The development team is comprised of 6 professionals having all almost the same age, but with different expertise, namely: computing (3), 3D animation and modelling (2) and illustration (1). They work all together making fragments of the same project, interacting and discussing all issues in an informal way. It is this informal way to work and the open-space interacting that the founder emphasized to show how they have succeed in their projects, which are mostly developed within short deadlines.

Table 2 details each new product development team member by chronological entry in Binteractive since the born of the firm until May 2015.

<table>
<thead>
<tr>
<th>Age</th>
<th>34</th>
<th>34</th>
<th>26</th>
<th>27</th>
<th>27</th>
<th>27</th>
<th>25</th>
<th>26</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Academic Background</td>
<td>Bachelor in Computing</td>
<td>Business Administration</td>
<td>Master in Computing</td>
<td>Master in Design</td>
<td>Master in Fine Arts</td>
<td>Arts high school</td>
<td>Master in Computing</td>
<td>Master in Computing</td>
<td>Master in 3D Animation</td>
</tr>
<tr>
<td>Professional Experience</td>
<td>8 years</td>
<td>8 years</td>
<td>2 years</td>
<td>2 years</td>
<td>3 years</td>
<td>3 years</td>
<td>1 years</td>
<td>3 years</td>
<td>2 years</td>
</tr>
<tr>
<td>Expertise</td>
<td>Programming</td>
<td>Economics</td>
<td>Programming and graphical computing</td>
<td>No</td>
<td>Illustration and design</td>
<td>Modelling and 3D animation</td>
<td>Programming</td>
<td>Programming and graphical computing</td>
<td>3D animation</td>
</tr>
<tr>
<td>Familiarity</td>
<td>Partner</td>
<td>Founder</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Member D</td>
</tr>
</tbody>
</table>

With ages between 25 and 27, BInteractive has a very young team. In March 2012 TM1 was the first to enter because of Cat walk project. TM2 entry in April 2012 as trainee, but the quality of work demonstrated was not sufficient to guarantee her stay at the firm. To advance more in the quality of Augmented Reality technology, it was necessary to hire by the end of 2013 and beginning of 2014 two additional collaborators, TM3 and TM4. TM5 was hired to do small projects as webpages and more simple applications
that could be done one for one person, but through the interaction with the team he was demonstrating great capabilities as autonomy and responsibility. At this moment TM5 is responsible for major projects. TM6 and TM7 entered from the necessity to continue growing work in augmented reality.

This firm is based in a 30m$^2$ office where everyone works without any physical barriers as we can observe in the Figure 4.

According to the founder this constitutes a great advantage permitting to develop a new product faster, due to closer communication - any doubt or any question can be solved just asking out loud. Nevertheless, it is recognised that such environment is not adequate for everyone. Thus, it requires that all new employees adapt themselves or leave the company.

At the present, all team members work very well together and everyone had adapted well and fast. This type of interaction allows a constant knowledge sharing and mutual aid, allowing also Narciso, the founder, select the most suitable member for each position on each NPD. Narciso points out also the importance of the diversity in his team which allows the further development of competencies and expertise of each team member.

![Figure 4: Room implantation where Binteractive is located](image)

*Source: Reproduced only for academic purposes with authorization by Binteractive.*

When team members starting work together with different expertise, they feel the need to learn from each other in order to do a better job.
4.2. New Product Development: main projects of Binteractive

4.2.1. Criteria for selecting the projects

Since its inception Binteractive undertook 17 projects, which were presented to us by the founder, detailing each project’s economic value, its importance to develop the company’s image, and the interaction of the human resources with New Product Development.

We selected 5 projects which presented the highest economic value (revenues generated) and/or biggest impact on company’s image/reputation. These projects are presented in Figure 6 with the corresponding economic value (revenues generated) and period when it occurred/was developed.

![Figure 6: Comparison of revenues for each project](Image)

*Source:* Bintercative company’s accounts.

4.2.2. Description of the projects

*Project 1: Impetus – CatWalk (03/2012-06/2012)*

Impetus group started its activity in the textile sector in 1973. Nowadays, with several companies and approximately 860 employees (693 in Portugal), the group reached an annual production of 4,650,000 articles. The group is specialized in the production of underwear, providing its customers different services that covers the development, R&D, production and shipping.

In recent years Impetus considered crucial to implement new communication strategies, promoting recognition and brand awareness and ensuring a sustained balance between
sensory and emotional development of the public and the company's communication strategy. In this context, and with a clear focus on social media and new technologies, the company invested in different communication and promotion platform brand interaction with customers, thus consolidating its innovative image in the global market. The business relationship between Binteractive and Impetus emerged from the need from the latter to implement its communication and marketing strategy.

The project consisted in developing two mobile applications which used augmented reality technology, Catwalk and Impetus Augmented Reality.

Cat walk app was developed for the beachwear collection 2013 of the brand and allowed users to simulate a photograph with brand models and share the results in social networks. Men and women models were filmed with the underwear collection, after this. The models were integrated in the app that uses the smartphone camera to take a normal photograph but with the model wearing underwear mounted in the screen. Figure 7 shows how the app works.

Figure 7: IMPETUS Catwalk app

Source: Reproduced only for academic purposes with authorization by Binteractive.

Impetus Augmented Reality app presents digital holograms of the various models of the four lines (Young, Trendy, Timeless and Seamless) brand. When pointing a smartphone camera for augmented reality markers present on a page of one magazine or on the packaging of Impetus products, users can see different models wearing the collection (cf. Figure 8).
Both applications are available for download (free) in the App Store and Google Play, the digital stores of Apple and Google, respectively. They are compatible with smartphones and tablets.

This was the first project of Binteractive and it was necessary to hire one professional to do the programming. The founder was very busy starting contacts with new clients and it was impossible for him to do all alone, so he hired the Team Member A (TMA) who had just finished his graduation in computing at Faculdade de Engenharia da Universidade do Porto (FEUP).

This project had some partnerships, like the model agency, photographers and designers, but Binteractive had the responsibility to make all the work, joining all the results in the two applications.

The TMA had the responsibility to program and test the mobile applications, always managed by the founder, which defined in a very detailed way all the steps of the project. The TMA only executed what the founder requested. This project lasted three months and was a good success in terms of the reputation it yielded to Binteractive.

Legend: Tm2 left Binteractive during Catwalk project- that is why the ‘m’ is in small caps. Continuous arrow depicts the founder as a Team Leader. Discontinuous arrow represents the partner, who is indirectly involved in NPD team performing the role of finance and economics Manager.

Source: Company’s – interview with the founder.
**Project 2: Walkys (09/2013-01/2014)**

Walkys is an application that allows to see virtually how shoes fit in the feet. In front of one big screen that simulates a mirror, we can choose different shoes by moving our arms and visualizing ourselves with the virtual shoes in our feet (see Figure 10).

![Figure 10: Walkys allow seeing virtually, how shoes fit in the feet](image)

During five months a team composed by four people, Narciso (the founder), TM1, TM4 and TM6. At this time, TM4 and TM6 were not yet formally employed in Binteractive. They were working with Binteractive in this project through external partnership as free-lancers. Due to their good work and commitment to the project, the founder employed them afterwards.

Narciso already knew TM4 and his capabilities as 3D modeller, so TM4 was responsible to design all shoes models, which were passed to TM6 to create the application that allowed showing those shoes models in the feet. Narciso and TM1 were responsible to do all the application that interacted with the user (see Figure 11).

This project was ordered by a footwear company from Felgueiras (North Portugal) that wanted something different to give visitors in the MICAM shoes fair, and Narciso propose that idea. This company is a regular exhibitor in the most important footwear fairs in Europe.

This project was a great success in terms of image of Binteractive, with references in the Portuguese media (e.g., Telejornal – RTP1). The client is using that product in every footwear fair in which the firm is present.
Figure 11: Human resources and NPD

Legend: Tm2 left Binteractive during Catwalk project - that is why the ‘m’ is in small caps. Continuous arrow depicts the founder as a Team Leader. Discontinuous arrow represents the partner, who is indirectly involved in NPD team performing the role of finance and economics Manager.

Source: Company’s – interview with the founder.

**Project 3: Rock in Rio interactive game (01/2014-05/2014)**

This project idea was born from one brainstorming session between Binteractive, Nixfuste and Sonae’s marketing department. Sonae was the client that asked Binteractive with Nixfuste partnership to develop one product that allowed people who were coming to Rock in Rio to have fun in the Continente’s (Sonae’s company) stand.

This game consisted in a platform with sensors that communicated with a computer display which showed one rock star dancing with the person (Figures 12 and 13).

**Figure 12: Space and hardware of interactive game in Continente stand in Rock in Rio 2014**

*Source: Reproduced only for academic purposes with authorization by Binteractive.*

**Figure 13: Visitors playing with interactive game in Continente stand in Rock in Rio 2014**

*Source: Reproduced only for academic purposes with authorization by Binteractive.*
When the visitor came to the interaction zone, it was raffled off one music and one rock idol, when the music started it was showed on the screen the number that must be pressed by feet on the sensor platform with the numbers 1, 2, 3, 4, to synchronize the dance of rock idol with the dance of player. The application evaluated the player performance and the best players/dancers were awarded. For each player was made a video and two pictures were taken, one for the player another to put on the wall (Figure 14).

**Figure 14:** Wall with pictures of players of the Rock in Rio interactive game.

*Source: Reproduced only for academic purposes with authorization by Binteractive.*

In this project were involved TM1, TM4 and TM6. It was to this project that Narciso hired TM6 and TM4, and it was because of their expertise in 3D design and graphical computing that was possible to do this work (Figure 15). It was necessary to make a partnership with Universidade do Minho to use the room of Motion Capture to read the movements of one dancer that danced all the musics of the game, those movements were joined to the virtual dancers (rock stars) on the game by programming.

This project started in January 2014 and was finished in May 2014 (5months).

**Figure 15:** Human resources and NPD

*Legend: Tm2 left Binteractive during Catwalk project, that is why the ‘m’ is in small caps. Continuous arrow depicts the founder as a Team Leader. Discontinuous arrow represents the partner, who is indirectly involved in NPD team performing the role of finance and economics Manager.*

*Source: Company’s – interview with the founder.*

This project includes two digital platforms for multi-touch tables. In one table, the museum’s visitor can see information about the Douro valley, wine tourism routes and museum’s information. This software is connected to the Douro municipalities that can add information about events or points of interest (Figures 16 and 17).

Figure 16: Multi-touch table with Douro valley routs
Source: Reproduced only for academic purposes with authorization by Binteractive.

Figure 17: Multi-touch table with municipality’s information
Source: Reproduced only for academic purposes with authorization by Binteractive.
In this project worked TM5 that made all the work since to collect the information from the client till programming of two applications for the multi-touch tables. TM5 was hired to do small projects like web pages or more simple applications, but, after working in some small projects he developed competencies that revealed great characteristics like autonomy and responsibility for his work (Figure 18). With these qualities, Narciso decided to give him liberty to do the project alone, only in meetings about deal tasks, Narciso was present. This project took a year to be done, some factors like the information that have to be collected from different sources, forced to extend the time to finish the project. The work of programming of two applications was done in five months and started in July 2014, but after the applications done was necessary to upload all the information about Douro Valley, museums, municipalities, etc..

![Figure 18: Human resources and NPD](image)

*Legend: Tm2 left Binteractive during Catwalk project, that is why the ‘m’ is in small caps. Continuous arrow depicts the founder as a Team Leader. Discontinuous arrow represents the partner, who is indirectly involved in NPD team performing the role of finance and economics Manager.*

*Source: Company’s – interview with the founder.*

This project was important mostly for portfolio and to begin a new business area, like culture, it was necessary to valorise the importance in terms of image instead of money revenue.

**Project 5 – Leopoldina - Missão Sorriso 2014 (09/2014-12/2014)**

Missão sorriso is an initiative of social responsibility and sustainable development. For this project the client wanted something different from books and music cd’s, more technological. With this proposal Binteractive with Nixfuste in partnership made a brainstorming to create an innovative product. From this exercise was born the game of glory that could be played as a board game or through one augmented reality application (Figures 19 and 20).
In this project worked TM1, TM3, TM4 and TM6, all team was very efficient and the result was very good. This project involved those professionals with diverse expertise and backgrounds but Narciso referred this diversity like a great advantage when he has a work that needs a lot of creativity and diverse expertise, like design, 3D modelling and programming (Figure 21).

This project started in September 2014 and was finished in three months.

---

**Figure 19: Leopoldina board game with augmented reality application**
*Source: Reproduced only for academic purposes with authorization by Binteractive*

**Figure 20: Augmented reality application in smartphone and tablet**
*Source: Reproduced only for academic purposes with authorization by Binteractive*

**Figure 21: Human resources and NPD**
*Legend: Tm2 left Binteractive during Catwalk project - that is why the ‘m’ is in small caps. Continuous arrow depicts the founder as a Team Leader. Discontinuous arrow represents the partner, who is indirectly involved in NPD team performing the role of finance and economics Manager. Source: Company’s – interview with the founder.*
4.3. The interaction of new team hiring and NPD performance

Project 1: Impetus – CatWalk (03/2012-06/2012)

In terms of performance this project was the one of all those selected for analysis which present the lowest revenue, not because it was simple, but because Binteractive was just starting the business and the important issue at this stage was not money but to gather reputation and notoriety through the project. This project achieved a good notoriety but was not particularly efficient or useful in attracting more clients (see Figure 22).

In this project diverse personality was moderated by the team leader’s interaction with TM1. The actions of the team leader were crucial for achieving good results in the NPD. The TM1 had a strong personality and as he was starting this new job. He wanted to implement some new ideas/new point of views. However, that was not possible/adequate as the team leader wanted the work done like he had first established.

![Figure 22: Team diversity dimensions and NPD performance present in Catwalk project](image)

**Legend:** Green means the presence in this project; Yellow line highlights the intensity in terms of revenue, notoriety and capability to attract new clients (Top to bottom in NPD performance, respectively)
Project 2: Walkys (09/2013-01/2014)

This project has achieved all the objectives in terms of NPD performance: it generated large revenue, high notoriety and it was highly relevant in attracting more clients.

With a team created, already with the project running, the importance of the team leader was crucial to connect and align all team to the goal. In this case functional diversity (fine arts, design and engineering) and diverse specialization (specific informatics platforms) and expertise (programming, modelling, graphical computing) were moderated by the product quality as an imperative necessity. This project was ordered by a client who wanted to show a different way to interact with its visitors in an international fair. Being from the fashion industry, the client imposed a challenged where the innovation and time to market act as critical variables.

With the association of TM4 and TM6, who at this stage were not yet Binteractive’s collaborators but instead external suppliers, the team gained creativity and specialization, as graphical computing, modelling and 3D animation that are areas from digital areas, very important to the product development integrating interactive applications. Such competencies were moderated by a goal constraint where the communication had to be worked by the team leader, in order to guarantee the flow of information and that everyone involved understanding each other’s tasks and roles - although with diverse functions team members had to work together for the same objective.

The project permitted to start business with the footwear industry. In the North of Portugal, namely São João da Madeira and Felgueiras, there are hundreds of footwear companies that every year are present in diverse fairs around the world, always searching the best way to show the power of innovation in products quality. In this sense, this project positioned Binteractive as potential key partner of these footwear companies.
**Figure 23: Team diversity dimensions and NPD performance present in Walkys project**

*Legend:* Green means the presence in this project; Yellow line highlights the intensity in terms of revenue, notoriety and capability to attract new clients (Top to bottom in NPD performance, respectively)

**Project 3: Rock in Rio interactive game (01/2014-05/2014)**

This project marked the consolidation the NDP team with the hiring of TM4 and TM6. The good work these two individuals presented in the Walkys project, evidenced that the team could be enriched with their diverse expertise (graphical computing, modelling and 3D animation) and specialization (specific design program).

The learning process developed the cognitive capacity dimension. The interaction between team members with diverse expertise promoted the exchange of knowledge and mutual aid, creating a vital dynamism to the development of innovative ideas that are the basis of these projects. Familiarity (as the two above mentioned individuals had already worked with Binteractive before) stands as a facilitator in the NPD team’s work, promoting, in this case, increasing efficiency.

In terms of performance, this project had the best results of all those selected for analysis. It achieved the largest revenue so far, and it was a great success in terms of notoriety, being recognized for hundreds of users in Rock in Rio music festival and for the press that publicized the interest for this product. The project boosted other projects, based in the same technology, which other clients demanded.

This project was developed only by one team member. Thus, it had no team diversity. Notwithstanding, this individual made all the steps of the work with the supervision of the team leader (founder).

This project was important to create new business opportunities in the interactive and technological equipment in museums. The yield/income of this project was very low barely covering the expenses and took longer than expected to be done. In terms of notoriety the project was below the expectations but nevertheless attracted potential customers interested in similar projects and currently Binteractive expects the closure of some businesses based on the technology underlying this project.
Figure 25: Team diversity dimensions and NPD performance present in Museu do Douro project

Legend: Green means the presence in this project; Yellow line highlights the intensity in terms of revenue, notoriety and capability to attract new clients (Top to bottom in NPD performance, respectively)

Project 5 – Leopoldina - Missão Sorriso 2014 (09/2014-12/2014)

This project involved almost all the team members and it is a great example of team diversity. Through brain-storming’s everyone were able to give ideas and freely contribute to the whole project.

The level of creativity was very high and the communication worked as a moderating characteristic in the sense that it contributed a lot the proximity of all team members that already know each other well and the capabilities that each other had to do some parts of the work.

In this project the team demonstrated to be very cohesive and functional diversity emerged naturally moderated by the relation between product quality and the speed to market. Additionally, the remaining team diversity dimensions contributed substantially for the success of the product/project.
Figure 26: Team diversity dimensions and NPD performance present in Leopoldina project

Legend: Green means the presence in this project; Yellow line highlights the intensity in terms of revenue, notoriety and capability to attract new clients (Top to bottom in NPD performance, respectively)

Indeed, the knowledge gained in previous projects and the absorptive capacity of the team spurred the team absorption capacity, making it increasingly possible to connect team members and make each intervene in a more efficient manner. The team leader was once again a facilitator because he provided each team member with the ideal conditions for exposing their opinion, always in an environment of freedom, which promoted creativity and the ability of each team member.
5. Discussion and conclusions

Very few studies exist focusing on NPD practices in start-up’s, and less so envisaging a longitudinal perspective. Given that NPD methods in small, new ventures are different from large and well-established firms (Marion et al., 012), in-depth case-studies are crucial to analyse the methods and NPD practices in small and early-stage firms.

In the present dissertation we pursued a detailed, longitudinal study on a small start-up operating in the computing industry, BInteractive. By analysing how 5 major projects/products evolved and how hiring of new personnel was related to NPD and business strategy, we demonstrated that team diversity in early-stage firms stand as a necessity.

Since the beginning the founder of BInteractive had a diversification strategy in terms of who to be included in the development team. For instance, his first collaborator, now his partner, did not possess any knowledge about computing. In all interviews with Narciso, he always emphasized the importance of having collaborators with different expertise and educational background, working together. However, this was not always a purposeful recruitment policy or business strategy. Often, the diversity was forced by the necessity in a given project for having a specific expertise that did not yet existed in the firm.

In the first project, Catwalk, TM1 it was hired directly to do the work that the founder had no time to do. Although TM1 had the same education background of Narciso (the founder), he presented a very distinct personality, which brought diversity to the NPD team. TM1 is an extroverted person and this characteristic can assume several facets such as friendliness, gregariousness and assertiveness (Reilly et al., 2002). Friendliness, however, might cause some inconvenient actions in a project of this type. As such, the personality of TM1 had to be moderated by the team leader who has a less extroverted personality. The combination of diverse personalities was a good influence in other projects like Rock in Rio or even more in Leopoldina, where creativity was essential. In accordance with the literature (see Reilly et al., 2002), in Rock and Rio and Leopoldina, projects characterized by radical type of innovation, we observed that team members with diverse personalities affected positively the overall performance of NPD. In contrast, in projects characterized by incremental innovation, such as Catwalk, too much creativity (as that associated to TM1) would be detrimental for NPD.
As the company grew in number of new projects, this required new hiring of employees with diverse skills and experiences (see Figure 27). The initial limited number of human resources was followed by the hiring of people from different areas. Over the process of hiring and NPD, we realized that for success of the projects (in any of the three dimensions considered – financial, clients attraction and public notoriety), the moderation of the team leader was crucial, corroborating extant literature (Reilly et al., 2002; Leenders et al., 2003; Sarin et al., 2003).

![Figure 27: Theoretical framework – relation between recruitment policies and business strategy](source: Own creation.)

The Catwalk project included also a professional from arts (TM2), a female who did not succeed in adequately integrate the NPD team, exiting soon after her hiring from BIntercative. Although at the beginning gender was not an issue, the founder admitted that it could be difficulty for a woman to integrate the NDP team that is composed only by men characterized by rather informal behaviours. Thus, for this particular firm, and according to his founder, gender diversity did not pay off in terms of NPD performance.

Business strategy – to invest in a new domain, 3D modelling - was critical to the subcontracting of TM4 and TM6 for the Walkys project. These individuals and their combined expertise (TM4 - 3D animation; TM6 – graphical computing) were critical
for the notable success of this project. These individuals were subsequently hired (TM4 during the project Walkys and TM6 in the project of Rock in Rio).

There was a project - Museu do Douro - that took longer to be done comparing with the others. This, however, was related to company’s business strategy - this project stood more like an investment on marketing and a way to enter in a new business area. With low budget, Narciso decided to assign to this project only TM5, who had revealed a great autonomy and efficiency in other projects. This team member had to develop every stage of the project, although some brainstormings with the rest of the team occurred along the development. TM5 is a good example of how work in a diverse team can contribute to the development of good capabilities and knowledge diversity of each team member (Sarin et al., 2003). TM5 started in Binteractive doing small projects like webpages. However, working day after day physically close to other team members and participating in discussions of another projects turned possible for him to learn more about other areas, like web design and graphical computing that were need to apply in the Museu do Douro project.

In sharp contrast with the above mentioned project, Leopoldina was a project where it was necessary a wide range of diversity. From an idea of a client it was necessary to make a brainstorming with all team, and everyone had an influence on the final outcome. As a result of the freedom provided by the founder to the NPD team, at the level of the methods for intervention and interaction the team increased its knowledge and was capable to apply faster and better new ideas and procedures. To undertake this project it was necessary to have different capabilities, such as programming, design or 3D modeling. The interaction between each team member was abundant and the knowledge that every one of them had about each other constituted an advantage when they start to do something new (Sarin et al., 2003; Haon et al., 2009).

This longitudinal analyses allowed to follow the growing process of a company that started with only one person. We can conclude that the diversity has two different forms of emergence: necessity and strategy. Necessity was related to functional diversity or diverse specialization and diverse expertise as a particular need of some new business area that the company was starting. Strategy reflected the desire of the founder/team leader for knowledge sharing, integrating professionals of different areas and expertise, fostering the team interaction among NPD team members seeking positive impacts on

In the present case study we found that team diversity in new product development had larger impact on larger projects where the required creativity level was higher than for smaller projects characterized by the necessity of higher technical content and simpler execution.

Furthermore, we found that new hiring (namely of TM4 and TM6) and subsequent team diversity impacted directly on the emergence of new product ideas in a highly requested business area (interactive applications).

Studying team diversity in such a small, young start-up translates to larger extent the process of knowledge sharing where each NPD team member always has something to give in order to reach the best overall performance.

With such longitudinal study it was possible to analyse the evolution of the NPD team, its diversity, and how the growing familiarity (Haon et al., 2009) between team members resulted in higher levels of performance both at the financial, and non-financial (notoriety and clients’ attraction) outcomes. In the present case study the increasing familiarity between team members resulted in larger interchange of ideas regarding the work flow process and division of specific tasks because everybody knew which tasks and competencies each one had.

It is important to underline that the layout of the work space, with the absence of physical barriers where everybody works in the same room and everybody knows in real time what team members are doing, enhanced the sharing of information and fastened the decision process.

The fact that the information gathering was based exclusively in the testimony of the team leader (who is also the company’s founder) might have biased the results of the study, in the sense that such results convey his vision about the company, the team and the projects. Due to time and logistics issues it was not possible to involve and analyse the point of view of all team members. This would constitute nevertheless a stimulating and challenging avenue for further research.
References


Yin, R. (2009), Case Study Research: Design and Methods, UK: Sage.