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**Bridging the Gap between the Demand and Supply of  
Medical Imaging Technicians in Israel: An Exploratory  
Marketing Approach Focused on the Image of the Profession**

**- Long Abstract -**

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## ABSTRACT

This study explores the gap between demand and supply of medical imaging technicians in the State of Israel. This is an important profession around the globe, and without it some of the illnesses cannot be diagnosed and treated. Medical imaging technicians are actually the eyes of doctors. Their main job definition is making a radiogram by operating an imaging machine, processing it while identifying life-risking pathologies, and then transferring the radiograph to a radiologist for medical diagnosis. Moreover, they must alert the diagnosing doctor in case they identify a pathology.

Over the years, with technological development, the population's rising age, and an increasing demand for imaging tests, more medical imaging technicians are required on the labor market. Yet, the supply is low. Waiting time for imaging tests is very long, creating problems of diagnosing illness at an early stage and treating them on time. Herein resides the importance of conducting a study that aims to comprehend how to increase the supply.

Hence, a 4-stage study has been conducted according to the mixed methods paradigm. The first stage, qualitative research, consists of semi-structured interviews with ten interviewees who undergo the process of deciding what to learn and which profession to choose. The interviews were meant to examine the professional image of medical imaging technicians and whether this is why students avoid learning this profession. The second stage, qualitative research, consists of a focus group discussion with eight medical imaging technicians, aiming to identify the factors involved in the professional image that must be improved in order to bridge the gap between the supply and demand. The results of the focus group and the semi-structured interviews revealed that the professional image is a major factor involved in the low supply of labor force. The focus group discussion shows that the image of the profession should be improved in order to narrow the gap between supply and demand of the labor force. The third and fourth stages consist of quantitative research. Based on findings derived from the qualitative research, the main hypothesis of the quantitative research is that medical imaging technicians have an image problem that undermines the supply.

The quantitative research consists of two a closed-ended questionnaires, aiming to investigate the image problem and the potential of using marketing communication as a tool for improving perceived image of the profession and, thus, bridging the gap between supply and demand in the field. The first questionnaire has been administered to 70 medical imaging technicians in order to explore the motivations that drive the medical imaging technicians themselves to choose this profession. The second questionnaire was administered to 100 people in the process of choosing their future career, to explore their perceptions about this profession, and the sources from which they obtain the information and advice they rely on choosing a career.

The empirical results have shown that the medical imaging technician profession suffers from an image problem, and its negative image affects the supply. Hence, this study focuses on discussing the improvement of the professional image of medical imaging technicians in Israel, in order to bridge the gap between supply and demand.

**Key words:** image, medical imaging technicians, X-rays technicians, misconception, access to correct information, awareness, perception, motivation, marketing approach.

# INTRODUCTION

## Research Background

This study aims to identify the factors that affect the low supply of medical imaging technician profession due to the fact that medical imaging technicians is one of the important professions in the field of medicine in the modern world, being included in the para-medical sector. Medical imaging technicians or X-rays technicians perform independently complex diagnostic and therapeutic procedures in numerous and varied areas. They are responsible for the diagnosis of radiograms taken by various machines, such as C.T., MRI, ultrasound, and others. This field has been increasingly developed in recent years, requiring more professionals who are qualified in the operation of these machines (Shaarey Mada and Mishpat Academic Center, no date).

The literature review illustrates that the medical imaging technician profession is performed in an ionizing radiation work environment (Romano, 2012), which has biological effects on the human body. It originates in nature or is created artificially by man-made devices, affecting people's health and life quality for better or worse (Nachshon, 2000). The public does not have the necessary information regarding the risks and advantages involved in this issue (Nasr et al., 2019). Moreover, it is unable to understand that in recent years, medical imaging technicians have been exposed to lower ionizing radiation. This is due to the fact that some of the machines that they operate do not emit radiation at all, among them the MRI and ultrasound machines (Geva, 2006; Hosch, 2012). This profession is important to the entire population, yet the research results show that its professional image and prestige are low and it is considered as a simple profession, without any complexity or responsibility.

One of the hypotheses underpinning this study is that the medical imaging technician profession has an image problem that undermines the supply (Mussmann et al., 2021). With the disciplines, required competences, and actual risks of the profession, real acquaintance with it will offer a greater chance of being chosen by potential students. When more people choose this profession, it will be possible to improve the supply (Gagova et al., 2017).

Nevertheless, reality is different. The current supply of medical imaging technicians on the labor market is much lower than their demand in Israel and in many countries around the globe (Smith & Baird, 2007; Vanckaviciene, 2014). Consequently, the research aim is to find solutions for

increasing the supply for the purpose of responding to this demand. Herein resides the motivation and importance of conducting a study to comprehend how to increase the supply.

### **Gap in Knowledge**

The development of the technology associated with the medical imaging technician profession, the aging of the population, and the great demand for imaging tests require more professionals in this field (Smith & Baird, 2007; Vanckaviciene, 2014). Nevertheless, in spite of the high demand, the supply is low (Frija et al., 2021). The literature in this field indicates a shortage of actual human resources in the medical technician profession. Still, to the best of our knowledge, there are no empirical studies investigating the perceived image of the professionals activating in the field of medical imaging as one of potential reasons for this type of human resource shortage in Israel. Moreover, the literature discussing this profession is quite poor. In spite of the shortage of human resources in Israel, there are no empirical studies that explore this field. Hence, one can say that there is a gap in knowledge with reference to the imaging technician profession.

### **Research boundaries**

In order to bridge the gap in knowledge about the perceived image of medical imaging technician profession a 4-stage study was conducted in Israel between the years 2022-2023 according to the mixed methods paradigm.

The first qualitative research consisted of semi-structured interviews with ten interviewees who were undergoing the process of deciding what to learn and which profession to choose. The second qualitative research consisted of a focus group discussion with eight medical imaging technicians, the findings obtained from the semi-structured interviews of the qualitative research and from the focus group illustrated that the perceived image of the medical imaging technicians constituted a major factor for the low supply of labor force. Moreover, the findings indicated that the image of the medical imaging technician profession should be improved in order to narrow the gap between supply and demand of labor force in this field.

The quantitative research included two stages and was based on the findings obtained derived from the qualitative research and similar clues discussed in the scientific literature (Mussmann et al., 2021). The main hypothesis underpinning the quantitative research was that the medical imaging technician profession had an image problem that undermined the supply.

At the quantitative stage, two closed-ended questionnaires were administered to two research groups. The first questionnaire was administered to 70 medical imaging technicians and investigated what drove them to decide to learn this profession. The intrinsic motivation was higher than the extrinsic motivation, yet both motivations were important in the process of choosing the profession.

The second questionnaire was administered to 100 people in the process of choosing a career. It investigated the image problem and the potential of using marketing communication as a tool for improving perceived image of medical imaging technician profession. As a result, the gap between supply and demand in the medical imaging field would be bridged.

The main findings of the quantitative research indicated that the professional image, awareness and perception of this profession were relatively low and that there was a positive relation between the professional image and the awareness and perception.

The findings also showed that the most important source of information for choosing the medical imaging technician profession was a marketing campaign with medical imaging technicians, since they had access to correct information that had a positive impact on the image of the profession. Moreover, they had the opportunity to talk with friends and family who worked in this field.

### **Research Aims**

1. To explore the factors involved in forming the perceptions and the image of the medical imaging technician profession.
2. To examine the developments needed for improving perceptions and the image of the medical imaging profession in order to narrow the gap between supply and demand.
3. To examine the intrinsic and extrinsic motivation for choosing the medical imaging technician profession.
4. To propose a marketing approach directed at bridging the gap between supply and demand in the medical imaging technician profession.

### **Research Questions**

1. What factors are involved in the image of the medical imaging technician profession?
2. What developments are needed for improving the image of the medical imaging technician profession and thus bridging the gap between supply and demand?

3. What are the motivations for choosing the medical imaging technician profession?
4. What components might comprise a marketing approach that can improve the supply of medical imaging technicians?

### **Significance of the Research**

Healthcare organizations constantly encounter difficulties in the recruitment of high-quality employees, as well as their training and retention in the long term in the healthcare system. In order to overcome the low supply and meet employment requirements, it is important to bridge the gap between demand and supply and increase the percentage of potential students. For this purpose, this study offers a marketing approach that focuses on improving the image that will improve the supply.

**Key words:** image, medical imaging technicians, X-rays technicians, misconception, access to correct information, awareness, perception, motivation, marketing approach.

## **Chapter 1: LITERATURE REVIEW AND MAIN THEORIES UNDERPINNING THIS STUDY**

### **1.1 The Healthcare System in Israel**

The Ministry of Health is the body that facilitates implementation of government policy. It acts as the regulator and service provider and it is in charge of ensuring the health of the population. The Ministry's functions include supervision and control, licensing, legislation, standards setting, research, human resources training and planning, organization for emergencies, and investment policy. The Ministry is headed by the Minister of Health and the general manager is accountable to him/her (Ministry of Health, no date).

### **1.2 Medical Imaging Technicians**

#### ***1.2.1 Medical imaging field***

Medical imaging technicians deal with the field of imaging that is wide and varied. The technicians work in an extensive area of occupation and operate many machines. The technological development that is increasingly growing expands the shortage of this profession. Imaging is a non-invasive test, describing internal parts of the human body and the spatial relationships between the organs.

### ***1.2.2 Description of the medical imaging technician profession***

The medical imaging technician profession is a key element in the field of medical diagnosis, and it has been constantly developing both in Israel and abroad. In the past, this profession comprised mainly X-Rays tests and screening. However, today, the accelerated technological and computerized development enables performing diagnostic tests and procedures that are more complex and on a higher level of quality. For example: CT, PET CT, MRI, mammography (breast imaging), ultrasound imaging, as well as medical procedures under imaging, such as cardiac catheterization, blood vessels catheterization and surgery performed under MRI. Medical imaging technicians are mainly responsible for the functional aspect of imaging tests, namely positioning the patient and the photographic means in the exact place required for the test; performing the radiography by operating the imaging device, processing the radiograms for the purpose of diagnosis and treatment; collecting, storing, and transmitting the information so that it allows doctors to access it and make a correct diagnosis for continuing the medical treatment; being acquainted with the medical equipment, operating it and limiting the unnecessary exposure to radiation of patients and their environment; initially identifying meaningful findings that endanger life or an organ; exercising their judgement in a case that requires an urgent and immediate treatment and alerting the treating physician (Ministry of Health, 2022a).

### ***1.2.3 Training process and medical imaging technician diplomas in Israel and worldwide***

Lack of homogeneity in the structure of the medical imaging technicians' curriculum is prevalent around the globe. This has been found in a survey conducted by the International Society of Radiographers and Radiological Technicians (Couto et al., 2018).

### ***1.2.4 Evolution of the medical imaging technician profession's name in Israel and worldwide***

The medical imaging technician profession is referred to by many names around the globe, although it deals with the same area, the same machines are operated, and the same tests are performed. In the European Union member-states, the generic title of this profession, allocated by the European Commission, is radiographer / radiotherapist. However, medical imaging technicians in these countries have many aspects, names, and several identities. There are at least 20 additional titles for this profession: diagnostic radiographer, therapy radiographer, radiation therapist, nuclear medicine technologist, and radiological technologist. The workers can be technicians, nurses, and radio manipulators, providing different services according to the country (Couto et al., 2018).

### ***1.2.5 Legal regulation of medical imaging technicians in Israel and worldwide***

As the literature review shows, the medical imaging technician profession is not regulated by law in some countries around the world. In Israel, only in 2023, the Knesset Committee of Health ratified the law of regulating engagement in healthcare professions with respect of the medical imaging technician profession (State of Israel, 2022b). This regulatory law aims to exercise basic rights or public interest, while guaranteeing the fulfillment of a role in a high-quality way. The definition of the law is granting an authorization, approval, license, franchise and so on, stipulated by law, instruction, procedure, or circular, according to legal authority. The regulatory authorization is required by law for performing an activity or an action by people. The authorization is granted also for a device or product. In fact, the law stipulates rules of conduct for the purpose of regulating an economic or social activity (State of Israel, 2022a).

### ***1.2.6 Medical imaging technicians' terms of employment in Israel and worldwide***

The terms of employment are one of the motivational factors for encouraging people to choose a profession for life and retain them in the system for many years after completion of their studies. Around the world there are considerable income differences between the private and public sector. These differences exacerbate the manpower shortage in the public sector, entailing a 'brain drain' from the public sector and, sometimes, even from the country (Frija et al., 2021).

### ***1.2.7 Working in an ionizing radiation environment***

Medical imaging technicians operate equipment that emits ionizing radiation and, therefore, in the course of their work, they risk being exposed to different levels of ionizing radiation (Romano, 2012). Over the years, many studies explored the relationship between working in an ionizing radiation environment and cancer. These studies were conducted in two main periods. The first period was between the 1940s and up to 2010. During this period, the studies showed a relationship between cancer and work with ionizing radiation. That is, people working in this environment were more likely to become sick with cancer (Simon et al., 2006; Wakeford, 2009). The studies conducted in the second period, from 2010 until today, found a significant relationship between exposure to ionizing radiation and cancer, and that exposure of young children was dangerous and cancerous. However, medical imaging technicians work in an ionizing radiation environment in which they are exposed to low levels of radiation that does not constitute a higher risk of cancer (Kitahara et al., 2018; Lee et al., 2015; Preston et al, 2016).

## **1.3 Supply of Medical Imaging Technicians**

### ***1.3.1 Supply of medical imaging technicians in Israel and around the world***

In Israel, following the failure to regulate the profession by law, the Ministry of Health did not engage in a long-term strategic planning in order to meet the market needs of medical imaging professions. Furthermore, it has not yet examined the shortage of medical imaging technicians in the Israeli imaging institutes and the future needs in this field. The Ministry does not have an updated database of the number of medical imaging technicians, the forecast of their retirement, and the forecast of new medical imaging technicians' integration into the profession. The chairman of the Medical Imaging Technicians Union underscored the existing and continuous shortage of workers that creates an overburden, particularly when special COVID-19 departments have been set up. This might lead to the collapse of the healthcare system (Eisbruch, 2020).

### ***1.3.2 Retention of workers in the healthcare system***

Human resource is essential to the organization and it is highly important to manage it and, not less importantly, retain it. The skills of this resource allow the organization to be prosperous and competitive (Amadasu, 2003). Workers' retention is the ability to encourage them to remain working in the same organization for a long period of time, or until the completion of a project. Satisfaction and retention are key factors for a successful organization. Workers who are happier and more satisfied with their work are more committed and exert greater efforts in order to improve the satisfaction of the customers of the organization in which they are working (Cutler, 2001; Gardner et al., 2004).

## **1.4 The Professional Image and Misconceptions of the Medical Imaging Technician Profession**

### ***1.4.1 Professional image of the medical imaging technician profession***

In spite of the technological progress of the imaging world, the public's professional identification with this profession is basic and simple. People perceive medical imaging technicians as workers who perform a simple action that has no professional complexity, and they are considered as "button pushers". However, this is far from reality and the public should understand that those who perform imaging tests and diagnosis are exposed to ionizing radiation. Hence, people must be sure that the medical imaging technicians who operate the machine, have the understanding and knowledge for achieving a high-quality and diagnostic radiogram, the justification for being exposed to radiation, extensive knowledge of anatomy, as well as numerous additional techniques. Although this profession is essential and complex, its professional prestige has been lost, and it is

highly important to change the language and terminology that describe this profession. Terms like ‘basic’, ‘regular’, and ‘button pusher’ should be replaced by words that reflect more correctly the complexity and responsibility encompassed in this profession. This will entail a change of the negative image perception and to improvement of the medical imaging technicians’ status, and will assist in saving the lost prestige of this profession and in improving the supply (Mussmann et al., 2021).

#### ***1.4.2 Misconceptions of the medical imaging technician profession***

The Constructivist theory emphasizes how knowledge is created, i.e., the process itself. This is an active subjective process that is affected by social interaction. This theory engages in the question: ‘What is knowledge?’. It defines knowledge as something temporary and subjective that develops and is built in people’s soul out of the interrelations between people’s background, personality structure, and social-cultural effects. The Constructivist theory relates knowledge to people who think, to their previous background, their beliefs, experience with previous beliefs, and personal experience. According to this approach, knowledge can be changed, and it is more subjective and personal. Conversely, the Positivist approach advocates that there is only one truth to be learned, and the more truths individuals have, the more knowledge they have (Libman. 2013).

### **1.5 Professional Perceptions and Professional Identity**

#### ***1.5.1 Professional perceptions***

Perception is the individuals’ identification and interpretation of sensory information in order to translate the meaning and insight of the environment. This is in fact an act of compilation and perception that encompasses all the signals from the nervous system. Perception is a stimulation that individuals feel, organize and then, interpret for understanding what has been identified (Duarte et al., 2016). The perceptions that relate to the decision to choose a profession for life are some of the most essential difficulties with which young people have to cope (Gati et al., 1996; Kelly & Lee 2002; Lancaster et al., 1999; Mateous et al., 2010; Mau, 2001). Some of the factors included in the choice of career are attributed to the candidates’ self-perception, as well as to the way they communicate with these factors (Aizen & Madden, 1986; Holland, 1977; Lebt et al., 2002, 2008)

#### ***1.5.2 Professional identity***

The development of the individuals’ ‘self’ transpires together with the learning processes of the characteristics of the profession. Here begins the relationship between the needs and values of self-

identity and professional identity (Hartung et al., 2005; Porfeli, 2007). It is noteworthy that individuals embody main figures that represent value-oriented perceptions of choosing a preferred profession (Hargreaves, 2006; Rodgers & Scott, 2008). Individuals explore their self and the occupational opportunities on the labor market, in order to provide an optimal response to the role that complies with their demands and needs (Oplatka, 2012).

### ***Professional identity of medical imaging technicians***

During the 1940s, the medical imaging technician profession changed its learning and training method in Canada. As a result of this change, new occupational identities were developed. During the 1920s and 1930s, the practitioners of this profession engaged in a quick practicum, and they continued working in this way throughout the hospital. The non-formal teaching of the 1920s and 1930s was changed and replaced by formal and qualified training programs that included national exams. The Canadian Medical Association and the medical imaging technicians themselves were involved in this change. At the same time, national organizations, such as the Canadian Association of Medical imaging technicians, tried creating a common professional identity with a clear occupational scope. Nevertheless, the professional identity of medical imaging technicians has remained unconsolidated, and for a very long time, it has been highly dependent on the formulation of national qualification standards. The professional identity has stayed flexible, depending to great extent on the local environment (Twobig, 2006).

## **1.6 Motivation for Choosing a Profession**

### ***1.6.1 Choice of a profession***

Two major mechanisms that function in parallel are involved in decision-making processes. One mechanism that functions in a rational way, can be described according to the rational model of decision-making. This model is grounded in the principle of taking one great challenge and fragmenting it into small and simple components. It is based on logic and order that offer an ability to cope with the challenge. This is achieved by calculating the pros and cons of the decision, identifying the challenge or the opportunity, collecting and analyzing data, and choosing the optimal alternative. Theories from the field of business and economy hypothesize that people make rational decisions when they consume goods and services (Indeed Editorial Team, 2021). On the other hand, the second mechanism is the emotional mechanism, namely the character in which people include their feelings in the decision-making process. Emotions constitute a powerful,

extensive, expected motive that is sometimes harmful and sometimes useful for making decisions, affecting people's judgement and choice (Lerner et al., 2015).

### ***1.6.2 Motivations in the world of work***

This study aims to develop a marketing approach that improves the image of medical imaging technicians, and the recruitment of people interested in choosing imaging as a career. Consequently, it is necessary to review the issue of workers' motivation.

#### ***Self-Determination Theory***

According to the Self-Determination Theory, an effective organization is an organization that promotes high-quality performance and prosperous workers, i.e., the organization members have the motivation to work. People's motivation stems mainly from their basic tendency towards personal growth, self-actualization, and ability to cope with new challenges that fill them with pleasure, vitality, and actualization (Deci et al., 2017; Michlol Jewish Encyclopedia, 2022). The Self-Determination Theory seeks in fact the factors that stimulate and support this natural tendency, and the factors that reduce and suppress it. This is a theory of human motivation that distinguishes between autonomous motivation, i.e., intrinsic motivation, and controlled motivation, namely extrinsic motivation.

## **1.7 Marketing Approach**

### ***1.7.1 Push-Pull marketing approach***

"Push" marketing implies pushing the product to the public. Marketing by this strategy focuses, in fact, on the principle of "pushing" products to a certain audience. There are several effective ways of pushing a product. For example, transmitting a message about the product and what it offers in advertisements of the product sales campaign. This type of marketing is particularly relevant in the case of a new business that is not known, a new product, a seasonal product that the manufacturer wishes to sell quickly (Corniani, 2008). This strategy relates to the development of firm-to-market processes. The firm invents and develops a product that is designed to find buyers. The wish to apply this strategy implies making the products, the services, or the brand as overt as possible, in order to achieve the best results.

### ***1.7.2 The Product and the Buyer approach***

Buyers who purchase products and have no direct experience with them base their judgement on clues that are not encompassed in the product itself. The buyers' direct experience with the products should be extended in order to increase their reliance on the properties and advantages of

the product itself. This will make buyers enhance the accuracy when they consider buying the product (Brown, 1995).

### 1.7.3 Marketing and advertising on the Internet

Marketing is "the social process by which individuals and groups obtain what they need and want through creating and exchanging products and value with others" (Kotler & Keller, 2007). Today, the Internet is an inseparable part of our life, and it affects our way of living. Digital marketing is an Internet-based marketing approach (Wardhana, 2015), and the search engine marketing is implemented by digital technology (Chaffey, 2013). This form of marketing has developed following the rapid technological progress and the changing market, and it is considered as the strongest marketing instrument in the global world (Mort & Drennan., 2002). Furthermore, it is the most effective tool that businesses and companies use for achieving a bigger success (Yannopoulos, 2011) by expanding the customers and providing necessary information to improve consumer's choice of purchasing (Cetinã et al., 2012).

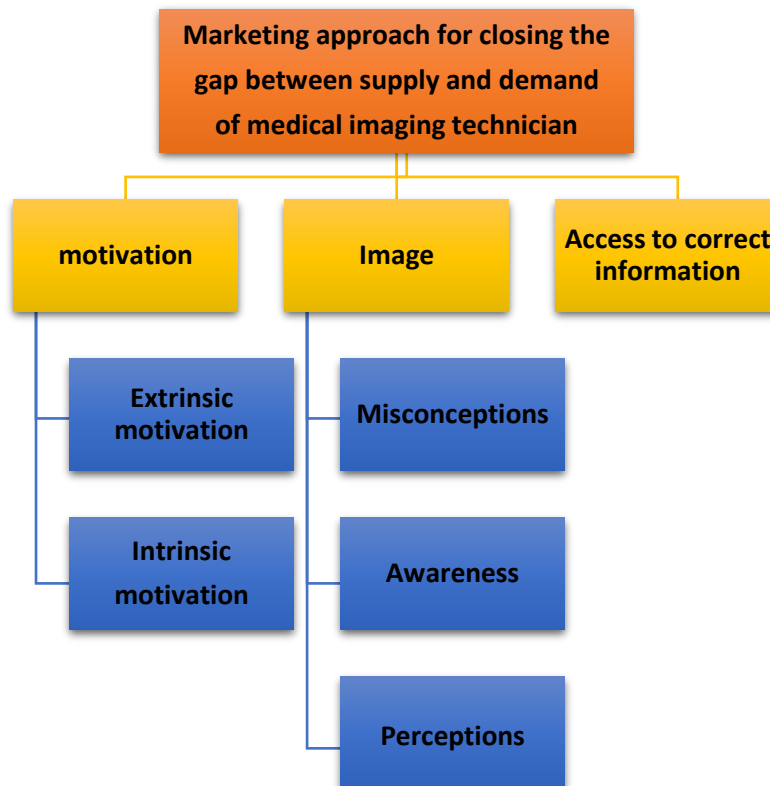


Figure 1: Schematic Framework

## Chapter 2: RESEARCH APPROACH AND METHODOLOGY

### 2.1 Mixed Methods Approach

This study was conducted according to the mixed methods approach. The acknowledgement that studies are not perfect and that there are many bias factors in all research types has stimulated organizations and researchers to integrate two methods in the same study. The objective is to reduce the bias and benefit from the advantages of each method on the basis that integrates the methods.

#### 2.1.1 Research hypotheses

Table 1 presents the research hypotheses tested in the quantitative stages of this research.

- Stage 3 of this research tested hypotheses *H1* and *H2*
- Stage 4 of this research tested hypotheses *H3* to *H8*

Table 1 also presents a synthetic view of the literature supporting the research hypotheses.

**Table 1: Research hypotheses of the quantitative stage**

	<b>Hypothesis</b>	<b>References</b>
H1	There is a significant difference between the impact of intrinsic (versus extrinsic) motivations on the decision of choosing the medical imaging technician profession.	Narayanasamy et al. (2019)
H2	There are differences in their importance among various items of intrinsic and extrinsic motivations for choosing the medical imaging technician profession.	Hizzett & Snaith (2022)
H3	Awareness levels regarding medical imaging technician profession will positively predict professional image.	Oplatka (2015); Gagova et al. (2017); Mussmann et al. (2021)
H4	Perceptions levels regarding medical imaging technician profession will positively predict professional image.	Kuzminsky (2008); Kremer & Hofman (1982); Mussmann et al. (2021)
H5	There is a significant difference in the access to correct information for choosing a medical imaging technician profession between individuals who desire to study a profession related to the medical field, and those who do not.	Gagova et al. (2017)
H6	There is a significant difference between the importance given to intrinsic (versus extrinsic) motivations for choosing a profession.	Haski-Leventhal (2022); Bigi-Moyal (2022)
H7a.	There is a significant difference in their importance among the sources that provide access to correct information for choosing a career.	Corniani (2008); Efrati (2017)
H7b.	There is a significant difference in their importance among the sources that provide access to correct information for choosing a medical imaging technician profession.	Corniani (2008); Efrati (2017)
H8	The sources that provide access to correct information for choosing a medical imaging technician profession will positively predict professional image.	Wackerhausen (2009) ; Gagova et al. (2017) ; Mussmann et al. (2021)

## 2.2 Research Design

Table 2 illustrates the mixed methods approach according to which this study was conducted. It consisted of four stages: two initial qualitative stages, and two additional quantitative stages.

**Table 2: Research design**

Stage	Research aim	Research instrument	Research Population	Data Analysis
1. Qualitative research	To explore the factors involved in forming the perceptions and the image of the medical imaging technician profession.	Semi-structured interviews	10 people in the process of deciding which profession to choose	Content Analysis
2. Qualitative research	To examine the developments needed for improving perceptions and the image of the medical imaging profession in order to narrow the gap between supply and demand	Focus group discussion	8 medical imaging technicians	Content Analysis
3. Quantitative research	To examine the intrinsic and extrinsic motivation for choosing the medical imaging technician profession	Closed-ended questionnaire	70 medical imaging technicians	Statistical Analysis
4. Quantitative research	To propose a marketing approach directed at bridging the gap between supply and demand in the medical imaging technician profession	Closed-ended questionnaire	100 people in the process of choosing a career	Statistical Analysis

## Chapter 3: FINDINGS

### 3.1 Findings Obtained as a Response to Research Question 1

Research question 1: “What factors are involved in the image of medical imaging technician profession?”

**Table 3: Misconception of the medical imaging technician profession in a work environment with ionizing radiation**

What factors are involved in the image of the medical imaging technician profession?			
Theme	Misconceptions about a profession in a work environment of ionizing radiation		
		Before delivery of the information	After delivery of the information
Category	Level of knowledge about ionizing radiation	<i>“I don’t know much about radiation”</i>	<i>“As I understand, I am constantly exposed to radiation all the time around the world”</i>
	Fear of ionizing radiation	<i>“I know that radiation has an adverse effect on people”</i>	<i>“I thought that radiation was much more dangerous”</i>
	Working in an ionizing radiation environment	<i>“I am purely afraid of the radiation”</i>  <i>“This is merely because of the radiation. It harms the body, working daily in an environment with ionizing radiation”</i>	<i>“I knew there was a control room...but didn’t know that I was not exposed at all to radiation there. It was new to me”</i>

### 3.2 Findings Obtained as a Response to Research Question 2

Research Question 2: What developments are needed for improving the image of the medical imaging technician profession and thus bridging the gap between supply and demand?

**Table 4: Factors affecting a negative image of the medical imaging technicians: Negative aspects and potential improvements**

Theme	Factors affecting the image of medical imaging technicians: Negative aspects		Factors affecting the image of medical imaging technicians: potential improvements
Categories	Wide public	Workplaces	
	<p><b>1. Lack of knowledge about the profession</b>  <i>“The wide public knows that hospitals consist of doctors and nurses... there are no X-Rays or CT technicians. For them this is only marginal”</i></p>	<p><b>1. Lack of knowledge about the profession</b>  <i>“There is also lack of knowledge among professionals who work in the field of medicine. They also do not understand to what extent medical imaging technicians can assist this setup of medicine”.</i></p>	<p><b>1. Lack of knowledge about the profession</b>  <i>“At the age of 18 organize open days... come and present to them the field of Medical imaging technicians”.</i></p> <p><i>“Some people do not want to do the same thing every day, every day, every day. Particularly in the field of X-Rays and imaging you have the option of diversity that is something extraordinary that hardly exists in any other profession”</i></p>
	<p><b>2. Fear of radiation</b>  <i>“When I say medical imaging technicians, people ask what are we doing? Isn't it dangerous? The first question is whether this profession involves danger”.</i></p>	<p><b>2. Fear of radiation</b>  <i>“We deal with radiation, unlike the rest of the population. Our level of risk is high in this profession. It is not like an interior decorator who has no danger in that profession”.</i></p>	<p><b>2. Fear of radiation</b>  <i>“People do not understand and are not aware of the technological progress of our profession in the last years. The amount of radiation that existed 20 years ago is not what it is today”.</i></p>
	<p><b>3. Terms of employment - Rewards and working hours</b>  <i>My husband told me that I was working too hard for the salary that I earn”.</i></p>	<p><b>3. Terms of employment - Rewards and working hours</b>  <i>“You have to work many hours in order to have a good salary”; “Our work is not finished throughout the day. We have asked for an addition for management hours at home, and they have almost ‘shot’ me”.</i></p>	<p><b>3. Terms of employment - Rewards and working hours</b>  <i>“Every work that involves danger should come together with rewards”</i></p>

### **3.3 Findings Obtained as a Response to Research Questions RQ3 and RQ4**

Research Question 3: "What are the motivations for choosing the medical imaging technician profession?"

Research Question 4 "What components might comprise a marketing approach that can improve the supply of medical imaging technicians?"

Hypotheses 1 and 2 refer to the sample of 70 participants who work as medical imaging technicians.

**H1 - There is a significant difference between the impact of intrinsic (versus extrinsic) motivations on the decision of choosing the medical imaging technician profession.**

This hypothesis was examined using a separate sample of 70 medical imaging technician professionals.

**Research hypothesis 1 was confirmed.**

To examine research hypothesis 1, which suggested that differences would be found between the importance of intrinsic and extrinsic motives for choosing the medical imaging technician profession, a dependent sample t-test was performed. The analysis indicated a significant difference between the importance of the intrinsic and extrinsic motivations [ $t(69) = 2.83, p < .01$ ]. Participants attributed greater importance to intrinsic motives ( $M=3.60, SD=0.88$ ) than to extrinsic motives ( $M=3.41, SD=0.82$ ) when choosing the medical imaging technician profession. Hence, the first hypothesis was confirmed. \*Number of missing values in this analysis: 0.

**H2 - There are differences in their importance among various items of intrinsic and extrinsic motivations for choosing the medical imaging technician profession.**

**Research hypothesis 2 was confirmed.**

The analysis showed significant differences between the importance of the different items of intrinsic motivation among the sample of imaging technician professionals,  $F(4,61) = 9.99, p < .001, \eta^2 = .40$ .

**Table 5: Means and Standard Deviations of the intrinsic motivation items**

Intrinsic motivation item	M	SD
Helping others	3.92	1.11
Matches the area of interest	3.77	1.14
Diversity	3.66	1.18
Independence	3.25	1.25
Creativity	3.11	1.21

Table 5 illustrated that the most important intrinsic motivation subject was helping others. On the other hand, the least important subject was creativity.

Hypotheses 3-4 refer to the sample of 100 participants who are in the process of choosing a career.

**H3 - Awareness levels regarding medical imaging technician profession will positively predict professional Image.**

**Research hypothesis 3 was confirmed.**

To examine research hypothesis 3, which posits that awareness levels regarding the medical imaging technician profession will positively predict professional image, a linear regression was performed. The results showed a positive impact of awareness on professional image. Hence, the third hypothesis was confirmed (see Table 6). \* Number of missing values in this analysis: 9 .

**H4 - Perceptions levels regarding medical imaging technician profession will positively predict professional Image.**

**Research hypothesis 4 was confirmed.**

To examine research hypothesis 4, which posits that perceptions levels regarding the medical imaging technician profession will positively predict professional image, a linear regression was performed. The results showed a positive impact of perceptions on professional image. Hence, the fourth hypothesis was confirmed (see Table 6). \*Number of missing values in this analysis: 10

**Table 6: Regression results: the effect of awareness and perceptions on professional image.**

	B	SE B	t	$\beta$	F	R <sup>2</sup>
<b>Awareness</b>	.17	.07	2.29	.24*	5.25*	.06
<b>Perceptions</b>	.62	.07	9.08	.69**	82.48	.48

\*p<.05; \*\*p<.001;

### **3.4 Summary**

The findings showed that high importance was attributed to the following issues:

1. The awareness, perception, and image of the medical imaging technician profession and the ionizing radiation are relatively low.
2. The intrinsic and extrinsic motivations for choosing the medical imaging technician profession are high.
3. Relatively low perceptions were found mainly in the following dimensions: salary, prestige, career opportunities, pleasant work, career opportunities, access to employment offers, profession which makes you feel important.
4. A relatively low image was found mainly in the following dimensions: medical imaging technician is a calling, medical imaging technician is an admirable profession, medical imaging technician works independently.
5. When the awareness is high, there is greater willingness to work in a profession that involves ionizing radiation.
6. The perception level affects the image, i.e., the higher the perception, the higher the image of the medical imaging technician profession.
7. The best way of marketing and delivering information about the profession to people who are not interested in learning a medical profession is to provide them a personal experience with the profession.
8. The findings showed that intrinsic motivation was valuable in the choice of a profession in general, and the medical imaging technician profession in particular.
9. The most important sources of information for choosing a profession are conversations with friends and family working in the field
10. The most important source of information for choosing the medical imaging technician profession is conversations with friends and family working in the field.
11. The awareness level of the medical imaging technician profession is higher among people who are interested in learning a medical profession than among those who do not.
12. Significant differences in their order of importance were found between the various items of intrinsic motivation among the 70 medical imaging technicians.
13. Significant differences in their order of importance were found between the various items of extrinsic motivation among the 70 medical imaging technicians.

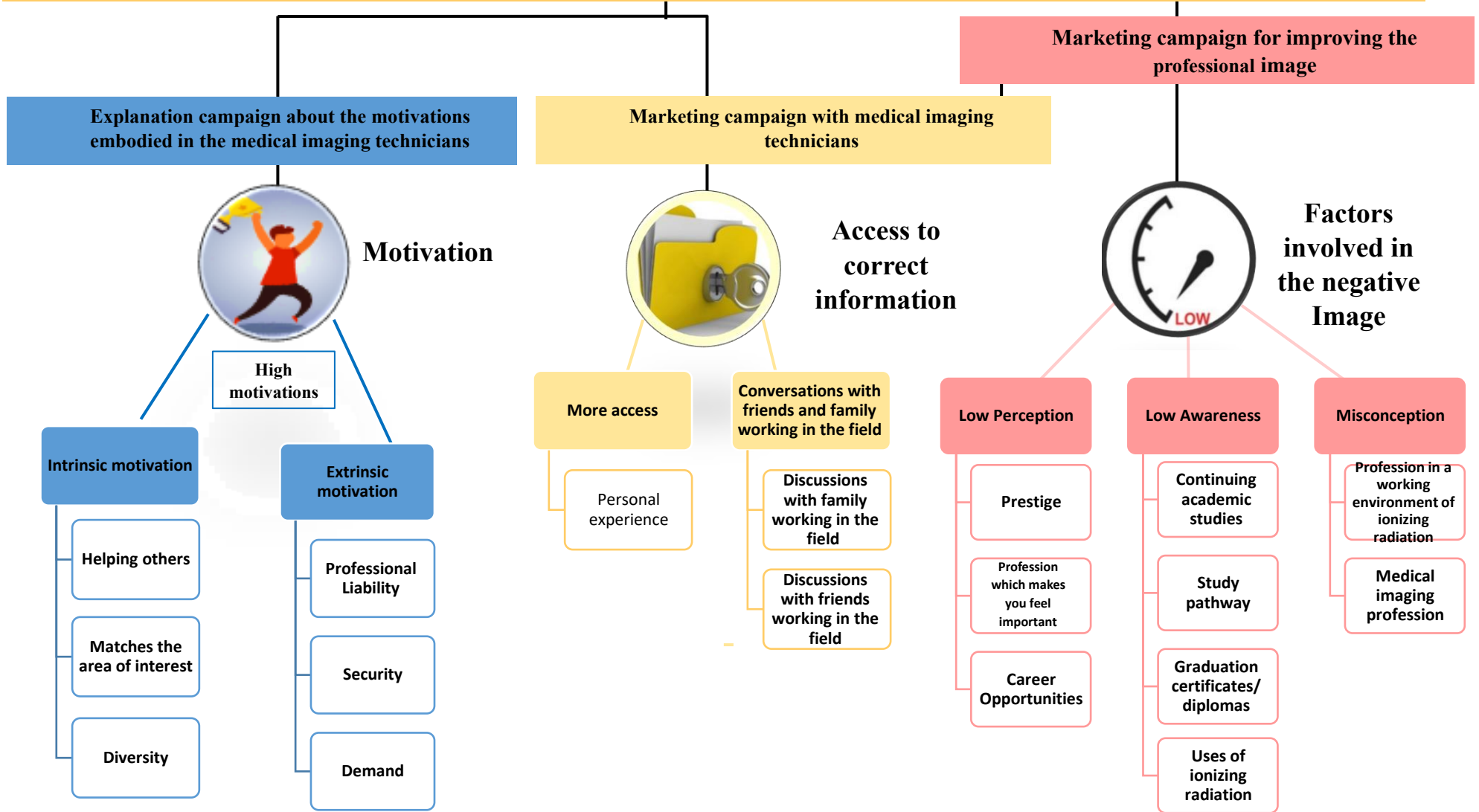
## **Chapter 4: CONCLUSIONS**

### **4.1 Conceptual Conclusions**

The factual conclusions drawn from the research questions facilitated the proposal of the schematized marketing approach presented in Figure 2.

Based on the findings obtained from the qualitative and quantitative research conducted in our exploratory study, Figure 2 presents the three major ways of using marketing to improve perceptions, enhance the image of the profession and, thus, reduce the gap between the demand and supply of medical imaging technicians in Israel.

© Marketing approach diagram for bridging the gap between supply and demand of medical imaging technicians



## Theoretical contribution

### MDIC Model

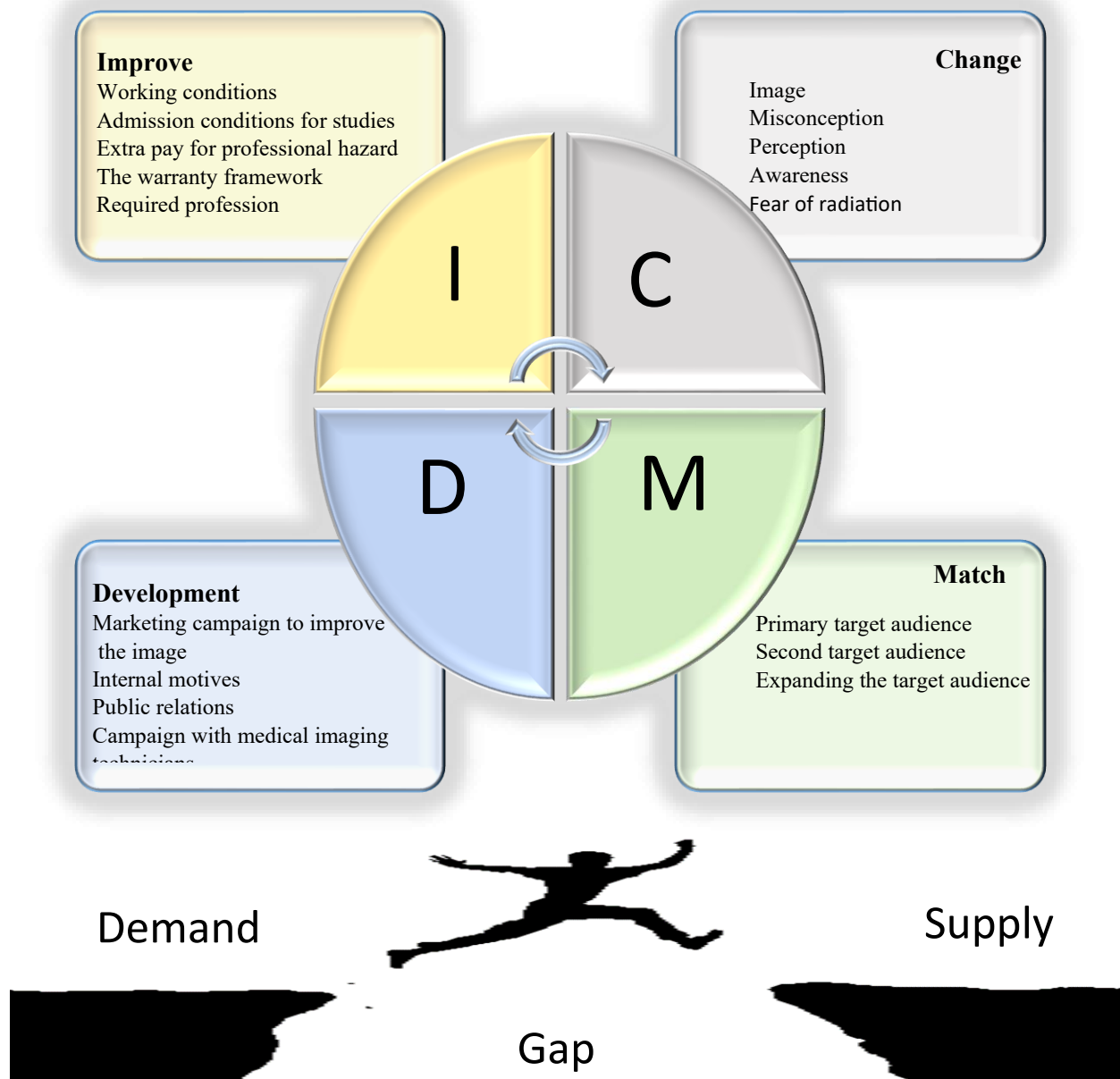


Figure 3: MDIC Model

MDIC is a theoretical model developed on the basis of the qualitative and quantitative research findings as a recommendation for a marketing approach and four stages of action (match; development; improvement; change) designed to narrow the gap between demand and supply of medical imaging technicians.

#### **4.2. Contribution to Knowledge**

The contribution to knowledge is in the innovations of this study regarding the following aspects:

1. Finding the factors involved in the image of medical imaging technicians
2. Finding the factors that can improve the image of this profession.
3. Finding empirical evidence that professional image is a major factor involved in the low supply of labor force.
4. Finding empirical evidence that improving the image will improve the supply of human resources in the field.
5. Advancing a new theoretical model (MDIC model) that recommends a marketing approach and four stages of action (match; development; improvement; change) meant to reduce the gap between demand and supply of medical imaging technicians in Israel.
6. Recommendation of a marketing approach for improving the image of the profession and the supply the human resources in the field.

#### **4.3 Future Studies**

1. Examining the factors of the professional image of medical imaging technicians among additional research populations (a population that wants to develop a second career).
2. Examining the results of the marketing approach of this study in another country around the world that deals with a similar problem – shortage of medical imaging technicians.
3. Examining the theoretical model - MDIC MODEL

#### **4.4 Universal Importance of this Study**

Many countries around the globe experience a shortage of medical imaging technicians. The medical imaging technician profession is one of the professions that are important to the entire world population. Without them, we cannot diagnose diseases, treat oncological patients, catheterize people, and many other areas. The imaging profession is the heart and core of medicine worldwide. This is a highly essential profession at the same level in all countries. Attention should be paid to its importance and contribution for the purpose of offering a just medical standard to the entire population. People should receive equal healthcare services in order to guarantee the right for healthcare to all people. It is important to encourage countries,

particularly those with a shortage of medical imaging technicians, to enforce regulation and control of the training so that only people with the proper education and training perform the tests.

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