COMPETENCE AND RESOURCE ARCHITECTURE OF AN ORGANIZATION OF PUBLIC SAFETY: THE CRIMINALISTICS SERVICES OF THE STATE OF MINAS GERAIS/BRAZIL

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This paper maps the resources and competences, and builds an architecture of the criminalistics services of the State of Minas Gerais/Brazil. The service plays a key role in crime investigation. It applies science and technology to help police solve crimes. The perspectives of analyses are the resource-based view and competences. The methodological approach was by a case study. The results found that the ‘core competence’ is to link the crime scene to a suspect (or to innocent someone wrongly accused). The support for this competence comes from a reasonable system to search, document, and collect physical evidence at the crime scene, and from skilled and experienced staff. The first resource is supported by the competence of embodying new technologies, and the second, which also supports the first one, is the competence in training and forming skilled personnel. The model was suitable to map the resources, identify the competences, build the architecture, and analyse the service, under a strategic perspective. Finally, the research showed that the combination of a highly qualified human resources, technology and scientific knowledge is what empowers the role of criminalistics in the investigation of crimes.

Keywords: Resource-based view and competences, Public services operations management, Public Safety, Criminalistics
1. Introduction

The crime scene investigation and its procedures in collecting and dealing with evidences gained substantial notice in Brazil on account of violence escalation. Basically, forensic science is the application of science and technology in helping to solve crimes. It is made up of three large fields: - Forensic Pathology, Criminalistics and Identification. Criminalistics encompasses a variety of science fields, as physics, biology, chemistry, engineering, computer science, questioned documents, and so on. The professionals of this area come from a considerable variety of knowledge fields. TV series, like “CSI” (CBS, 2006) also help to increase the interest in this profession.

The goal of this paper is to map and analyze the Criminalistic Services of the State of Minas Gerais (MG) under the resource-based view (RBV) and competences perspective, in order to build an architecture inspired on Mills et al’s (2003) model. MG is the second State in population (approximately 20 million inhabitants) and the third richest in Brazil, with a total of 853 cities and towns. The service covers the entire State. It counts with 591 criminalists, besides police agents and clerical workers. In 2006, it responded to a total of 144,112 requests and issued 91,938 reports for police and court system. The reason of choosing this theoretical perspective is because it is a good starting point to map the resources and identify the competences, and at the same time to analyze the organization’s strengths and weaknesses.

This paper is justified owing to the role played by the service sector on the economy, particularly the public sector, and also on account of the importance on the strategic perspective of operations on services, in terms of costs, quality, and responsiveness.

This paper is divided into five sections, besides this introduction. The second one brings out the theoretical approach. The third is about the methodology. The fourth presents the results and discussions. The last one shows the final considerations.

2. Operations strategies

There are a lot of challenges and opportunities waiting for production and operations management (P/OM) in the services field, particularly in public health, homeland security and public safety. This is so inasmuch as “in homeland security good production and operations management thinking has become essential” (STARR, 2005). The author even suggests a governmental agency named “Public System Operations Management” (PS/OM) to insure safety and security. Slack (2005) sustains that the operations research does not reflect the weight of the service sector in the economy, that is, in most of the economies the service sector is dominant, but the majority of the research is about manufacture. And he goes further when he affirms that “unless academic operations strategy starts to reflect the balance of economic activity, it will become a manufacturing ghetto, increasingly irrelevant”. What both authors mean is that the operations management should expand its scope from manufacturing production to include all the processes in both manufacturing and services.

In the last three decades the operations strategy perspective has been highlighted by the literature. We can mention the main approaches: - SWOT (Strengths, Weakness, Opportunities, and Threatens) (SKINNER, 1969), the Porter’s five forces (1979), the emergent strategy (MINTZBERG, 1987), the core competences (PRAHALAD; HAMEL, 1990), and the resource-based view (RBV) (WERNERFELT, 1984). According to Slack (2005), both RBV and the core competence model are vitals, if the operations are to play a decisive role in helping the organization: “resource-based theory is clearly of central
importance to operations strategy”. The goal of this paper is to map the resources and analyze the competences of criminalistics services, a segment of Public Safety Department, under these two operations strategy perspectives: - the RBV and the core competences.

2.1 The resource based view and competences

The RBV approach received much attention after the 90’s, although the subject is not new on account of Penrose’s (1959) apud MILLS et al, (2003) theory on the growth of firms. She brought up the issue of the importance of tangible and intangible resources to the sustainability of long term competitive advantage. The RBV emphasizes the efficiency on the organization’s scarce resources and it might be a starting point with which to analyze the organization’s strengths and weaknesses (DE TONIA & TONCHIA, 2003).

First of all, it is necessary to define resources, competences, capabilities and routines. Resource is “anything which could be thought of as a strength or weakness of a given firm […] as those (tangible and intangible) assets which are tied semi-permanently to the firm (WERNERFELT, 1984, p. 172). Table 1 summarizes the main resources mentioned by the authors (WERNERFELT, 1984; GRANT, 1991, apud DE TONI & TONCHIA, 2003; MILLS et al, 2000). Mills et al (2000) and Mills et al (2003) suggest we must combine tangible and intangible assets in a pictorial history in order to get a better assessment of the resources.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td>Capital</td>
</tr>
<tr>
<td>Physical</td>
<td>plant capacity, material’s availability, machinery, and equipment,</td>
</tr>
<tr>
<td>Human</td>
<td>skilled personnel, training, experience, tacit and technological knowledge and insights, clerical and managerial staff</td>
</tr>
<tr>
<td>Technological</td>
<td>hardware, software, innovations, patents, machinery and equipments</td>
</tr>
<tr>
<td>Reputation</td>
<td>recognition of brand</td>
</tr>
<tr>
<td>Organizational</td>
<td>values, culture, management style and trade contacts, efficient procedures, long-lived personal contacts and networks with key suppliers, customers and/or legislative authorities, performance measure and reward system</td>
</tr>
</tbody>
</table>


Table 1- Resources descriptions

Routines are “all regular and predictable behavioral patterns of firms […] they are heritable” (NELSON & WINTER, 1982, apud MILLS et al, 2003). They include procedures for recruiting, selecting and hiring, technical routines for producing services, and so on.

Core competences are “the collective learning in the organization especially how to coordinate diverse production skills and integrate multiple streams of technologies” (PRAHALAD & HAMEL, 1990). In their definition the role played by human resources and organizational processes is relevant. Organizational capabilities is “a high-level routine (or a collection of routines) that, together with its implementing input flows, confers upon an organization’s management a set of decision options for producing significant outputs of a particular type” (WINTER, 2000, p.983, apud MILLS et al, 2003). A core product is the physical representation of a core competence, that is, “resources and products are two sides of the same coin” (WERNERFELT, 1984). The core competences are the base for the production of core products, which are used in different business units, and enable delivery of the final products to the customers. In a nutshell, the resources and competences should be valuable in the customer’s eyes, difficult to imitate and substitute, and easy to replicate in other markets (PRAHALAD & HAMEL, 1990).
MILLS et al (2003) proposed an architecture (Figure 1) based on Penrose’s (1959) duality of resource and service, once one can extract multiple services from the same resources. They used a triangle to represent the boundary of the activity and its resources hierarchically, and the arrows represent the coordination. Their model building block is a set of resources and coordination forces.

![Source: Mills et al (2003)](image)

Figure 1 - The service, routine & competence building block

They formulated equations to express the interaction between resources and competences:

a) Resource(s) + Co-ordination = Service(s)
b) Services + Co-ordination = Competence(s)
c) Competence(s) + Co-ordination = Higher-level competences

An organization can go further if it has a better coordination of their resources and services. It depends on organization’s culture, values, traditions and leadership. The coordination is “difficult to evaluate, but can make the difference” (DE TONI & TONCHIA, 2003). Thus:

“Certainly any resource/competence architecture must reflect the importance of co-ordination […] the co-ordination applied may be implicit in the resource itself, especially of human resources, or applied through other resources like sets of rules, procedures, or a performance measurement and reward system” (MILLS et al, 2003).

They extended this architecture from the customer perception’s standpoint, which is supported by two sub-competences: - one is the “resource development competence” that will act on resources to change their state; the other one is the “co-ordination development competence”, which affects the coordination of higher-level competences. The visual representation of this resource/competence architecture is shown in figure 2, below:

![Source: Mills et al (2003)](image)
Their architecture “distinguishes between high-level competences that customers recognize, for example, fast product delivery, and competences that support high-level competences but are less visible customers, like competences in rapid knowledge acquisition and deployment” (MILLS et al, 2003). Each firm has its specific resources, and it is essential to represent them. This approach emphasizes the role played by coordination of the resources and establishes the relationships between resource, competence, capability and routine.

3. Methodology

To accomplish the goal of this study, a qualitative research was performed. The method was the case study. This method enables to probe deeper into a unique case or a particular organization. It might provide exploratory insights, test theories, and confirm results from other studies, although they are not generalized. It uses techniques as participant observation, interviews, history, and documental research (YIN, 1994).

The research took place in Minas Gerais Department of Public Safety, from last August up until last March, 31st. One of the reasons for this is that the first author is a member of the department who has been working as criminalist for 20 years. Although, he will keep the necessary distance to carry out the research (PINTO, 1998).

Based on the theory, documental analyses, participant observations, interviews with personnel and key elements were carried out. To map the resources, every division and section at headquarter was visited and the personnel was interviewed. The data from the interior of the State was obtained from the Regional Criminalistics Sections Division. Afterwards, the interviews were transcripted and categorized to build a framework. It also combines the analyses of the tangible and intangible resources. The interviews also helped to obtain organizational and resources history (MILLS et al, 2000; MILLS, et al, 2003). As secondary data, the report results from a research carried out by Federal University of Rio de Janeiro and sponsored by the National Public Safety Department (SENASP, 2007) were also used.

4. Mapping the resources, identifying the competences and building the architecture

The Minas Gerais Public Safety Department is comprised of Military Police, which is responsible for patrolling streets, and the Civilian Police, which is responsible for the investigation, besides the Fire Department, and Penitentiary Administration. Forensic Science is a branch of the Civilian Police, denominated Superintendence of Scientific and Technical Police, which is directly subordinated to the Civilian Police Chief. It encompasses three institutes: - Forensic Pathology, Criminalistics, and Identification. The Criminalistics Institute is managed by a Director chosen from among one of its members at the final career level. Its organizational chart is shown in Figure 3. In 2006, it replied to 144,112 (65,535 at Headquarter and 78,577 in the interior and metropolitan area) exams requests, both indoor and outdoor, and issued 91,938 (48,594 at Headquarter and 43,344 in the interior and metropolitan area) reports.
At headquarters (located in the State’s capital), there are the Specialized and the Laboratory Divisions. The Criminalistics Regional Sections Division manages six Criminalistics Sectors in the metropolitan area, and 42 Criminalistics Sections located in key cities in the interior of the State. There are also 10 Integrated Forensic Science Offices (IFSOs) in the interior, subordinated directly to the Superintendence of Scientific and Technical Police, where criminals and forensic pathologists work together at the same building. But from this point on, they will all be denominated criminalistics services.

4.1 The role of the criminalist

Criminalistics applies science and technology to help the police solve crimes. Its main goal is to link the crime scene to a suspect (or innocents who are wrongly accused) (FISCHER, 2004; JAMES & NORDBY, 2005, RESEARCH DATA). The criminalists attend a diversity of investigations, as homicides, kidnapping, rapes, robbery, theft, vehicular accidents, environmental crimes, fires, drugs, documents, digital crimes, and many others. According to Brazilian law, it must attend any crime scene where traces or evidence were left.

The exams might take place internally (Laboratory), or externally (crime scene). Basically, when there is a crime and depending on the nature of the crime, the Military Police arrives first at the crime scene and preserves it. This is a critical factor for the success of the investigation. Then, the criminalists attend the crime scene and look for evidences, take notes, photographs and measurements, sketch it, and ask questions. Finally, he/she collects evidences, such as bloodstains, hairs, fibers, footprints, fingerprints, and bullets or shell castings, etc. in the appropriate procedural manner. Subsequently, the criminalists from the laboratory division will carry out exams, as DNA, microscopic comparison of bullets striations, and so on. In the eventuality of death, the body has to be sent to the forensic pathologist for autopsy. Sometimes it is necessary to reconstruct the crime scene to discover the dynamics and events. Then, a written report with the results, conclusions and scientific evaluations is formulated and sent to the police to later be presented in court. It might be necessary to provide an expert testimony in court. It is not part of its duties to arrest criminals. This is the job of police officers and detectives. However, they should work as a team in solving crimes. The main clients of this service are the police, prosecutors and judges.
4.2 Resources, competences, and the architecture of criminalistics services

In terms of history, what most impacted criminalistics resources were: - the redemocratization of the country after 21 years of a military dictatorship (1964-1985) and the promulgation of the democratic Federal Constitution of 1988; the requirement of a Bachelor’s degree starting in 1989 in order to apply for the job (before only a high school degree was required); the expansion of human rights agenda throughout the country; and the movement for separation from the Civilian Police that took place in the State in 1997, and although the movement was not successful, it caught the attention of forensic science position and there was more investment done and more autonomy for the Institute and its members.

The main resources of the criminalistics services are shown in Table 2, below. Financial resources are key point, once the service depends on the State government endowment for the Civilian Police. Some specific projects are financed by Union. In terms of plants, in the interior of the State, the facilities are shared with police units, except at the IFSOs.

The attributes of human resources is diversity. The applicant must have a Bachelor’s degree in any field, although the exams focus more on physics, chemistry and biology. This reflects on the number of criminalists per field (see Figure 4). There are also physical and psychological exams in the selection process. In the last recruitment, there were 6,809 applicants for 60 job openings.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Financial</td>
<td>Depends on State government endowment and funding to Civilian Police.</td>
</tr>
<tr>
<td>Physical</td>
<td>Digital and non-digital photographic laboratory; standard vehicles; plant capacity at headquarter and IFSOs; material’s availability.</td>
</tr>
<tr>
<td>Human</td>
<td>Personnel with a bachelor degree in a diversity of fields; skilled, trained, and experienced personnel; stability on career; tacit knowledge and insights.</td>
</tr>
<tr>
<td>Technological</td>
<td>DNA typing; chemical reagents; digital cameras; comparison and digital microscope (bullets and cartridges, fibers, hair) ; brush-and-powder dusting latent fingerprint; magnetic brush and magnetic powder for lifting fingerprints; software for fragmented fingerprint analysis; gas chromatography; infrared spectroscopy; luminol reagent; GPS; evidence collection kits; voice comparison software; and PCs and internet.</td>
</tr>
<tr>
<td>Reputational</td>
<td>Recognition of Criminalistics Institute as a brand.</td>
</tr>
<tr>
<td>Organizational</td>
<td>The monopoly of forensic science examinations; relationships with State and Federal representatives, prosecutors, judges, police commandees, and human rights associations; a culture of searching for the real truth through science and technology; and values as ethics, integrity and independence.</td>
</tr>
</tbody>
</table>


Table 2 - The resources description of the criminalistics services of the State of Minas Gerais

After applicants are tested and selected, they attend full-time training during an average of six months at the Police Academy. Then, they are assigned their duty. After a period of time, they take a refreshing course. Finally, depending on their level, they can take a management course. Eventually, other trainings are offered. However, during the interviews, many of them requested for training regularly. There are 591 criminalists in the Institute, 283 at headquarters, 268 in the interior and 40 in the metropolitan area, besides clerical employees. They come from a variety of fields, such as medicine, engineering, biochemistry, physics, chemistry, biology, mathematics, law, etc., and 27.3% of them have a specialization, 14% a Master’s degree, and 5.9% have a PhD (SENASP, 2007). Another important factor is the experience: - 39.7% have been working for more than 13 years in the field, and some were detectives before (SENASP, 2007). These numbers imply strong tacit knowledge.
In terms of remuneration, the wages are compatible with other jobs at the Public Safety Department, which require a university degree (See Table 3). Besides the four vertical levels, there are horizontal levels (A, B, C, D, E), except the last one. The promotion system is a combination of permanence in the profession with professional and academic education.

<table>
<thead>
<tr>
<th>Criminalist/Forensic Pathologist</th>
<th>Civilian Police Chiefs (CPC)</th>
<th>Military Police Officers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criminalist Special</td>
<td>2,498.59</td>
<td>Colonel 2,544.44</td>
</tr>
<tr>
<td>Criminalist 3 A</td>
<td>2,460.97</td>
<td>Lt-colonel 2,109.96</td>
</tr>
<tr>
<td>Criminalist 2 A</td>
<td>2,358.54</td>
<td>Major 2,045.71</td>
</tr>
<tr>
<td>Criminalist 1 A</td>
<td>2,003.84</td>
<td>Captain 1,893.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1st lieutenant 1,684.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2nd lieutenant 1,431.31</td>
</tr>
</tbody>
</table>

Source: Research Data. The values were converted from Brazilian Real to United States Dollar (1US$= R$2.018)

Table 3 - Personnel monthly wages (US $) from State Public Safety Department

The technological resources involve considerable high-tech equipments and devices that criminalist must know how to operate. In the interviews with personnel, all of them mentioned the importance of technology in their job, but reinforced that the tacit knowledge of the criminalist is fundamental to find, collect and analyze evidences.

The “core competence” of criminalistics, perceived by clients, is to link the crime scene to a suspect. Other competences are: - to materialize, perpetuate the crime scene; and to reconstruct the events and its dynamics. These competences involve a series of capabilities as management, technological devices, academic research, continuing education and training, and to work as a team with the police agents.

Based on the competence perceived by clients and on the resources mapped, using Mills et al. (2003), it was possible to build the architecture for criminalistics services in the State (Figure 5). The core competences are sustained by two resources: - a reasonable system to search, document, and collect physical evidence at the crime scene; and the skilled and experienced staff. The first is supported by the competence of embodying new technologies and the resources are the skills in handling modern technological devices, the laboratory structure and the modern technological devices. The apex of this competence pierces the boundary of the higher-level competence to show the closer connection between them. The second is supported by the competence in recruiting, selecting, training and forming skilled personnel. This competence also provides support to the first one (incorporating new technologies), where the key resource is skilled and trained personnel. It is sustained by tacit knowledge and personnel experience, the performance measurement and reward system, skills in using problem solving methods. The multidisciplinary workforce and capability in acquiring new knowledge, besides values (ethics, integrity and independence) are at the base of the pyramid.
With regards to coordination, the public sector, as a whole, is still crawling, in spite of the advances allocated by the State in this direction. The control is unsteady and it is fulfilled more by the clients. There is no management information system. However, there is one being developed in house, and it is contributing towards organizational learning and changes to some processes. The managers of the service are aware of the necessity for using the resources available more advantageously.

The competence and resources architecture performed well for the goals of this paper. It was a valuable tool to map the resources and competences of one of the key actors in the public safety system. It demonstrated that the combination of a high-level human resources, technology and scientific knowledge is what empowers the role of this profession in investigations.

5. Final considerations

The aim of this paper was to map and analyze the resources and to identify the competences of the criminalistics services of the State of Minas Gerais, a segment of the Public Safety State Department. Then, an architecture inspired on Mills et al’s (2003) model was built. The methodology was a case study, including interviews, document analyses, besides participant observation and visits to the facilities.

The model was suitable to analyze the resources, competences, strengths and weakness of the criminalistics services in the State. The core competence perceived by the clients is to link the crime scene to a suspect, or to innocent someone wrongly accused. This core competence is sustained by two sub competences: - embodying new technologies; and training and forming skilled personnel. The analyses showed that the strategic strengths of the service are staff multidisciplinary qualification, tacit knowledge and capability to incorporate new knowledge and deal with new technologies. The weakness is resources coordination in order to obtain better results. However, there are efforts being made in this direction, as, for example, the development of a management information system.

Summarizing, the analyses showed that the combination of highly qualified human resources, technology and scientific knowledge is what empowers the role of criminalistics during the course of investigation.

References


