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Innovation Assessment of a Portuguese
Railway branch of a foreign multinational - A case study

PhD in Technology Assessment

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Innovation Assessment of a Portuguese railway branch of a foreign multinational - A case study [1]

Abstract

This paper analyses the application of the Innovation Scoring model and its results to the railway business branch of a foreign multinational. Results confirm some enrolment in non-core Research & Development connected to the commercial activity of selling trains. Two main determinants were found to support this enrolment: the impact of a new Portuguese law imposing R&D investment for public contracts; and a certain degree of openness in the multinational's innovation strategy based on predictable growth for the Portuguese market. The study also confirms the usefulness of the Innovation Scoring model, leaving some suggestions for improvement such as tailoring for multi-decision centres, implementing it through a third party, reducing the number of questions and introduction of a product evaluation methodology.

Keywords: Innovation Assessment; Railway; Policy; Scoring model; Multinational, Portugal.

JEL codes: M16, O32, R42

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1. Introduction

The Innovation Scoring questionnaire is a tool model developed to assess innovation capabilities and performance in companies operating in Portugal, aiming at improving their competitiveness in a knowledge-based economy. The tool was developed by the Portuguese business association dedicated to raise innovation awareness – Cotec [2], designed to contribute to a strategic reflection on internal innovation processes of companies. It allows for an inclusive understanding of the different dimensions sustaining innovation processes, and it points to areas of potential improvement.

According to Caraça *et al.* (2006: 4-5) the Innovation Scoring tool is based on the "chain-linked" model of Kline and Rosenberg (1986), extending the technology innovation concept to organizational marketing and innovation (OECD Oslo Manual 2005), and targeting industry and services within their context.

The questionnaire draws on the concept of systemic innovation as presented by Smits *et al.* (2008:1), where systemic innovation is "a process involving a heterogeneous set of actors who are inspired by both the potential that science and technology offer and by the context in which they have to function". These actors are involved in a complex decision making process that leads to innovative activity.

The Innovation Scoring model was developed in two stages. The first, held from 2006 to 2008, consisted on observing worldwide best practices, such as in Singapore, USA, Canada and Belgium. The second phase started in 2008 and will go on until December 2010, aimed to enlarge this free tool application to a substantial number of companies in Portugal[3], to internationalize the Innovation Scoring and to disseminate, nationally and abroad, the use of the Portuguese Normative framework. The latter normative framework [4] was created to help, integrate and manage Research & Development and Innovation

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[2] COTEC Portugal - Associação Empresarial para a Inovação [Enterpreneurial Association for Innovation], created in April 2003, following an initiative of the President of Portugal. Link: www.cotecportugal.pt
[3] The questionnaire was tested in a group of 15 pilot Portuguese large companies, such as Amorim Revestimentos, Brisa Auto-Estradas de Portugal, Efacec Sistemas Electrónicos, Nokia Siemens Networks, Martifer Energia - Equipamentos para Energia and Sonae Indústria.
[4] NP4456:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI). Terminologia e definições das actividades de IDI [Research, Development and Innovation (RDI) Management. Terminology and definitions of RDI

(R&D+I) in Portuguese companies. However, these set of norms do not fully comply with the Frascati Manual guidelines, and were adapted broadly to finance innovative Portuguese companies and to raise awareness in society.

The study applies the Innovation Scoring model to a railway branch of a Portuguese subsidiary of a foreign multinational. The following chapter covers the used methodology, chapter 3 presents the case study and chapter 4 closes with concluding remarks.

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activities]; NP4457:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI). Requisitos do sistema de gestão da IDI [Research, Development and Innovation (RDI) Management: Management System Requirements]; NP4458:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI). Requisitos de um projecto de IDI [Research, Development and Innovation (RDI) Management: RDI project management requirements]; and NP4461:2007 - Gestão da Investigação, Desenvolvimento e Inovação (IDI). Competência e avaliação dos auditores de sistemas de gestão da IDI e dos auditores de projectos de IDI [Research, Development and Innovation (RDI) Management: Competences and evaluation of Auditors of RDI Management systems and Auditors of RDI projects].

2. Methodology

The present paper studies the application by the authors of the Innovation Scoring questionnaire to the railway branch of a Portuguese subsidiary of a foreign multinational. The subsidiary is present in a wide range of business areas, such as transport, producing and supplying trains, trams and metros, signalling and engineering solutions. The authors have chosen the railway business area, because is the most active in Research & Development (R&D) inside the Portuguese subsidiary company.

It was agreed not to reveal the identity of the company, by replacing its name with Tech-Train when referring to the railway business branch, Tech Portugal SA when referring to the subsidiary in Portugal, and Tech Group when referring to the multinational or motherhouse.

The answers to the questionnaire refer to 2009, resulting from informal interviews conducted with the relevant personal from Tech-Train for about ten hours, e.g. two persons from top management and three working in R&D. An interview with the international technical director from Tech Group, with duration of 3 hours was also conducted in a random order and in some cases answers refer to more than one question.

The questionnaire Innovation Scoring was a tool specially developed in Portugal to assess companies' innovation systems. The questionnaire[5] is supported by guidelines[6] clarifying with examples and explaining the use of ratings and scoring formulas.

The questionnaire is structured in four different dimensions: Conditions, Resources, Processes and Results (for details see Annex 1 Table 1). Each dimension has different themes. The 13 themes present in the questionnaire are Culture, Leadership and Strategy (in the dimension of Conditions), Human Capital, Competences, External relations and Structures (in the dimension of Resources), Management of R&D+I activities, Systemic

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[5] Available online at www.innovationscoring.pt
[6] The Guidelines - Innovation Scoring Manual de Apoio ao Preenchimento, COTEC, March 2009 - can be downloaded from COTEC website at http://www.innovationscoring.pt/images/conteudo/manual_innovation_scoring_projecto.pdf

learning and improvement, Protection and assessment of results (in the dimension of Processes), and Financial and operational, Market and Society (in the dimension of Results). Overall, the questionnaire has 43 questions.

The Innovation Scoring is based in two criteria for evaluation: the *Approach* (e.g. what is envisaged by the company), and the *Implementation*, (e.g. what is practice by the company). Most questions are evaluated through a quantitative indicator regarding its *Approach* and *Implementation* score within the company (annex Table 1). The sole exception to this is in the dimension of Results, which considers only the *Implementation* quantitative scoring.

The *Approach* evaluation has a quantitative scale based on its different qualitative levels: *non-existent* with 0 points, *reactive* with 1 point, *defined* with 2 points, *integratted* with 3 points and *excellent* with 4 points. The Implementation scores have also different attributions: *weak* with 0 points, *less developed* with 1 point, *reasonable* with 2 points, *highly developed* with 3 points and *excellent* with 4 points. The final Innovation Scoring results from the weighted sum of the lowest classified answers between the *Approach* and the *Implementation* (annex 1 presents the quantitative results, weights and totals).

In order to focus on analytical issues, the authors selected only the most relevant Tech-Train replies leaving in Annex all 43 answers (Annex 2). Consequently, a ranking with the highest and the lowest scores was elaborated to select the most relevant ones, resulting from the application of the Innovation Scoring, and is presented in the following Chapter, Figure 2. The ranking was then denied in four categories (colours) in order to highlight the different levels of scores in a comparable percentage scale: From 0 percent to 25 percent using red, from 26 percent to 50 percent using blue, from 51 percent to 75 percent using green and from 76 percent to 100 percent using black.

3. Case study

3.1. The railway branch of the Portuguese subsidiary

The company Tech-Train is the railway branch of Tech Portugal SA, the Portuguese subsidiary of a foreign multinational here named Tech Group[7].

Tech-Train is part of the multinational history in Portugal, which started in the 1940's with a series of acquisitions within the metallurgic sector. Today, Tech Group through its subsidiary Tech Portugal SA, has a significant market share in different business areas, exporting 80 percent of its factories' production. With a volume of sales of 88 thousand million € in 2009, Tech Portugal has about 300 employees, of which 174 graduates from high school, 67 from university (ISCED[8] 5) and two with a master degree (ISCED 6).

The branch Tech-Train registered a sales volume of 5.7 thousand million € in 2009, with orders growing nine percent per year, employing 12 persons of whom six have tertiary education: Four are engineers and two have non-engineering university degrees (ISCED 5). One engineer and one non-engineering employees have also a masters degree (ISCED 6).

The branch Tech-Train sells and maintains rolling stock, signalling, rail infrastructures and engineering rail systems solutions. Its main clients are rail operators such as the public CP[9], the private Fertagus, public transport companies, such as Carris and Metro do Porto, and infrastructures managers such as the public Refer. Tech-Train has a joint business with CP's maintenance company named EMEF[10].

Tech-Train's main mission is costumer satisfaction, customizing its global solutions to the local market needs, in all segments of the rail market. In order to gain market position against its major competitors, Tech-Train anticipates its costumers' needs through collaborative R&D projects and Innovation (R&D+I) at a pre-market stage. In fact, Tech-Train launched its Railway Knowledge Centre, to foster joint research between industry,

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[7] As mentioned above, the names used are fictitious, to avoid revealing details of the company.
[8] ISCED, International Standard Classification of Education, Paris, UNESCO Institute for Statistics (1997), pp. 49
[9] Caminhos de Ferros de Portugal.
[10] Empresa de Manutenção de Equipamento Ferroviário.

universities and component suppliers on a project based approach. Its strategy for R&D+I is developed in 3 axes: 1) Network: protocols with universities and R&D cooperation agreements with component suppliers; 2) R&D projects; and 3) Education and training.

Recently the Portuguese law imposing a one percent of R&D investment in Portugal for each public contract above 25 million € (in place since 2008 by Decreto Lei 18/2008 and Portaria 701-J/2008) to suppliers contributed to increase Tech-Train R&D+I activities in Portugal. As a result, Tech-Train already established protocols with the main Portuguese universities (for example, the University of Porto and Technical University of Lisbon), is an Industry Affiliate to MIT[11] and has two significant R&D projects supported by the national funding scheme QREN[12], one on innovative maintenance and the other on bio-materials. In 2009 Tech-Train launched a design challenge to 200 students from six Schools, to decorate the interior of its latest model of trains. Taking all these R&D+I activities, Tech-Train announced in 2009 a 12 million € leverage investment on R&D for the next five years in Portugal. Given the R&D+I activities described above, the knowledge flows is summarized in the following figure.

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[11] Massachusetts Institute of Technology
[12] National Strategic Reference Framework.

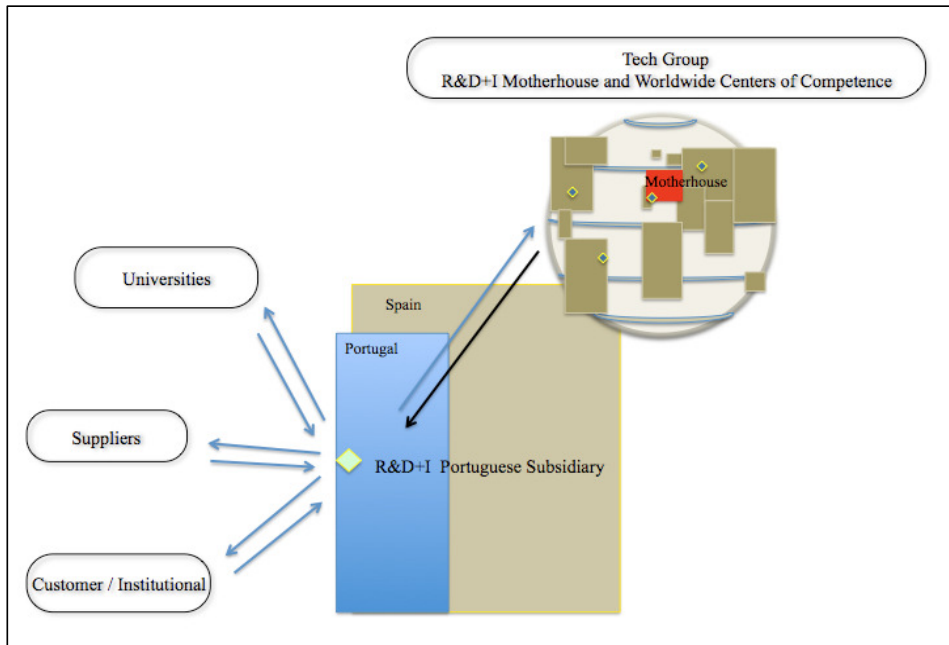*Figure 1: Knowledge relations in the Portuguese railway branch*

Figure 1 illustrates Tech-Train' knowledge relationship (input and output) with its motherhouse and centres of competences spread around the world, as well as with its network of Portuguese universities, suppliers, customers and national institutions.

3.2. Most significant results

Tech-Train innovation strategy is part of the global innovation strategy of the multinational motherhouse. It follows a bottom-up approach to innovation, axed on the collaboration with its network partners and on a project-based approach, regulated bilaterally by cooperation and confidentiality agreements, as well as by consortia agreements when more than one partner is involved. This strategy aims to satisfy local market needs or to find local competitive innovative solutions, to integrate in their worldwide products. However, such operational innovation strategy takes place within a

quite complex management business structure, which seams to justify some difficulties that delayed the implementation of the Innovation Scoring.

Figure 2 summarizes the results of the application of the questionnaire to Tech-Train. The following paragraphs discuss the Tech-Train most relevant responses to the Innovation Scoring questionnaire, collected and scored by the authors, selected from the ranking of the results found in Annex 1 and Annex 2.

Figure 2: Ranking of the results by themes found through the application of questionnaire to Tech-Train
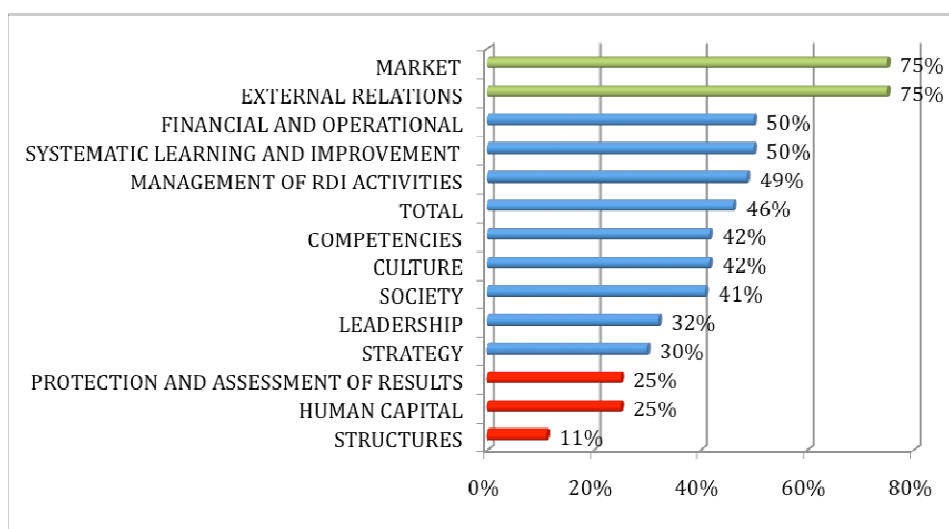
The analysis of Figure 2 points to two main conclusions: first, Tech-Train scored the highest on market and external relations both with 75 percent; secondly, the worst scorings were primarily the existence of R&D+I Management Structures with 11 percent, followed by protection and assessment of results and human capital both with 25 percent.

These results are consistent with findings showing that Tech Group has mainly a commercial strategy towards Portugal in its railway business area. In fact, the two best results were in themes linked to a commercial strategy, namely market and external relations of the company. On the contrary, the worst results were in areas more related to organizational management of innovation, such as R&D+I management structures, protection and assessment of results and human capital.

Given the analytical value of the answers in the best and worst rated theme to the innovation assessment of Tech-Train, it seems productive to focus specially on these questions. Therefore, given that the highest ratings of 75 percent concerning *Market (Results)* and *External Relations (Resources)*, Tech-Train reply was as follows:

In the *Market* theme, all the four questions scored 3 points on the *Implementation*:

Question 38 was "Has the innovation a positive impact on the market share of the organization and on its expansion to new markets?" In this question Tech-Train was rated as *Highly Developed Implementation* (3 points). The justification for this score was that, in fact, Tech-Train is being successful using innovation to increase its market share. It has been a valuable tool to conquer market from competition and to enter into new market segments.

Question 39 was "Has the development of the weight of new products and services in the total business volume been positive?" Tech-Train was rated as *Highly Developed Implementation* (3 points). The justification for this score was that Tech-Train embeds its motherhouse culture, where innovation is key to increase business volume. Tech Group incorporates the latest high-tech solutions. In Portugal, Tech Group is involving its customers and bringing in its suppliers to the group's innovation activities and processes. The results are not yet seen in the Portuguese railway market, as it is quite static with a small volume of orders, while it is notorious in other markets where Portuguese component suppliers contribute to Tech Group increase of its market share. Until now, no metric system was given to calculate the effective relation between innovative products and business volume, as Tech-Train sales of trains is calculated on the formula given by the client in the tender, which does not include innovation (usually it is based on cost, technical quality of the product, guaranty and the quality of the engineering team).

Question 40 was "Has the contribution of innovation to the image and reputation of the organization and its products been positive?" Tech-Train was rated as *Highly Developed Implementation* (3 points).

The justification for this score was that Innovation is a key factor in Tech-Train image and branding, both for the Group and for the subsidiary. Tech Group image and main

driver is the product of environmental and design innovation. Tech Group is the sole railway company with a design department often referred in magazines, and often releases new products in railway trade shows, such as Innotrans.

Question 41 was "Have the innovation activities of the organization had a positive impact on the activity sector?" Tech-Train was rated as Highly Developed Implementation (3 points). The justification for this score was that Tech Group is considered a leader in railway technology, not only due to its own developments but also by bringing suppliers from other sectors into its value chain, such as in aeronautics, in automotive and in information technology. Good examples of implementation of innovation are, for instance, its trains which are 95 percent recyclable, as well as its tram-trains recovering 90 percent of their breaking energy into power energy. In Portugal, Tech Group introduced the concept of having end-users designing the interior of their own trains, involving schools, professional designers and interior suppliers working together. The Group is also involved in launching PRIA[13] promoting the integration of the Portuguese component suppliers in the rail supply chain.

In what concerns *External Relations*, both questions scored 3 points on the *Approach* and the *Implementation*:

Question 21 was "Does the organization develop systematic cooperation actions on innovation with external entities?" and Question 22 was "Does the organization boost many ways of networking? In both questions Tech-Train was rated as *Integrated Approach* (3 points) and *Highly Developed Implementation* (3 points). Tech-Train R&D+I activity in Portugal is open and relies on joint projects and networking. Due to increase in outsourcing and need to customise its global solutions to the local market, Tech-Train often promotes research activities with its suppliers, universities and customers as means to find innovative solutions improving the performance of its products and market acceptance. The recent Portuguese law imposing 1 percent of R&D reinforced such an approach. Therefore, Tech-Train is looking for greater involvement with R&D+I stakeholders, such as component suppliers, universities and customers, at a

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[13] PRIA - Portuguese Rail Industry Association

pre-market stage, developing a more systematic cooperation with them and expecting to follow to the market stage.

In contrast, Tech-Train worst ratings of 25 percent goes to the themes *Protection and Valorization of Results (Processes)* and *Human Capital (Resources)* and 11 percent goes to *R&D+I Management Structures (Resources)*.

In what concerns *Protection and Valorization of Results*, the single question was rated one point in both *Application* and *Implementation*.

Question 35 was "Has the organization defined processes for evaluating and deciding on the protection and assessment of its intellectual capital and the results of R&D+I activities?" Tech-Train was rated as Reactive Approach (1 point) and Less Developed Implementation (1 point). Tech-Train has no formal evaluation processes or autonomy of decision. It is centralized in its motherhouse. Tech Group technical director has in hands the procedure to assure its conformity with the company's overall strategy, confidentiality policies, property rights and available resources. Tech-Train suppliers only have to report.

Furthermore, in what concerns the theme *Human Capital*, the three questions were rated 1in both *Approach* and *Implementation*, except for the last question rated as 2 points in the *Approach*.

The following two questions refer to: Question 13 **"**Has the organization a Human Capital policy oriented to innovation?" and Question 14 "Has the organization a training policy for its staff, oriented to innovation?" In these questions Tech-Train was rated as *Reactive Approach (1 point)* and *Less Developed Implementation* (1 point). Last, Question 15 was "Does the organization stimulates and supports creativity and innovative initiative from its staff?" In this question Tech-Train was rated as *Defined Approach* (2 points) and *Less Developed Implementation* (1 point).

The answer to these questions can be aggregated in a single reply, as Human Resources in the Portuguese branch has no particular orientation on this matter. It is up to the rail Customer Director to manage and organise its team, in what concerns activities on innovation. The rail team in Portugal has about 12 persons (2 have a master degree) with

4 engineers and 2 with non-engineering university degrees. Innovation activities depend on individual initiative, spread between Commercial and Marketing Department, Maintenance and technical support staff. There is one person working full-time on innovation, acting as project officer supported by the other colleagues, according to the technical capabilities needed for the specific R&D project. This person's job title is Market Development, and it reports to the Costumer Director in Portugal and to the motherhouse's Technical Department. The annual Employee Evaluation Assessment released by the Human Resources is the only mechanism where employees can be evaluated for their contribution to the company's innovation culture, in item "others".

In the *R&D+I Management Structures* theme, two of the three questions were rated 0 points in both *Application* and *Implementation*, and one was ratted with two points also in both *Application* and *Implementation*.

In Question 23 "Has the organization an organizational structure dedicated to R&D+I activities?" and 24 "Has the organization an adequate structure for managing knowledge?", Tech-Train was rated as *Non Existent Approach* (0 points) and *Weak Implementation* (0 points). In Question 25 "Has the organization information and communication systems enabling innovation?" Tech-Train was rated as *Defined Approach* (2 points) and *Reasonable Implementation* (2 points).

According to the information collected, Tech-Train has no defined internal structure for R&D+I activities. The team of R&D+I changes according to the technical skills needed for the project, and often involves the technical leadership of the motherhouse. However, it is always the same person who usually manages the R&D project and the external network. As patents are centralized in the motherhouse, Tech-Train protection mechanisms are confidentiality agreements and consortium agreements. However even these ones have to comply with the motherhouse procedures and to be approved by its legal and technical departments. Share of know-how and communication are held on a project base demand, and limited to the duration of the project.

3.3. Some conclusions about the case studies

Several conclusions can be drawn from the application of the Innovation Scoring questionnaire to the Portuguese rail branch Tech-Train: first, a significant difference was found between the *Approach* and *Implementation* scorings; second, the reported R&D+I activities appeared from factors exogenous to the Portuguese branch; and third, the innovation activities of the rail branch reflect the different degrees of openness defined by the multinational in its motherhouse.

On the first conclusion one can say that the difference between the *Approach* and *Implementation* scorings can be attributed to three factors:

a) Tech-Train activity is mainly commercial, selling trains, maintenance and railway engineering solutions, and only recently innovation has been associated to its strategy;

b) Despite the good knowledge of innovation management tools and existing norms, the innovation activities of Tech-Train are not structured. They are mostly based on the goodwill of its collaborators and top management; and

c) Tech-Train innovative approach in Portugal is based on a close relationship with the Group, its suppliers, the universities and its clients for joint R&D+I.

On the second mentioned conclusion (innovation activities of Tech-Train are not structured), in fact, the R&D+I strategy was set by the motherhouse, and was mostly imposed by the Portuguese law requiring one percent of R&D investment for bids above 25 million € as well as driven by the market expectations of growth for the coming years.

In core technical areas (e.g. structures, boogies, cables and energy conversion) R&D+I activities are highly protected, and tend to be concentrated in the motherhouse by the core team of engineers of the Group. This reflects the mentioned third conclusion. In a slightly different way, and to the technical areas relevant to the Group but outside its core engineering competences (e.g. communications, signalling and monitoring of maintenance), R&D activities are subject to restrictive innovation controlled by worldwide centres of competences. At this level a few Portuguese companies and

universities were involved in R&D mostly on a bilateral basis, in which the Portuguese partner worked either with the core team of engineers at the motherhouse or with a centre of competence anywhere in the world. Lastly, in areas that can be subject to outsourcing (e.g. panels, seats, windows, toilets, refrigeration, information technology systems, etc), R&D+I activities tend to be fully shared with suppliers invited to co-develop innovation activities.

Summarizing, it is too early to address the question on how much knowledge will be created or fixed in Portugal using taxpayers' money to develop rail transport and in particular high-speed-trains. On one hand, the national law enforcing one percent of R&D investment for bids above 25 million € provides a good framework to retain knowledge, although much remains in the hands of the government to be negotiated with multinational groups, such as Tech Group. On the other hand, the technological driver created by this kind of public investment will depend on the multinational's policy for innovation, and its knowledge strategy towards non-core activities of their high-speed trains, particularly in relation to small markets like the Portuguese one.

4. Concluding remarks

The questionnaire was a useful tool to get acquainted with Tech-Train, to understand its innovation processes and it provided a good source for R&D+I diagnosis. It represents a fine instrument to support decision-making. Besides, the tool allows for an internal reflection on where the concerned organisation is and where it wants to be, in terms R&D+I.

However, the questionnaire is time demanding if it has to be applied in depth by employees with heavy workloads, and it requires a high degree of inter-department coordination. Therefore, the Innovation Scoring risks to be left aside when facing difficulties, such as other job obligations or poor inter-department communication.

Furthermore, it seems that the questionnaire was designed for companies which have a single decision centre in Portugal and direct report lines. Therefore, an organisation like Tech-Train, with multi-decision centres and asymmetric management interactions, might find the questionnaire unadjusted and complex to a certain extent.

In order to overcome the abovementioned barriers, it could recommend to companies to use a consultant or any other external third party, to steer this process assisting the employees on this task. In addition, workshops and training sessions could be made available, depending on the degree of difficulties and barriers. This strategy would allow for language harmonisation, decrease misinterpretations, overcome emotional replies and avoid relational or hierarchical constraints.

The reduction or comprehension of the 43 questions to minimize the initial negative impact of its load could also be suggested. Very often employees are under pressure with their everyday tasks, and R&D+I staff usually are not administrative or bureaucratic oriented. Such reduction of questions can be overcome if the questionnaire is held by consultants or any other external entity.

Moreover, it might be interesting to add the questionnaire a product profile and evaluation, since this would empower the tool with a complete assessment of the innovative technology included in the products of the company. However, this might be a difficult task since it can cross the core competences of the company.

Finally, there are two main weaknesses in this paper that should be further investigated. First, the methodology used to quantify and weight the indicators and to construct the final composite indicator, needs to be critically addressed. Second, the work needs further research on innovation assessment on train subsidiaries and branches around the world, which could contribute to its theoretical integration and comparison of the results found in this paper.

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Annex 1 - Innovation Scoring questionnaire results

		approach					implementation					weight	total
		non-existent	reactive	defined	integrated	excellent	weak	less developed	reasonable	highly developed	excellent	weight	total
CONDITIONS		**CULTURE**											
	1	Do the values of the organization promote adaptability, experiment, learning and continuous change?			2				1				20	20
	2	Do the values of the organization promote international openness?				3					3		15	45
	3	Does the internal communication of the organization integrates various perspectives, using formal and informal mechanisms of circulating information and sharing knowledge?				3				2			20	40
	4	Does the organization's culture stimulates entrepreneurship and the capacity to take risks, without penalizing failures?			2				1				20	20
		LEADERSHIP											
	5	Do top-management transmits an innovative vision that orients the definition of purposes and the strategy of the organization?			2					2			20	40
	6	Do top-management systematically promotes the adaptation of leadership structures, in order to deal with change?			2				1				15	15
	7	Do leadership structures promote the appearance of leaders for developing innovative activities through the responsibility and autonomy of its staff?			2				1				15	15
	8	Do top-management makes an effort and assume responsibility in the management of innovation?			2				1				20	20
		STRATEGY											
	9	Has the organization a clear and shared innovation strategy, engaging the staff in its definition?			2				1				20	20
	10	Does innovation strategy appear as a plan of action with quantitative purposes and targets on medium and long term?			2				1				20	20
	11	Has the organization a marketing strategy that supports and values the activity of innovation, consistent with the business model and processes?			2				1				20	20
	12	Has the organization a business-intelligence monitoring system, and uses it in the definition and implementation of its innovation strategy?				3				2			15	30
RESOURCES		**HUMAN CAPITAL**											
	13	Has the organization a Human Capital policy oriented to innovation?		1					1				20	20
	14	Has the organization a training policy for its staff, oriented to innovation?		1					1				15	15
	15	Does the organization stimulates and supports creativity and innovative initiative from its staff?			2				1				20	20
		COMPETENCIES											
	16	Does the organization systematically proceeds to the identification, consideration and planning of the development of its organizational competencies?			2					2			20	40
	17	Has the organization specific competencies in the management of R&D+I?		1				0					20	0
	18	Has the organization has the adequate technical competencies for performing R&D+I activities?		1					1				20	20
	19	Has the organization specific competencies related to activities concerning production and/or services?				3					3		15	45
	20	Has the organization specific competencies related to its marketing activities?				3					3		15	45
		EXTERNAL RELATIONS											
	21	Does the organization develops systematic cooperation actions on innovation with external entities?				3					3		20	60
	22	Does the organization boost many ways of networking?				3					3		10	30
		STRUCTURES											
	23	Has the organization an organizational structure dedicated to R&D+I activities?	0					0					20	0
	24	Has the organization an adequate structures for managing knowledge?	0					0					15	0
	25	Has the organization information and communication systems enabling innovation?			2					2			10	20
PROCESSES		**MANAGEMENT OF RDI ACTIVITIES**											
	26	Does the organization develop systematic processes for planning, organizing, monitoring and controlling R&D+I projects?		1					1				35	35
	27	Does the organization develop systematic processes for understanding needs, expectations and market opportunities?				3					3		30	90
	28	Has the organization systematic processes for generating, identifying and selecting ideas and concepts of new products, processes, services and business and/or organization models?			2					2			30	60
	29	Does the organization develop systematic processes for interdepartmental co-operation?		1					1				25	25
	30	Has the organization well-defined routines for building and defining tasks concerning the project teams?				3					3		20	60
	31	Has the organization processes for systematic management and evaluation of innovation activities?		1					1				25	25
	32	Does the organization develop systematic processes of innovation concerning the management of chain/value system activities?				3					3		25	75
		SYSTEMATIC LEARNING AND IMPROVEMENT											
	33	Does the organization incorporate into its activities all the learning obtained?			2					2			25	50
	34	Has the organization systematic devices for adopting good practices?			2					2			20	40
		PROTECTION AND ASSESSMENT OF RESULTS											
	35	Has the organization defined processes for evaluating and deciding on the protection and assessment of its intellectual capital and the results of R&D+I activities?		1					1				25	25

		implementation					weight	total
		weak	less developed	reasonable	highly developed	excellent	weight	total
RESULTS		**FINANCIAL AND OPERATIONAL**						
	36	Do R&D+I activities make a positive contribution to the financial development of the organization?			2			60	120
	37	Does the intellectual capital of the organization make a positive contribution to financial development?			2			25	50
		MARKET						
	38	Has the innovation a positive impact on the market share of the organization and on its expansion to new markets?				3		60	180
	39	Has the development of the weight of new products and services in the total business volume been positive?				3		40	120
	40	Has the contribution of innovation to the image and reputation of the organization and its products been positive?				3		30	90
	41	Have the innovation activities of the organization had a positive impact on the activity sector?				3		30	90
		SOCIETY						
	42	Has Innovation of the organization a positive impact in terms of qualified job creation and generation of externalities?	0					25	0
	43	Has innovation of the organization positive implications concerning Sustainable Development?				3		30	90
		Innovation Scoring Final							**461**

Annex 2 – Answers to the questionnaire

I. Conditions

Culture

Question 1 - Do the values of the organization promote adaptability, experiment, learning and continuous change?

Question 1 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point).*

Tech-Train reflects the motherhouse culture, open to innovation. As it has a light organizational structure in Portugal, the branch is open to co-developments with its suppliers, and there is a direct dialogue between its team of engineering and high management in Portugal. However, it is worth mentioning that this does not happen in other business branches, reflecting the heritage of the traditional metallurgic companies acquired in Portugal, with a less flexible management structure. Despite the company's innovation approach, its implementation is weak as it lacks an organizational instrument alike the ones developed by the motherhouse. Tech Group has for instance its own academy, promotes innovation awards within its workers and has well defined centres of competence on different areas responsible for the research of innovative solutions.

Question 2 - Do the values of the organization promote international openness?

Question 2 was rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

Tech-Train is international by nature, reflecting the international culture of the motherhouse. Often the company promotes meetings and projects with its team of engineers in Portugal and the Group's development centres worldwide, as well as with Portuguese suppliers, clients and universities. In Portugal the company applies all the international standards and procedures aligned with the motherhouse, and transfer them to its supply chain. An example of this is IRIS[14] certification, unique to the railway sector for the evaluation of management systems across the supply chain.

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[14] International Railway Industry Standard. Link http://www.iris-rail.org/.

Question 3 - Does the internal communication of the organization integrate various perspectives, using formal and informal mechanisms of circulating information and sharing knowledge?

Question 3 was rated as *Integrated Approach (3 points)* and *Reasonable Implementation (2 points).*

The way know-how is shared and the communication instruments are used, mirrors the level of maturity reached by the innovation culture of Tech-Train. From what was said in Question 1, this happens within an integrated approach, but informally and bottom-up. Furthermore, there is no formal mechanism supporting it. The same happens with the communication and share of know-how with the Group, justified by the fact that in Portugal a centre of competence does not exist, as it happens for example with the subsidiary in Spain, with its Design and Sub-Systems interiors. There is also a generational gap between the "old" and "new" engineering workers, which difficult information flows inside the branch. The positive element is that informality allows for a direct communication with high management and with the Group. However, informality is very much dependent on the individual initiative. Furthermore, the communication of innovation activities is done on an individual initiative basis, such as participation at conferences, publication of articles in the internal newsletter and magazines, etc.

Question 4 - Does the organization's culture stimulate entrepreneurship and the capacity to take risks, without penalizing failures?

Question 4 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point).*

Each R&D project held by the company is managed by the Project Officer, alike an autonomous activity. Tech-Train supports the risk of the project preparation and taking-off, if well justified and integrated inside the subsidiary engineering activities. The project's responsible has to build its technical and business case, not only towards its management team in Portugal but also with the core technical team of the motherhouse. Despite the Group' R&D+I integrated approach, the Portuguese subsidiary does not reflect this. In fact, this is limited to a micro universe of persons depending again on the individual initiative.

Leadership

Question 5 - Do top-management transmit an innovative vision that orients the definition of purposes and the strategy of the organization?

Question 5 was rated as *Defined Approach (2 points)* and *Reasonable Implementation (2 points)*.

Tech Portugal SA top-management, supports a competitiveness vision axed on innovation. They are personally involved in the promotion of the organisation's public communication, support several inherent initiatives and are engaged in setting an innovative culture inside the structure. For example, its President is personally involved in the Railway Knowledge Cluster dedicated to promote a network of joint research with its partners in Portugal. However, due to its recent launching it is too soon to evaluate this initiative.

Question 6 - Do top-management systematically promote the adaptation of leadership structures, in order to deal with change?

Question 6 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point)*.

The live cycles of the railway branch are directly linked to its order book. Due to its small dimension in Portugal, the time between bids is published and contracts are signed, the leaders and teams of engineers are fully allocated to the project and the resources available for parallel research are scarce. Consequently, innovation happens in counter cycle to the business cycle. For the purpose of R&D resources management, it is therefore important to map the following commercial bids in order to overcome the human resources reallocation to commercial activities, similarly to what happens with any Small and Medium Company (SME).

Question 7 - Do leadership structures promote the appearance of leaders for developing innovative activities through the responsibility and autonomy of its staff?

Question 7 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point)*.

Tech-Train's bottom-up innovation activity implies a self-initiative and autonomy from its employees. Top management only requirement is a balanced business case of the envisaged activity and compliance with the strategies of the subsidiary and the Group. The branch covers the risk of launching the project, but requires a return on investment. The employee has to manage the project, warranting at all stages coordination with its motherhouse and the concerned engineering teams worldwide.

Question 8 - Do top-management make an effort and assume responsibility in the management of innovation?

Question 8 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point)*.

Top-management is directly involved in the R&D+I bottom-up activities, responsible for approving innovation objectives, communication and resources. However, the railway branch still lacks incentive instruments and a proper framework structure to promote and award employee innovation initiatives.

Strategy

Question 9 - Has the organization a clear and shared innovation strategy, engaging the staff in its definition?

Question 9 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point)*.

Following Tech Group global innovation strategy, Tech-Train has in place a defined bottom-up strategy for innovation, however not yet sufficiently developed inside the organization. It should be noticed that although the branch allows time for innovation activities, their engagement in the strategy depends on the involvement of its collaborators and individual merit.

Question 10 - Does innovation strategy appear as a plan of action with quantitative purposes and targets on medium and long term?

Question 10 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point)*.

The existing action plan is held on a project-based approach. In fact, each project presents its own action plan with budget, risk management, communication, targets and calendar plans. Individual action plans are defined but not integrated nor quantified in the overall innovation strategy.

Question 11 - Has the organization a marketing strategy that supports and values the activity of innovation, consistent with the business model and processes?

Question 11 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point).*

Tech-Train innovation strategy for railways exists as means to a competitive business model, mostly monitored by the marketing and business development unit. It is therefore part of the marketing strategy for the country and considered as a relevant instrument to obtain market share.

Question 12 - Has the organization a business-intelligence monitoring system, and uses it in the definition and implementation of its innovation strategy?

Question 12 was rated as *Integrated Approach (3 points)* and *Reasonable Implementation (2 points).*

Tech-Train benefits from the Group's worldwide technological monitoring and its global network of suppliers. The motherhouse is a world leader in most product innovation in the railway sector. Therefore the Portuguese subsidiary through its rail business branch channels-in worldwide technology innovations to the local market and, on the other hand, it contributes to the dissemination of locally developed technology, thus attaining international visibility. Tech-Train participates and contributes in international conferences and fairs (such as InnoTrans[15]), scientific meetings, literature analysis, benchmarking studies, experts groups, etc.

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[15] InnoTrans is an international platform for buyers and sellers of passenger and freight transport technology. InnoTrans has become established as an international industry showplace focusing on Railway Technology. A full range of rail vehicles are presented in static displays on the Messe Berlin tracks located outside the exhibition halls. Other key InnoTrans features include Railway Infrastructure, Interiors, Public Transport and Tunnel Construction. Link: http://www1.messe-berlin.de.

II. Resources

Human Capital

Question 13 – Has the organization a Human Capital policy oriented to innovation? Question 14 - Has the organization a training policy for its staff, oriented to innovation? Question 15 – Does the organization stimulate and support creativity and innovative initiative from its staff?

Questions 13 and 14 was rated as *Reactive Approach (1 points)* and *Less Developed Implementation (1 points).*

Question 15 was rated as *Defined Approach (2 points)* and *Less Developed Implementation (1 point).*

The answer to these questions can be aggregated in a single reply, as Human Resources in the Portuguese branch have no particular orientation on this matter. It is up to the rail Customer Director to manage and organise its team, in what concerns activities on innovation. The rail team in Portugal has about 12 persons (2 have a master degree) with 4 engineers and 2 with non-engineering university degrees. Innovation activities depend on individual initiative, spread between Commercial and Marketing Department, Maintenance and technical support staff. There is one person that works full-time on innovation, acting as project officer supported by the other colleagues, according to the technical capabilities needed for the specific R&D project. This person's job title is Market Development, and it reports to the Costumer Director in Portugal and to the motherhouse's Technical Department. The annual Employee Evaluation Assessment released by the Human Resources is the only mechanism where employees can be evaluated for their contribution to the company's innovation culture, in item "others".

Organizational Skills

Questions 16 - Does the organization systematically proceed to the identification, consideration and planning of the development of its organizational competencies?

Question 16 was rated as *Defined Approach (2 points)* and *Reasonable Implementation (2 points).*

A prospective analysis of organizational competencies is made on a regular basis by the top management. This analysis is based on the collection of data, benchmarking with competition, action plans, etc, and reported to the motherhouse. It is a top-down process and quite centralized in the Customer Director and elaborated in collaboration with the person fully in entrusted of innovation.

Question 17 - Has the organization specific competencies in the management of R&D+I?

Question 17 was rated as *Reactive Approach (1 points)* and *Weak Implementation (0 points)*.

Although there is a strategy, the company has no action plan for the management of the R&D+I activities. It has a reactive approach depending on the approval and involvement of the Technical Department of the motherhouse. There is no particular definition of the projects portfolio, reports on the developments of the project, no tools to manage R&D+I or a given budget to R&D+I activities. Therefore, it is quite difficult to account how much of the company resources are allocated to R&D+I and, more specifically, to its management.

Question 18 - Has the organization the adequate technical competencies for performing R&D+I activities?

Question 18 was rated as *Reactive Approach (1 point)* and *Less Developed Implementation (1 point)*.

The employees of the company are skilled, some of them with many years of experience and deep knowledge of the Portuguese railway market. The person that is responsible for innovation has training and experience in R&D+I project management is the only one person qualified to assure the quality of the projects and control its risks. R&D+I are mostly done in collaboration with outside entities, from suppliers to universities. The integration of the project to the organization main needs and challenges are steered by the motherhouse group of engineers. Tech-Train is therefore involved in national research

projects, such as innovative maintenance, biomaterials, innovative train interiors, Eureka[16], and participates in European projects.

Question 19 - Has the organization specific competencies related to activities concerning production and/or services? Question 20 - Has the organization specific competencies related to its marketing activities?

Questions 19 and 20 were rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

The Portuguese railway branch Tech-Train has no specific competencies in terms of production. Its competencies are found in directed to servicing, in whatever concerns supply and maintenance of the trains. The branch has skills in terms of marketing. For example, Tech-Train often promotes technical workshops and open days with clients and suppliers.

External Relations

Question 21 - Does the organization develop systematic cooperation actions on innovation with external entities? Question 22 - Does the organization boost many ways of networking?

Questions 21 and 22 were rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

Tech-Train R&D+I activity in Portugal is open and relies on joint projects and networking. Due to increase in outsourcing and need to customise its global solutions to the local market, Tech-Train often promotes research activities with its suppliers, universities and customers as means to find innovative solutions improving the performance of its products and market acceptance. The recent Portuguese law imposing 1 percent of R&D reinforced such an approach. Therefore, Tech-Train is looking for greater involvement with R&D+I stakeholders, such as component suppliers, universities and customers, at a pre-market stage, developing a more systematic cooperation with them and expecting to follow to the market stage. Furthermore, the rail branch have so far established several protocols with the main Portuguese Universities, mostly on

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[16] Eureka, is the Europe World-Wide Network for market oriented R&D - http://www.eurekanetwork.org/

engineering, such as FEUP[17], IST[18], Universidade do Minho, Universidade de Aveiro, Universidade Nova de Lisboa, Faculdade de Arquitectura de Lisboa and IADE[19]. Tech-Train, through Tech Portugal, is also an Industry Affiliate to MIT[20]. It also has R&D projects funded by QREN[21], such as projects concerning innovative maintenance, bio-materials and train interiors. One of its initiatives in 2009 was a design award, challenging over 200 students from 6 Schools to decorate the interior of its latest model of trains. In all Tech-Train announced a 12 million € leverage investment on R&D in Portugal for the next 5 years to come.

R&D+I Management Structures

Question 23 - Has the organization an organizational structure dedicated to R&D+I activities? Question 24 - Has the organization an adequate structure for managing knowledge? Question 25 - Has the organization information and communication systems enabling innovation?

Questions 23 and 24 were rated as *Non Existent Approach (0 points)* and *Weak Implementation (0 points).*

Question 25 was rated as Defined Approach (2 points) and Reasonable Implementation (2 points).

According to the information collected, Tech-Train has no defined internal structure for R&D+I activities. The team of R&D+I changes according to the technical skills needed for the project, and often involves the technical leadership of the motherhouse. However, it is always the same person who usually manages the R&D project and the external network. As patents are centralized in the motherhouse, Tech-Train protection mechanisms are confidentiality agreements and consortium agreements. However even these ones have to comply with the motherhouse procedures and to be approved by its legal and technical departments. Share of know-how and communication are held on a project base demand, and limited to the duration of the project.

III. Processes

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[17] FEUP – Faculdade de Enginharia da Universidade do Porto.
[18] IST – Instituto Superior Tecnico.
[19] IADE – Instituto de Artes Visuais, Design e Marketing.
[20] MIT – Massachusetts Institute of Technology.
[21] QREN - National Strategic Reference Framework - http://www.incentivos.qren.pt/

R&D+I Management

Question 26 - Does the organization develop systematic processes for planning, organizing, monitoring and controlling R&D+I projects?

Question 26 was rated as *Reactive Approach (1 point)* and *Less Developed Implementation (1 point).*

R&D+I accomplishments are measured on a result and market uptake basis. This assessment is shared between Tech-Train and its motherhouse, according to their expectations on customers' specifications in the order book and specific regulations of the Portuguese market. This activity crosses the commercial projects with the ones on R&D+I, in a flexible and informal way, dependent on direct communication between the commercial, marketing, technical and operational departments. There is no systemic practice in planning and organizing R&D+I activities. As these activities are directly linked to commercial projects, their failure or cancellation can, therefore, cause a negative impact on the R&D+I.

Question 27 - Does the organization develop systematic processes for understanding needs, expectations and market opportunities?

Question 27 was rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

Tech-Train R&D+I activities are closely linked to Market Development. It is the instrument to monitor local market developments, which include market studies, SWOT analysis, legislative and tender procedures, certification processes and specific technical needs. Besides being involved in R&D+I projects, the branch is also involved in other monitoring market activities in technology platforms and scientific networks, not only related to railways but also to other sectors, such as the Portuguese Technology Platform for Construction (PTPC[22]) and affiliation to MIT Portugal Program -Transport Systems[23]. In addition, technology transfer plays a relevant role because railway transport

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[22] PTPC – Platafoma Tecnológica Portuguesa de Construção, Link: http://www.ectp.org/ntps.asp
[23] Massachusetts Institute of Technology Portugal Programme Transport Systems focus area is the design of complex, large-scale systems that have major societal impact and provide opportunities for sustainable economic development - Link: http://www.mitportugal.org/programs/transportation.html

innovations mostly come from other technology sectors (e.g. materials, information technology, aeronautics and car industry).

Question 28 - Has the organization systematic processes for generating, identifying and selecting ideas and concepts of new products, processes, services and business and/or organization models?

Question 28 was rated as *Defined Approach (2 points)* and *Reasonable Implementation (2 points).*

Tech Group stimulates the identification of new ideas internally, across its different centres of competence spread around the world, as well as with their network of suppliers and universities. For example, one of its centres of competence in Europe jointly with breaking suppliers and some universities developed an innovative breaking system for tram-trains, converting 15 percent of the breaking energy into power supply. Another example is the co-development with raw-materials suppliers and local universities of a biomaterial solution for train interiors, allowing for weight and mass reduction with consequent energy saving. Tech Group communicates these and other innovative ideas at its annual Innovation Award. The Portuguese railway branch Tech-Train contributes to it, flagging existing local solutions aiming at its final integration in Tech Group global products.

Question 29 - Does the organization develop systematic processes for interdepartmental co-operation?

Question 29 was rated as *Reactive Approach (1 point)* and *Less Developed Implementation (1 point).*

Tech-Train relies significantly on inter-department cooperation due to its limited resources. The employee responsible for the R&D+I activities has a reactive and non-structured form of inter-departmental coordination and involvement of the subsidiary engineers in Portugal, as well as with the different centres of competence spread around the world.

Question 30 - Has the organization well-defined routines for building and defining tasks concerning the project teams?

Question 30 was rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

Tech-Train leaves a high degree of autonomy and responsibility to the project leader to assemble a team, which can be selected from the subsidiary Tech Portugal as well as from different centres of competence in the Tech Group. This is well integrated in the company activity and quite well developed.

Question 31 - Has the organization processes for systematic management and evaluation of innovation activities?

Question 31 was rated as *Reactive Approach (1 point)* and *Less Developed Implementation (1 point).*

There is no internal auditing to R&D+I activities. However, the organization's flexible structure allows for a direct monitoring of activities and an immediate access to results. Most of these activities engage more than one department, are mostly self-financed, and have regular reports to top management. However, such practices do not have any formal procedure of control, except for an excel database. Some projects funded by public authorities and in consortia have external auditors that help to evaluate innovation activities. However, in both cases, there is a project management plan, where milestones and deliverables are defined, and regular project meetings are held as well as continuous reporting.

Question 32 - Does the organization develop systematic processes of innovation concerning the management of chain/value system activities?

Question 32 was rated as *Integrated Approach (3 points)* and *Highly Developed Implementation (3 points).*

Innovation processes concerning the management of Tech-Train supply chain have an integrated approach and are highly implemented, because the increasing of outsourcing requires the co-development of solutions with suppliers. Frequently the branch requests suppliers for innovative solutions to solve specific technical problems. Furthermore, Tech-Train promotes events such as suppliers' days.

Learning

Question 33 - Does the organization incorporate into its activities all the learning obtained? Question 34 - Has the organization systematic devices for adopting good practices?

Questions 33 and 34 were rated as *Defined Approach (2 points)* and *Reasonable Implementation (2 points).*

The *Approach* and *Implementation* to incorporate learning is informal. Due to its light structure, Tech-Train best practices are brought by direct experience rather than theoretical know-how, and easily adopted. Although learning and good practices are informal, there is compliance with the general strategy of the company and it is closely monitored.

Protection and Valorisation of Results

Question 35 - Has the organization defined processes for evaluating and deciding on the protection and assessment of its intellectual capital and the results of R&D+I activities?

Question 35 was rated as *Reactive Approach (1 point)* and *Less Developed Implementation (1 point).*

Tech-Train has no formal evaluation processes or autonomy of decision. It's centralized in the motherhouse. Tech Group technical director has in hands the procedure to assure its conformity with the company's overall strategy, confidentiality policies, property rights and available resources. Tech-Train only has to report.

IV. Results

Finance and Operational

Question 36 - Do R&D+I activities make a positive contribution to the financial development of the organization?

Question 36 was rated as *Reasonable Implementation (2 points).*

R&D+I activities make a positive contribution to the financial development of the organization. Cost reduction is one of the main drivers for R&D+I activities, besides

increase of market share and customer satisfaction. It is difficult to measure R&D+I impact on the overall balance account of Tech-Train, because these activities are integrated in the Group's overall results, since the innovations are integrated in global solutions or processes.

Question 37 - Does the intellectual capital of the organization make a positive contribution to financial development?

Question 37 was rated as *Reasonable Implementation (2 points).*

The subsidiary Tech Portugal has a traditional account system, where human capital and know-how are not measured. However, quantification might be identified on a project basis, as it considers the number of hours of work and the project results are weighted.

Market

Question 38 - Has the innovation a positive impact on the market share of the organization and on its expansion to new markets?

Question 38 was rated as *Highly Developed Implementation (3 points).*

Tech-Train has been successfully using innovation to increase its market share. It has been a valuable tool to conquer market from competition and to enter into new market segments.

Question 39 - Has the development of the weight of new products and services in the total business volume been positive?

Question 39 was rated as *Highly Developed Implementation (3 points).*

The justification for this score was that Tech-Train embeds its motherhouse culture, where innovation is central to increase business volume. Tech Group incorporates the latest high-tech solutions. In Portugal, Tech Group is involving its customers and bringing in its suppliers to the group's innovation activities and processes. The results are not yet seen in the Portuguese railway market, as it is quite static with a small volume of orders, while that is notorious in other markets, where Portuguese component suppliers contribute to Tech Group increase of its market share. Until now, no metric system was given to calculate the effective relation between innovative products and business

volume, as Tech-Train sales of trains is calculated on the formula given by the client in the tender, which does not include innovation (usually it is based on cost, technical quality of the product, guaranty and the quality of the engineering team).

Question 40 - Has the contribution of innovation to the image and reputation of the organization and its products been positive?

Question 40 was rated as *Highly Developed Implementation (3 points).*

Innovation is key factor in Tech-Train image and branding, both for the Group and for the subsidiary. Tech Group image and main driver is environmental and design innovation. Tech Group is the sole railway industry with a design department often referred in magazines, and releases new products in railway trade shows such as InnoTrans.

Question 41 - Have the innovation activities of the organization had a positive impact on the activity sector?

Question 41 was rated as *Highly Developed Implementation (3 points).*

Tech Group is considered a leader in railway technology, not only due to its own developments but also by bringing suppliers from other sectors into its value chain, such as in aeronautics, in automotive and in information technology. Good examples of implementation of innovation are for instance its Trains which are 95 percent recyclable, as well as its Tram-Trains recovering 90 percent of their breaking energy into power energy. In Portugal, Tech Group introduced the concept of having the end-user designing the interior of its own train, involving schools, professional designers and interior suppliers by working together, and is also involved in launching PRIA[24] promoting the integration of the Portuguese component suppliers in the rail supply chain.

Society

Question 42 - Has Innovation of the organization a positive impact in terms of qualified job creation and generation of externalities?

Question 42 was rated as *Weak Implementation (0 points).*

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[24] PRIA - Portuguese Rail Industry Association

Tech-Train mainly sells trains, maintenance and railway engineering solutions to the Portuguese market, and recently associated innovation to its commercial activity. Innovation had a minor impact in terms of qualified job creation and externalities due to lack of orders. In this context, innovation remains marginal although several activities were developed: integration of graduates in other subsidiaries through protocols with the universities, participation in job-shops, involvement in the MIT cat-walk[25] and the organization of the People Quest Programme to promote internships. Tech-Train is also involved in other activities such as the European project promoting training within the railway sector, is a member of ADFER[26] and PRIA[27] and sponsors all the main railway events in Portugal.

Question 43 - Has innovation of the organization positive implications concerning Sustainable Development?

Question 43 was rated as *Highly Developed Implementation (3 points).*

Tech-Train R&D activities concerns with all the elements of sustainability: economic, environmental and social. However, they can only impact if considered within the Group.

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[25] MIT cat-walk – Massachusetts Institute of Technology Portugal Programme includes in its Master Programme for Transport a seminar called cat-walk, that alike a University job-shop, students have one to one meeting with the MIT Industry Affiliates to present their Curriculum Vitae and to Thesis Plan. Te objective with MIT cat-walk is to approximate the thesis field of study to the industry needs.
[26] ADFER - Portuguese Association for the Development of Railways
[27] PRIA – Portuguesa Railway Industry Association, launched in January 2010 by a group of Portuguese industries, Amorim Crock Composites, Caetano Components, Activespace Technologies, Alamadesign, Instituto de Soldadura e Qualidade (IPQ), Faculdade de Engenharia do Porto (FEUP) in collaboration with Techtrain Portugal, and with the support of AICEP (Agência para o Investimento e Comércio Externo de Portugal), aims at creating a railway cluster of Portuguese companies envisaging to supply to the rail market. PRIA main task is to promote the Portuguese technology solutions within the railway sector. As the association was recently launched there is no web site yet.