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Health Technology Assessment in Hospitals: First Results from a Behavioral Perspective

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Executive Summary

The concern about poor economical resources, together with a greater technology availability that allows more services, compels to find solutions in order to efficiently use assets. In the context of National Healthcare System (NHS), technologies represent a considerable component. Therefore, among the different area of intervention, it becomes fundamental the definition of an appropriate technology park for each hospital company belonging to NHS. The sustainability of NHS is one of the goal that could be reached with the implementation of Health Technology Assessment. This methodology permits to consider all the aspects related to the acquisition of a new technology, taking into account several perspectives besides purchasing cost. Within the hospital context, Head Doctor of a Clinical Department is responsible for the evaluation of a new technology that he/she suggests for the adoption. Nevertheless the proper assessment of a new technology is a voluntary action and there is a shared sentiment that the most part of Head Doctors are reticent and ill-disposed towards it. Hence, there is great interest about what the managing board of an hospital could do to favor and promote the application of instrument such as HTA in order to make more efficient and effective purchase. According to these consideration, we defined the boundaries of our research detecting four research questions:

1. How to model Head Doctor's behavior performing Health Technology Assessment?
2. What are the individual factors that affect Head Doctor's behavior?
3. What are the organizational levers that support or hinder Head Doctor's behavior?
4. How results change among different technologies?

Answers to these questions will shed light on the application of HTA at hospital level from the point of view of Head Doctors, that is the proponents of a new technology. This last aspect is especially meaningful since, until now, most part of literature has addressed to this issue from the perspective of decision-makers. In particular, to frame the behavior of Head Doctors concerning HTA in a well-established behavioral theory was the first step of our study, as well as the first original contribution to the literature. To model the behavior allowed us to consider all the elements that could promote or hinder Head Doctor committed to technology assessment. The set of factors could be grouped in two categories depending on the individual or the organizational aspect. To test our model in a real hospital company with a proven experience in the field of HTA permitted us to identify individual factors that have influence on Head Doctor's behavior. Furthermore, we were able to support the managing board in order to determine what managerial levers affecting organizational factors could support Head Doctor engaged in technology assessment. Lastly, with respect to the broad definition

of “technology” that includes devices, drugs, medical and organizational procedures, we were able to discern if the kind of technology has an impact on Head Doctor’s behavior.

According to the literature review, we defined HTA as “the systematic evaluation of properties, effect or other impacts of health technology” (Goodman, 2004). This methodology is aimed at decision-making and it is suitable to different level of NHS: the regional, national or international level, the level of the healthcare provider, the patient or individual level (Ryynanen, et al., 1999). Besides decision-making, two other basic principles of HTA are the evidence-based knowledge and the interdisciplinary overall assessment. The foundation of HTA is to guarantee the coherence between resources and investments. This requisite is expressed in the first phase of HTA process, that is priority setting. This resource allocation is aimed at defining priorities among several requests for adoption of new technologies. Contributions in literature suggest that high technologies are a priority within a hospital, even if results depend on the context (Kinnunen, et al., 1998). Furthermore, with respect to HTA applied in hospital, doctors are emphasized as an essential figure in prioritization (Myllykangans, et al., 1996). The second step of HTA recalls its second principle that is to collect evidence-based knowledge in order to support the proposal for the adoption of a new technology. Evidence Based Medicine is an information process intended for arranging the best evidence both from individual and external clinical knowledge. Many articles concern the use and implementation of guidelines and recommendations drawn from EBM in the clinical routine. The most part of them agree in the belief that doctors perceive several barriers that prevent them to apply EBM in their practice (Limbert, et al., 2002). Factors are both individual, such as a perceived limit to the clinical judgment (Jorm, 2004), social, like the opinion of colleagues (Limbert, et al., 2002) or organizational related to the context, as insufficient time (Gagnon, et al., 2006). The role of doctor as budget holder who proposes and assesses a technology emerges as pivotal in the process of HTA. Hence, we decided to explore the level of the healthcare provider, also called meso level. The process of acquisition of a new technology falls within the annual budget process. Every doctor responsible for the equipment of his/her own Clinical Department is allowed to propose his/her requests for the adoption of new technologies. In the context of hospital-based HTA a model for capital planning and technology assessment was proposed by Uphoff and Krane (1998) and, moreover, a tool named “mini-HTA” was realized in Denmark in order to limit the content of an exhaustive HTA in a more flexible and brief questionnaire. Both these instruments gained popular acknowledgement since they integrate four perspectives: technology, patient, organization and economy. Nevertheless, there is a general consensus affirming that Head Doctors are reluctant towards the use of such instruments. This situation leads to a stalemate since HTA is an effective methodology that could guarantee the sustainability and the efficiency of investments, an essential

requisite for the survival of modern hospitals. Furthermore, recent literature focused on measures to assess a technology, omitting aspects related to the predisposition of Head Doctor to implement HTA. On the one hand, individual factors such as the personal attitude and the skills of a Head Doctor, explain his/her interest to technology assessment; on the other hand managerial levers should be employed to promote HTA process and to play on organizational factors in order to create a proper context for the implementation of HTA. Therefore, we framed the behavior of a Head Doctor committed to technology assessment in a well-established behavioral theory, adding variables of interest shaping organizational aspects. A comprehensive literature review helped us to understand pros and cons of several social theories and allowed us to define MOA (Motivation-Opportunity-Ability) theory as the most suitable for our purpose. In addition to the original constructs of MOA, that are directly linked to the behavior, we added four antecedents with the goal to catch organizational factors that affect proximal antecedents, represented by *motivation*, *opportunity* and *ability*. We decided to test our model in a hospital company located in Milan, ICP (Istituti Clinici di Perfezionamento), since it has a long tradition of training about HTA and a concrete and formalized experience of technology assessment. Several interviews with the members of HTA nucleus were useful to specify the hypotheses of our model, starting from the behavior of Head Doctors of Clinical Department. As a matter of fact, we were able to focus on a specific behavior that is the contextualization of a new technology in the environment in which Head Doctor works. We pointed out four aspects of this behavior:

1. Evaluation of the *organizational implications* about the introduction of the technology (e.g.: space, time and human resources).
2. Evaluation of the *transition period* before the new technology becomes operative.
3. *Economic assessment* of the technology (e.g.: investment costs, costs of additional human resource, training and maintenance costs).
4. Assessment of the *impact on patient management* (e.g.: the type of therapy, the level of information, the level of actual and perceived safety by the patient, the quality of service provided).

Once established the behavior, we defined which variables among individual and organizational factors explained it. For each construct included in the model we reported the underlined hypotheses:

1. *Head Doctors' motivation to perform technology assessment positively affects their level of assessment*: *motivation* is the personal disposition of a subject to perform a behavior (MacInnis, et al., 1989). In the context of our research this aptitude is referred to the

willingness of the Head Doctor of a Clinical Department who decide to gather knowledge on several subjects (economic aspects, organizational impact, benefits for patient and the transition period) and to contextualize it in his/her context to propose the acquisition of a new technology.

2. *Head Doctors' level of opportunities related to technology assessment positively affects their level of assessment*: *opportunity* is generally indicated as the complex of factors both internal and external that encompass Head Doctor and the activity he/she has to perform (Siemsen, 2005). We identified a technological perspective that comprehends instruments made available by the hospital such as the intranet and the proposal form. Furthermore, we defined an organizational perspective related to the role of Head Doctor and his/her working load.
3. *Head Doctors' ability to perform technology assessment positively affects their level of assessment*: *ability* is the complex of skills, aptitudes and experiences that enable the successful achievement of a task (Minbaeva, et al., 2010). In our context, the construct referred both to what skills Head Doctor owns and how he/she could properly use them.
4. *Social interaction positively affects Head Doctors' ability to assess a technology*: the ability to socialize with colleagues favors the exchange of information and thus the transmission of knowledge (Kelloway, et al., 2000). This process promote the possibility to identify areas for improvement, to discover the need to increase Head Doctors' skills and to create a relationship of trust and collaboration.
5. *Social interaction positively affects Head Doctors' opportunity to assess a technology*: interviews confirmed that the interaction with Head Doctor's staff, other colleagues and experts outside the company increase the *opportunity* of Head Doctor to evaluate and contextualize the new technology.
6. *Social interaction positively affects Head Doctors' motivation to assess a technology*: a Head Doctor that develops interaction with other doctors succeeds in the creation of a relationships based on trust and mutual exchange of knowledge. In so doing, he/she became more confident in the result of the assessment, increasing his *motivation*.
7. *Perceived organizational commitment to HTA positively affects Head Doctors' motivation to assess a technology*: the construct represents the organizational climate shared and perceived by Head Doctors (Rabbiosi, et al., 2009). A positive commitment of the managing board towards HTA is supposed to increase Head Doctor's *motivation*.
8. *Perceived organizational commitment to HTA positively affects Head Doctors' opportunity to assess a technology*: the original construct applied to knowledge sharing had a positive

influence to the extent in which individuals use the opportunities of interaction provided by the organization.

9. *Trust to HTA nucleus positively affects Head Doctors' motivation to assess a technology*: it is the willingness to be vulnerable to a third party and the risk is understood as the uncertainty related to the benefits of adopting a certain behavior (Siemsen, 2005). In our study *trust* is based on the perception that the process of evaluation of the proposal conducted from the HTA nucleus follows standard phases and it is impartial in order to increase Head Doctor's *motivation* towards technology assessment.
10. *A lower degree of psychological safety positively affects Head Doctors' motivation to assess a technology*: it refers to a climate where people feel themselves free to express their views without fear of any repercussions (Edmondson, 1999). We measured it as the perception of a personal injury, a damage on prestige or professional reputation in front of colleagues and the managing board after a certain behavior, that is in practice the absence of *psychological safety*.

The figure below shows the model how it appears with proximal and distal antecedents.

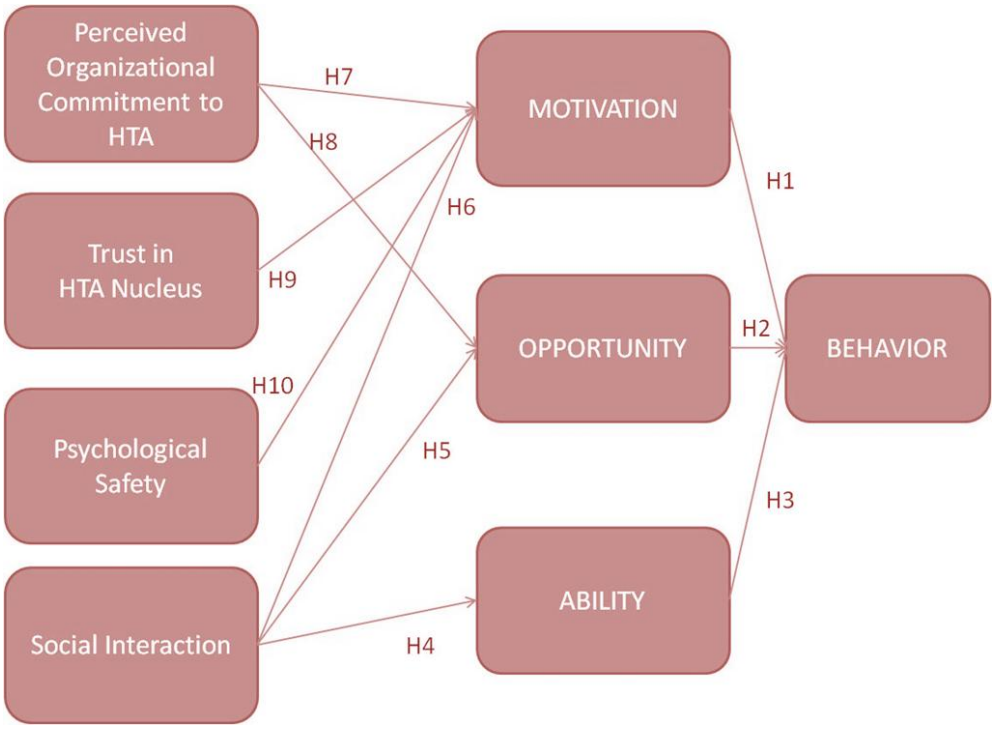

Figure 0.1: Graphical representation of our hypotheses

According to the formulated hypotheses, we developed the questionnaire in order to validate our model. The first section of the survey referred to the constructs of the research model, while the second was composed of general information about the respondent (e.g.: age, gender, years of

career, etc.). Once collected the responses, we conducted a two-tier analysis. In the first part, we checked the measures associated to our model, assessing the reliability of each construct with Cronbach's alpha, as indicated by Nunnally (1978). Then, we explored the correlations between variables in order to recognize a pattern that could explain the adoption of the behavior we intend to predict. Downstream, we analyzed the constructs of *ability* and *opportunity* conducting the *Exploratory Factor Analysis* (EFA), since they were poor correlated with the behavior. On a second level of analysis, we tested our hypotheses using multiple regression method, in particular a hierarchical regression. This recursive regression is suitable for our study since the aim is to test the hypotheses and validate the overall model instead of obtain an accurate prediction of the behavior (Petrocelli, 2003). Each model was estimated with ordinary least square regression (OLS) and was run using STATA 9.2. We submitted the questionnaire to 63 Head Doctors and we obtained a 73% response rate (46 responses). After the analysis of Cronbach's alpha and correlations among constructs, we decided to drop four items that presented problems within the constructs of *ability*, *social interaction* and *trust in HTA nucleus*. These eliminations allowed us to reach high values of reliability for all constructs. Furthermore, with EFA, we identified a predominant construct for *opportunity* (*workload*) and two relevant components for *ability* (*self-efficacy* and *communication capabilities*). The first set of hierarchical regression was run with respect to the behavior adding proximal antecedents (*motivation*, *opportunity*, *ability*) step by step, concluding with the combined model that include all proximal antecedents. Results showed that *motivation* and *ability* had a positive influence on Head Doctor's behavior both individually and in the combined model. On the contrary, the hypothesized relation between *opportunity* and the behavior was not confirmed. Then, we proceeded setting *motivation*, *opportunity*, *ability* as dependant variable and distal antecedents (*social interaction*, *psychological safety*, *perceived organizational commitment to HTA* and *trust in HTA nucleus*) as independent factors, following the hypotheses previously reported. Results confirmed the hypothesis for *opportunity* and *ability*, while *motivation* appeared to be explained only by *social interaction*. Finally, we concluded the first run of regression with the complete model that integrated both proximal and distal antecedents and we obtained a positive and significant effect of *ability* on behavior. Hence, we applied the F test in order to keep in the regression only the most explicative variables, since those rejected verify the null hypothesis demonstrating their poor influence. As a consequence, we inferred that *motivation*, *ability* and *trust in HTA nucleus* are the most predictive variables with respect to the behavior. After EFA analysis conducted on *opportunity* and *ability,* we isolated three relevant components: *workload* from the original variable of *opportunity*, *self-efficacy* and *communication capabilities* from the previous construct of *ability*. In pursuit of that analysis, we run a second set of regression following the previous scheme. We

obtained similar results. In particular, the combined regression with proximal antecedents as independent variables predicting the behavior added *motivation* among the significant factors. Furthermore, among the component of *ability*, *self-efficacy* resulted as the most important variable explaining the variance of the behavior. With respect to the last complete model, once again, we applied F test to and results confirmed that, besides *motivation* and *trust in HTA nucleus*, *self-efficacy* is the most representative component of Head Doctor's *ability* to the point that it has positive influence on the behavior.

Below (cf. Figure 0.2), we reported the graphical representation of the verified hypotheses obtained through the hierarchical regression.

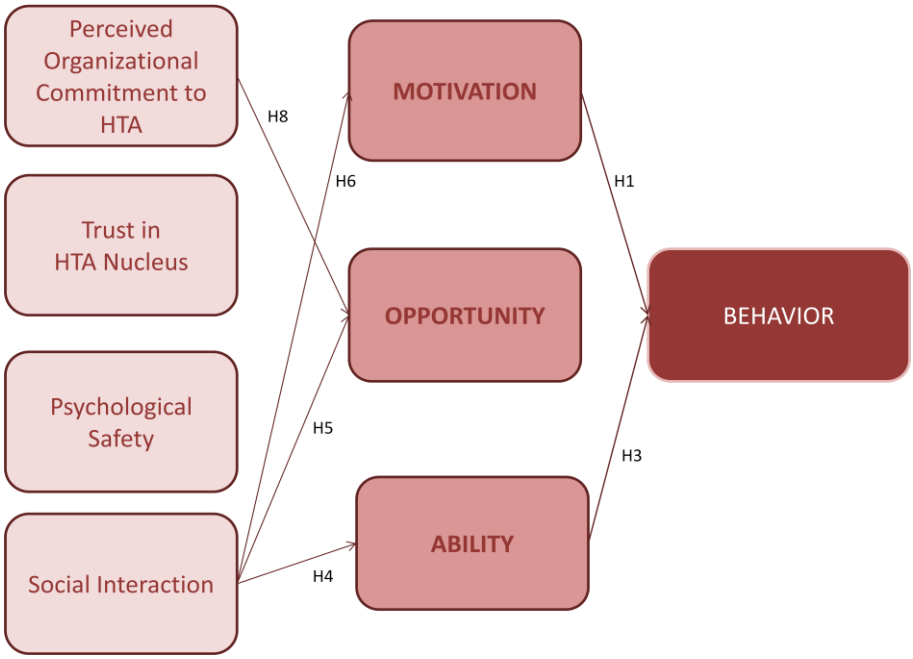

Figure 0.2: Graphical representation of the verified hypotheses

According with the research questions and in the light of results we obtained, we inferred some implications useful for the managing board and for further researches. First of all, we identified the contextualization of a new technology as the behavior that Head Doctor had to accomplish in order to assess the technology they intended to acquire. The effort we did to model the behavior is of particular interest considering the integration between literature contributions and real case study. Furthermore, results from hierarchical analysis demonstrated that the model we realized was proper for the behavior we intended to predict and suitable for the research questions that we addressed. Hierarchical analysis allowed us to meet the main objectives of our research that were to identify individual and organizational factors that support Head Doctors in technology assessment. Individual factors appeared to be preeminent with respect to factors related to the hospital company. In

particular, Head Doctor's predisposition towards technology assessment and his/her personal skills were the most explicative variables, while instruments and opportunities provided by hospital, such as the use of the corporate intranet or the budget form, did not seem to have influence on Head Doctor's behavior. The little interest that Head Doctors demonstrate towards the tool provided by the hospital in order to support their task causes concern. According to the result that indicates *social interaction* and *perceived organizational commitment to HTA* as relevant organizational antecedents, we suggested that communication should be stimulated in every directions, that is horizontal to facilitate exchanges among same professional levels and vertical to promote knowledge sharing between doctors and managerial levels. A greater degree of social interaction among hospital company would probably enhance a better climate and perception of values shared in the company. This last expected result is coherent with the role of *trust in HTA nucleus* as appeared in the final regression where it assumed a pivotal role together with *motivation* and *ability* in predicting Head Doctor's behavior. Furthermore, a feedback mechanism could increase the knowledge of HTA process to Head Doctors that might comprehend also the reason of a possible rejection of their proposals. Feedbacks would also guarantee the traceability of results, creating a collection of evidences useful to increase knowledge overall the company. According to our last research question, we concluded that Head Doctors who propose the acquisition of brand-new technologies were more committed to technology assessment than those who assess technology in order to substitute obsolete one. This result was predictable since in the first case the effort required to assess the new technology is greater than the second case. Concerning the impact of new technologies, the organizational one appeared to be the most frequent, since Head Doctors had a perspective more focused on their Clinical Department rather than the overall hospital company. Lastly, the most requested technologies were equipment, devices and organizational procedures while drug and services were less recurrent even if not circumscribed only to specific Departments, thus without affecting results on Head Doctor's behavior.

Sommario

La preoccupazione riguardante le risorse economiche scarse insieme ad una maggiore disponibilità tecnologica che permette di offrire più servizi, obbliga a trovare soluzioni per usare in modo efficiente le risorse. Nel contesto del Sistema Sanitario Nazionale (SSN), le tecnologie rappresentano una componente considerevole. Per questo motivo, tra le diverse aree di intervento, diviene fondamentale la definizione di un appropriato parco tecnologico per ogni ospedale facente parte del SSN. La sostenibilità del SSN è uno degli obiettivi che può essere raggiunto con l'implementazione della Valutazione delle Tecnologie Sanitarie (HTA). Questa metodologia permette di considerare gli aspetti relativi all'acquisizione di una nuova tecnologia, prendendo in considerazione diversi aspetti oltre al costo d'acquisto. All'interno del contesto ospedaliero, il Responsabile di Unità Operativa è responsabile per la valutazione di una nuova tecnologia che intende proporre per l'adozione. Ciononostante l'adeguata valutazione di una nuova tecnologia è un'azione volontaria ed è opinione comune che la maggior parte dei Responsabili sia reticente e mal disposta verso la stessa. Di conseguenza, c'è grande aspettativa riguardo a ciò che la direzione di un ospedale può fare per favorire e promuovere l'applicazione di strumenti come l'HTA in modo da rendere gli acquisiti più efficienti ed efficaci. Rispetto a questa considerazione, abbiamo definito i confini della nostra ricerca identificando quattro domande di ricerca:

1. Come è possibile modellare il comportamento di un Responsabile di Unità Operativa impegnato nella Valutazione della Tecnologia Sanitaria?
2. Quali sono I fattori individuali che influenzano il comportamento del Responsabile di Unità Operativa?
3. Quali sono le leve organizzative che supportano o ostacolano il comportamento del Responsabile di Unità Operativa?
4. Come cambiano i risultati al variare delle diverse tecnologie?

Le risposte a queste domande faranno luce sull'applicazione dello HTA a livello ospedaliero dal punto di vista del Responsabile di Unità Operativa, ovvero colui che propone la nuova tecnologia. Questo ultimo aspetto è particolarmente significativo dal momento che, finora, la maggior parte della letteratura si è rivolta a questa tematica dalla prospettiva dei decisori. In particolare, inquadrare il comportamento dei Responsabili di Unità Operativa nei confronti dello HTA all'interno di una consolidata teoria comportamentale è il primo passo del nostro studio, nonché il primo contributo innovativo alla letteratura. Modellare il comportamento ci ha permesso di considerare tutti gli elementi che possono supportare o ostacolare il Responsabile di Unità Operativa impegnato nella

valutazione della tecnologia. L'insieme dei fattori possono essere raggruppati in due categorie a seconda dell'aspetto individuale o organizzativo. Testare il nostro modello in un'azienda ospedaliera con comprovata esperienza nel campo dello HTA, ci ha permesso di identificare i fattori individuali che influenzano il comportamento dei Responsabili di Unità Operativa. Inoltre, siamo stati in grado di supportare la direzione aziendale nel determinare quali leve manageriali possono supportare il Responsabile di Unità Operativa impegnato nella valutazione della tecnologia. Infine, rispetto all'ampia definizione di "tecnologia" che include strumenti, farmaci, procedure cliniche e organizzative, siamo stati in grado di discernere se il tipo di tecnologia ha un impatto sul comportamento del Responsabile di Unità Operativa.

Rispetto all'analisi della letteratura, abbiamo definite lo HTA come "la valutazione sistematica delle proprietà, degli effetti o di altri impatti di una tecnologia sanitaria" (Goodman, 2004). Questa metodologia è indirizzata al supporto decisionale ed è adatta ai diversi livelli del SSN: livello regionale, nazionale o internazione, livello del fornitore di servizi sanitari, livello del paziente o individuale (Ryynanen, et al., 1999). Oltre al supporto decisionale, gli altri due principi alla base dello HTA sono la conoscenza basata sulle evidenze (EBM) a la valutazione globale multidisciplinare. Il fondamento dello HTA è garantire la coerenza tra risorse e investimenti. Questo requisito si esprime nella prima fase del processo di HTA, ovvero nella definizione delle priorità. L'allocazione delle risorse è orientate a definire le priorità tra le diverse richieste di adozione di nuove tecnologie. I contributi in letteratura suggeriscono che le alte tecnologie sono una priorità all'interno dell'ospedale, anche se i risultati dipendono dal contesto (Kinnunen, et al., 1998). Inoltre, rispetto allo HTA applicato in ospedale, i dottori vengono indicati come una delle figure chiave per la definizione delle priorità (Myllykangans, et al., 1996). La seconda fase dello HTA richiama il suo secondo principio, ovvero raccogliere conoscenza basata sulle evidenze al fine di supportare la proposta di adozione di una nuova tecnologia. The second step of HTA recalls its second principle that is to collect evidence-based knowledge in order to support the proposal for the adoption of a new technology. L'Evidence Based Medicine (EBM) è un processo di informazione finalizzato all'integrazione delle migliori evidenze disponibili sia dalla conoscenza clinica individuale che da quella esterna. Vari articoli riguardano l'uso e l'implementazione di linee guida e raccomandazioni ricavati dalla EBM nella pratica clinica. La maggior parte di essi concorda nell'assunzione che i dottori percepiscono diverse barriere che gli impediscono di applicare la EBM nella loro routine (Limbert, et al., 2002). I fattori sono sia individuali, come la percezione di un limite al proprio giudizio clinico (Jorm, 2004), sociali, come l'opinione dei colleghi (Limbert, et al., 2002) o organizzativi relativi al contesto, come la mancanza di tempo (Gagnon, et al., 2006). Il ruolo del dottore come detentore di un budget che propone e valuta una tecnologia emerge come centrale nel processo di HTA. Per questo motivo,

abbiamo deciso di esplorare il livello del fornitore di servizi sanitari, indicato anche come livello meso. Il processo di acquisto di una nuova tecnologia rientra nel processo annuale di budget. Ad ogni dottore responsabile dell'attrezzatura della propria Unità Operativa è consentito proporre le proprie richieste di adozione di nuove tecnologie. Nel contesto dello HTA a livello ospedaliero un modello per la pianificazione degli investimenti e la valutazione delle tecnologie è stato proposto da Uphoff and Krane (1998) e, inoltre, uno strumento chiamato "mini-HTA" è stato realizzato in Danimarca allo scopo di limitare il contenuto di una valutazione della tecnologia estesa in un questionario più flessibile e breve. Entrambi questi strumenti hanno conquistato un ampio riconoscimento dal momento che integrano quattro prospettive: tecnologia, paziente, organizzazione e aspetto economico. Ciononostante, c'è un consenso generale verso la convinzione che i Responsabili di Unità Operativa siano riluttanti nei confronti di questi strumenti. Questa situazione porta ad uno stallo dal momento che lo HTA è una metodologia efficace che potrebbe garantire la sostenibilità e l'efficienza degli investimenti, un requisito essenziale per la sopravvivenza dei moderni ospedali. Inoltre, la letteratura recente si è focalizzata sulle metriche per valutare una tecnologia, tralasciando gli aspetti relativi alla predisposizione di un Responsabile di Unità Operativa di implementare lo HTA. Da un lato i fattori individuali come l'attitudine personale e le abilità del Responsabile di Unità Operativa, spiegano il suo interesse per la valutazione della tecnologia; dall'altro lato dovrebbero essere impiegate leve manageriali per promuovere il processo di HTA e per agire sui fattori organizzativi in modo da creare un contesto adeguato per l'implementazione dello HTA. Di conseguenza abbiamo inquadrato il comportamento dei Responsabili di Unità Operativa impegnati nella valutazione di una tecnologia in una teoria comportamentale consolidate, aggiungendo variabili di interesse che cogliessero aspetti organizzativi. Un'estesa analisi della letteratura ci ha permesso di comprendere pro e contro di diverse teorie sociale, arrivando a definire la teoria MOA (Motivazione-Opportunità-Abilità) come la più adatta al nostro scopo. Oltre ai costrutti originali della MOA direttamente connessi al comportamento, abbiamo aggiunto quattro antecedenti allo scopo di cogliere i fattori organizzativi che impattano sugli antecedenti prossimali, rappresentati da *motivazione*, *opportunità* a *abilità*. Abbiamo deciso di testare il nostro modello all'interno di un'azienda ospedaliera di Milano, gli ICP (Istituti Clinici di Perfezionamento) dal momento che l'azienda ha una significativa tradizione di formazione riguardo allo HTA, nonché un'esperienza concreta e formalizzata di valutazione delle tecnologie. Diverse interviste con i membri del nucleo HTA sono state utili per specificare le ipotesi del nostro modello, a partire dal comportamento dei Responsabili di Unità Operativa. Infatti, abbiamo potuto definire in dettaglio un comportamento specifico, ovvero la contestualizzazione di una nuova tecnologia nella realtà in cui il Responsabile di Unità Operativa opera. Abbiamo sottolineato quattro aspetti di questo comportamento:

1. Valutazione delle *implicazioni organizzative* riguardo l'introduzione della tecnologia (es.: spazio, tempo e risorse umane).
2. Valutazione del *transitorio* prima che la nuova tecnologia diventi operative a regime.
3. *Valutazione economica* della tecnologia (es.: costo d'acquisto, costo per risorse umane aggiuntive, costo per la formazione, costo di manutenzione).
4. Valutazione degli *impatti sulla gestione del paziente* (es.: tipo di terapia, livello di informazione, livello di sicurezza percepita, qualità del servizio fornito).

Dopo aver stabilito il comportamento, abbiamo definito quali variabili tra i fattori individuali e organizzativi lo rappresentano al meglio. Per ogni costrutto incluso nel modello riportiamo le ipotesi effettuate:

1. *La motivazione del Responsabile di Unità Operativa di effettuare la valutazione della tecnologia influenza positivamente il suo grado di valutazione*: la *motivazione* è la predisposizione personale di un soggetto a compiere un certo comportamento (MacInnis, et al., 1989). Nel contesto della nostra ricerca questa attitudine è riferita alla volontà del Responsabile di Unità Operativa che decide di raccogliere conoscenza su diverse tematiche (aspetti economici, impatti organizzativi, benefici per il paziente e transitorio) e di contestualizzarla nel suo contest per proporre l'acquisizione di una nuova tecnologia.
2. *Il livello di opportunità del Responsabile di Unità Operativa di effettuare la valutazione della tecnologia influenza positivamente il suo grado di valutazione*: l'*opportunità* è generalmente definita come l'insieme dei fattori interni ed esterni che comprende il Responsabile di Unità Operativa e l'attività che compie (Siemsen, 2005). Abbiamo identificato una prospettiva tecnologica che comprende gli strumenti resi disponibili dall'ospedale come la intranet aziendale e la scheda di richiesta della tecnologia. Inoltre abbiamo definito una prospettiva organizzativa relativa al ruolo del Responsabile di Unità Operativa e al suo carico di lavoro.
3. *L'abilità del Responsabile di Unità Operativa di effettuare la valutazione della tecnologia influenza positivamente il suo grado di valutazione:* l'*abilità* è il complesso di capacità, attitudini a esperienze che permette il raggiungimento efficace di un compito (Minbaeva, et al., 2010). Nel nostro contesto il costrutto si riferisce sia alle capacità che il Responsabile di Unità Operativa deve possedere sia a come egli può usarle efficacemente.
4. *L'interazione sociale influenza positivamente l'abilità dei Responsabili di Unità Operativa di valutare una tecnologia:* l'*abilità* di socializzare con i colleghi favorisce lo scambio di informazioni e di conseguenza la trasmissione della conoscenza (Kelloway, et al., 2000). Questo processo promuove la possibilità di identificare le aree di miglioramento, di scoprire

la necessità di aumentare le capacità dei Responsabili di Unità Operativa a di creare una relazione di fiducia e collaborazione.

5. *L'interazione sociale influenza positivamente l'opportunità dei Responsabili di Unità Operativa di valutare una tecnologia:* le interviste hanno confermato che l'interazione con lo staff dei Responsabili di Unità Operativa, altri colleghi e esperti esterni all'azienda ospedaliera aumentano l'*opportunità* dei Responsabili di Unità Operativa di valutare e contestualizzare la nuova tecnologia.
6. *L'interazione sociale influenza positivamente la motivazione dei Responsabili di Unità Operativa di valutare una tecnologia:* un Responsabile di Unità Operativa che interagisce con altri dottori realizza la creazione di una relazione basata sulla fiducia e sullo scambio reciproco di conoscenza. Così facendo egli diventa più sicuro dei risultati della propria valutazione, aumentando la propria *motivazione*.
7. *La percezione dell'impegno dell'organizzazione verso lo HTA influenza positivamente la motivazione dei Responsabili di Unità Operativa di valutare una tecnologia:* il costrutto rappresenta il clima organizzativo condiviso e percepito dai Responsabili di Unità Operativa (Rabbiosi, et al., 2009). Si suppone che un impegno positivo da parte della direzione aziendale verso lo HTA aumenti la *motivazione* dei Responsabili di Unità Organizzativa.
8. *La percezione dell'impegno dell'organizzazione verso lo HTA influenza positivamente l'opportunità dei Responsabili di Unità Operativa di valutare una tecnologia:* il costrutto originale applicato all'ambito dello scambio di conoscenza ha un'influenza positiva sulla misura in cui gli individui usano le *opportunità* di interazione rese disponibili all'interno dell'organizzazione.
9. *La fiducia nel nucleo di HTA influenza positivamente la motivazione dei Responsabili di Unità Operativa di valutare una tecnologia:* è la percezione di essere vulnerabili ad un terzo soggetto e il rischio si traduce nell'incertezza relativa ai benefici di adottare un certo comportamento (Siemsen, 2005). Nel nostro studio la fiducia è basata sulla percezione che il processo di valutazione della proposta condotto dal nucleo di HTA segua fasi standard e sia imparziale in modo tale da aumentare la *motivazione* dei Responsabili di Unità Operativa nei confronti dello HTA.
10. *Un minor grado di sicurezza psicologica influenza positivamente la motivazione dei Responsabili di Unità Operativa di valutare una tecnologia:* si riferisce ad un clima organizzativo in cui le persone si sentono libere di esprimere le proprie opinioni senza paura di subire ripercussioni (Edmondson, 1999). Abbiamo misurato la sicurezza psicologica come la percezione di avere commesso uno sbaglio, di aver subito un danno al proprio prestigio o

alla propria reputazione professionale di fronte ai colleghi e alla direzione, che in pratica si traduce in assenza di sicurezza psicologica.

La figura sottostante mostra il modello completo con gli antecedenti prossimali e distali.

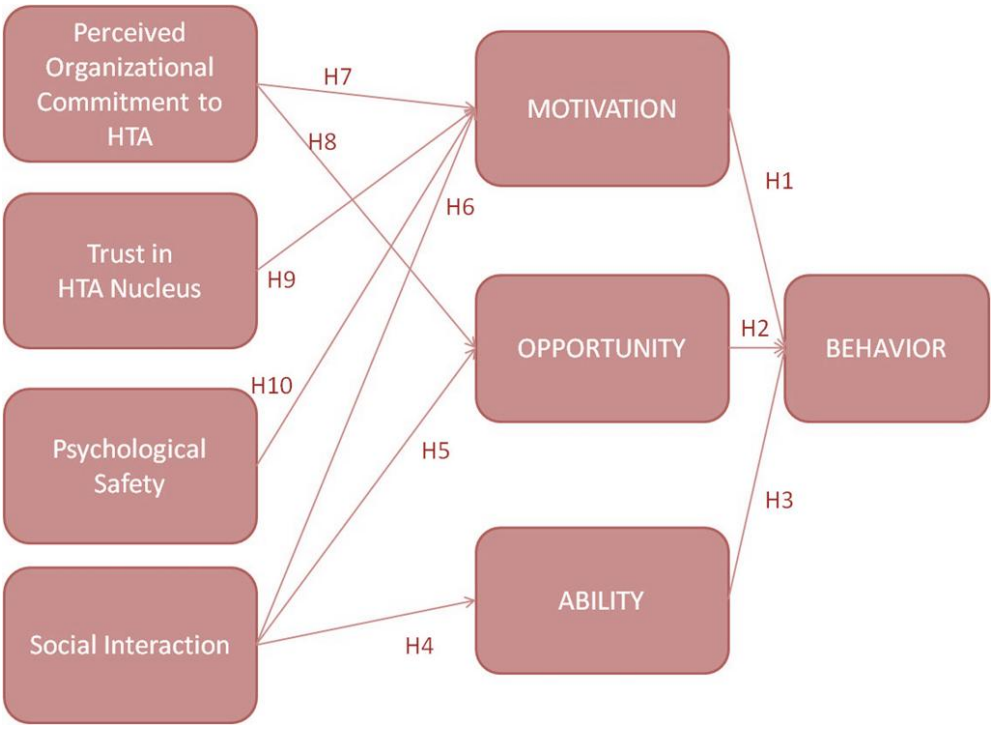

Figura 0.1: Rappresentazione grafica delle nostre ipotesi

Rispetto alle ipotesi formulate abbiamo sviluppato il questionario allo scopo di testare e validare il nostro modello. La prima sezione dell'indagine è relativa ai costrutti del modello di ricerca, mentre la seconda riguarda informazioni di carattere generale relativa al rispondente (età, sesso, esperienza professionale, ecc.). dopo aver raccolto le risposte abbiamo condotto un'analisi sviluppata su due livelli. Nella prima parte abbiamo verificato le misure associate al nostro modello, verificando l'attendibilità di ogni costrutto con l'alpha di Cronbach, come indicato da Nunnally (1978). In seguito abbiamo esplorato le correlazioni tra le variabili in modo da riconoscere un modello che potesse spiegare l'adozione del comportamento che intendiamo predire. A valle, abbiamo analizzato i costrutti di *abilità* e *opportunità* eseguendo una Exploratory Factor Analysis (EFA) dal momento che essi risultavano poco correlati con il comportamento. Passando al secondo livello di analisi, abbiamo testato le nostre ipotesi usando un metodo di regressione multipla, in particolare una regressione gerarchica. Questa regressione ricorsiva è adatta per il nostro studio dal momento che il nostro scopo è verificare le ipotesi e validare il modello nel suo complesso anziché ottenere una predizione accurata del comportamento (Petrocelli, 2003). Ogni modello è stato stimato con la regressione basata sui minimi quadrati usando il software STATA 9.2. abbiamo somministrato il questionario a 63

Responsabili di Unità Organizzativa, ottenendo un tasso di risposta del 73% (46 risposte). In seguito alle analisi dell'alpha di Cronbach e delle correlazioni tra i costrutti, abbiamo deciso di eliminare quattro domande che presentavano problemi rispetto ai costrutti di appartenenza, ovvero *abilità*, interazione sociale e fiducia nel nucleo HTA. Queste eliminazioni ci hanno permesso di raggiungere un elevato valore di attendibilità per ciascun costrutto. Inoltre, con l'analisi EFA abbiamo identificato la componente predominante del costrutto *opportunità* (il *carico di lavoro*) e due componenti rilevanti per le *abilità* (*efficacia personale* e *capacità comunicative*). Il primo gruppo di regressioni gerarchiche è stato eseguito rispetto al comportamento aggiungendo ad ogni step gli antecedenti prossimali (*motivazione*, *opportunità*, *abilità*), per concludere con il modello combinato che includeva tutte le variabili prossimali. I risultati hanno mostrato che *motivazione* e *abilità* hanno influenza positiva sul comportamento dei Responsabili di Unità Organizzativa sia prese individualmente che nel modello combinato. Al contrario, la relazione ipotizzata tra *opportunità* e comportamento non stata confermata. In seguito, abbiamo impostato *motivazione*, *opportunità* e *abilità* come variabili dipendenti e gli antecedenti distali (interazione sociale, sicurezza psicologica, percezione di impegno da parte dell'organizzazione verso lo HTA e fiducia nel nucleo HTA) come fattori indipendenti, seguendo le ipotesi discusse precedentemente. I risultati hanno confermato le ipotesi riferite a *opportunità* ed *abilità*, mentre la *motivazione* risulta essere spiegata solo dall'interazione sociale. Infine, abbiamo terminato il primo insieme di regressioni eseguendo il modello completo che integra antecedenti prossimale e distali e abbiamo ottenuto un effetto positivo e significativo dell'*abilità* rispetto al comportamento. Quindi, abbiamo applicato il test F per mantenere all'interno della regressione solo le variabili più esplicative, dal momento che quelle rifiutate verificano l'ipotesi nulla dimostrando il loro scarso effetto. Di conseguenza ne abbiamo dedotto che la *motivazione*, l'*abilità* e la fiducia nel nucleo HTA sono le variabili maggiormente predittive rispetto al comportamento. Dopo l'analisi EFA condotta rispetto a *opportunità* e *abilità*, abbiamo isolato tre componenti rilevanti: il *carico di lavoro* dall'originale variabile dell'*opportunità*, l'*efficacia personale* e la capacità comunicativa dal precedente costrutto delle *abilità*. Come proseguimento di quella analisi, abbiamo svolto un secondo insieme di regressioni gerarchiche seguendo lo schema precedente. Abbiamo ottenuto risultati comparabili. In particolare, la regressione combinata con gli antecedenti prossimali come variabili indipendenti che predicono il comportamento ci ha permesso di aggiungere la *motivazione* tra i fattori significativi. Inoltre, tra le componenti delle *abilità*, l'*efficacia personale* è risultata essere la variabile più esplicativa della varianze del comportamento. Rispetto al modello completo, ancora una volta, abbiamo applicato il test F e i risultati hanno confermato che oltre alla *motivazione* e alla fiducia nel nucleo di HTA, l'*efficacia personale* è la componente più

rappresentativa delle *abilità* dei Responsabili di Unità Operativa, al punto di avere un'influenza positiva sul comportamento.

Di seguito (cf. Figura 0.2) riportiamo la rappresentazione grafica delle ipotesi confermate attraverso l'analisi gerarchica.

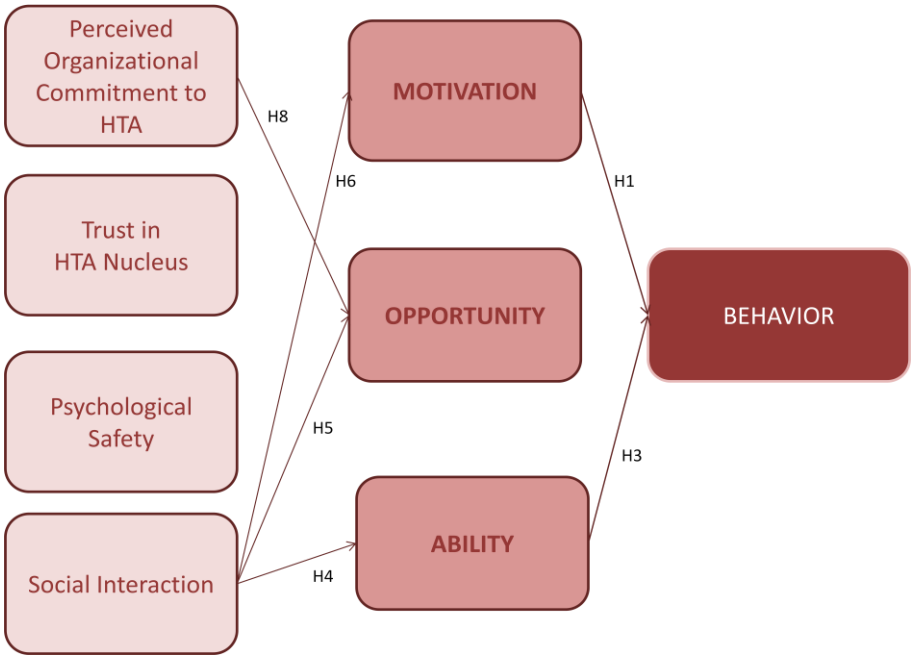

Figura 0.2: Rappresentazione grafica delle ipotesi confermate

Secondo le domande di ricerca e alla luce dei risultati ottenuti, abbiamo dedotto alcune implicazioni utili per la direzione aziendale e per future ricerche. Innanzitutto, abbiamo identificato la contestualizzazione di una nuova tecnologia come il comportamento che i Responsabili di Unità Operativa compiono al fine di valutare la tecnologia che intendono acquisire. Lo sforzo che abbiamo fatto per modellare il comportamento è di particolare interesse considerando l'integrazione tra i contributi della letteratura e lo studio di un caso reale. Inoltre, i risultati dell'analisi gerarchica hanno dimostrato che il modello da noi realizzato era adatto per il comportamento che intendevamo prevedere e adatto per le domande di ricerca che abbiamo affrontato. L'analisi gerarchica ci ha permesso di raggiungere gli obiettivi principali della nostra ricerca, ovvero identificare i fattori individuali e organizzativi che supportano i Responsabili di Unità Operativa nella valutazione della tecnologia. I fattori individuali sembrano essere preminenti rispetto ai fattori relativi all'azienda ospedaliera. In particolare la predisposizione dei Responsabili di Unità Operativa nei confronti della valutazione delle tecnologie e le sue *abilità* personali sono state le variabili più esplicative, mentre gli strumenti e le *opportunità* offerte dall'ospedale, come l'uso della intranet aziendale o la scheda di budget, non sembrano avere influenza sul comportamento del Responsabile di Unità Operativa. Lo

scarso interesse che i Responsabili di Unità Operativa dimostrano verso gli strumenti forniti dall'ospedale per supportarli nel loro compito desta preoccupazione. Rispetto al risultato che indica l'interazione sociale e la percezione di impegno da parte dell'organizzazione verso lo HTA come antecedenti organizzativi rilevanti, abbiamo suggerito che la comunicazione debba essere stimolata in tutte le direzioni, ovvero in orizzontale per facilitare gli scambi tra gli stessi livelli professionale e in verticale per promuovere la condivisione delle conoscenze tra medici e livelli manageriali. Un maggior livello di interazione sociale all'interno dell'azienda ospedaliera probabilmente potrebbe migliorare il clima e la percezione dei valori condivisi all'interno dell'azienda. Questo ultimo risultato atteso è coerente con il ruolo della fiducia nel nucleo HTA così come appare nella regressione finale dove assume un ruolo centrale insieme alla *motivazione* e alle *abilità* nel predire il comportamento dei Responsabili di Unità Operativa. Inoltre, un meccanismo di feedback potrebbe aumentare la conoscenza del processo di HTA dei Responsabili di Unità Operativa che potrebbero comprendere anche il motivo di un possibile rifiuto delle loro proposte. I feedback potrebbero anche garantire la tracciabilità dei risultati, creando una raccolta di evidenze utili per aumentare la conoscenza globale dell'azienda ospedaliera. In accordo con la nostra ultima domanda di ricerca, abbiamo concluso che i Responsabili di Unità Operativa che propongono l'acquisizione di una tecnologia completamente nuova sono più impegnati per la sua valutazione rispetto a quelli che valutano la tecnologia al fine di sostituirne una obsoleta. Questo risultato era prevedibile in quanto nel primo caso lo sforzo richiesto per valutare la nuova tecnologia è maggiore del secondo caso. Per quanto riguarda l'impatto delle nuove tecnologie, quello organizzativo sembra essere il più frequente, in quanto i Responsabili di Unità Operativa hanno una prospettiva più orientata alle loro Unità Operative, piuttosto che all'azienda ospedaliera nel suo complesso. Infine, le tecnologie più richieste sono apparecchiature, dispositivi e procedure organizzative, mentre i servizi e i farmaci sono meno ricorrenti, anche se questo trend non è circoscritto solo a specifici reparti, di conseguenza non intacca i risultati rispetto al comportamento dei Responsabili di Unità Operativa.

1. Introduction

1.1 Research Context

Italian health system is a regionally based National Health Service (NHS), founded in 1978, that provides universal coverage free of charge at the point of service. The system is organized across three levels: national, regional and local. The national level is responsible for ensuring the general objectives and fundamental principles of the NHS. Regional governments are responsible for ensuring the delivery of a benefit package through Local Health Care Trusts, as well as public and private hospitals. The Italian NHS is largely funded through national and regional taxation, supplemented by co-payments. Decentralization of the healthcare system has led regions to have substantial legislative, administrative and regulatory powers.

The main welfare challenges of the National program, first of all problems of social and healthcare related to the lack of self-sufficiency, the great number of senior and old people, the availability of high cost treatments to specific patients, need a convergence of financing from various sectors on defined and shared objectives. The growth of the absorbed resources, in consequence of the welfare challenges, highlights the problem of the economic sustainability which has to be pledged by a multilevel governance (national, regional and company) able to maintain a steady balance between services and financing, effectiveness and efficiency with respect to costs. The hard compromise between growing healthcare needs and scarce resources, which guarantee the supply of services, determines the effective sustainability of the whole supply system. To warrant the right of healthcare means to offer services, activities and treatments required to the prevention, the diagnosis and the treatment of illness and the rehab from disabilities and meantime it also means that these are high quality services, activities and treatments, offered on the right time, at the right place, in the right manner for the effective needs of society. An inefficient use of the available resources compromises the opportunity for all citizens to benefit by the NHS. If the sustainability of the system is the scope, it becomes fundamental to measure periodically the financial resources together with procedures to regain efficiency, especially for those hospital company with considerable deficit, so that the resources arranged by State keep tied up to the fundamental objectives of improvement of the National Health Service.

The specific objectives are, on the one hand, to enhance all the elements of excellence of the NHS and to invest in strategic sectors as prevention, new technologies, informative system, clinical governance and safety of treatments, research and clinical innovation; on the other hand, the

objectives are those about the reclamation of efficiency and appropriateness and the improvement of quality perceived from citizens.

National Health Service stands out from international system for its excellence: quick welfare response, accessibility to services by citizens, wide pharmaceutical coverage, long life expectancy, network for transplant, free pediatric welfare, high technology diagnosis, high level of vaccination. Against this strengths there are also some weaknesses, for instance: some services are not suitable, as the inappropriate use of ward and hospital admissions due to an insufficient organization of general medicine and welfare house; long waiting list, high pharmaceutical expense par person in some Regions and a highly differentiate quality level among Regions. Among them, new technologies are the cause of an increment of new services related but this is not balanced with a reduction of obsolete services.

The planning of public investments to refurbish structures and technologies of National Health Service has recently taken into account the need to qualify the welfare service, paying attention to an efficient and effective allocation of investments to control public health expense. Regions can plan investments with their own resources and with public funds in respect of these guidelines:

- to keep a safe and efficient technology park to perform health services;
- to innovate health processes, clinical protocols and technologies;
- to pursue regional projects on innovative guidelines;
- to extend technology park, especially new health structures, to improve and update the offer, to provide high quality services.

Regions have to pledge the economical and administrative sustainability.

The quick development of medical devices is a well-known occurrence by health worker and the other stakeholder belonging to this sector, since in all these area new and innovative devices are often suggested. Health authorities are called into this dynamic market to act on two principle ways with interventions both on regulatory field and on the governance of the system, from a clinical and administrative point of view.

The availability of many innovative medical devices and the purchase cost are taking up a higher importance. Therefore it is important to balance different factors: the availability of new devices to patient, the appropriateness of planning, purchase and use of medical devices, the availability of funds of the National Health Service's structures. It is essential to reach a correct assessment of the innovative product (not just "new") to enhance the benefits for patients and, in general, for the system. The main instrument in this field is represented by Health Technology Assessment (HTA).

In healthcare, as in other many realities, technologies represent an essential component. The medicine in the last years has experienced quick transformations with the introduction on the market of innovative and high performance technologies that, on the one hand, allow the evolution towards more accurate procedures and, on the other hand, can increase costs of the health system. In Italy, the spread of technologies on the territory is inhomogeneous with a prevalence among Nord Regions and a major lack in Southern and Central Regions. For the great part, obsolete systems coexist with innovative systems of recent acquisition. In the universe of health technologies, it is possible to identify two area of interventions: the area of biomedical devices, with diagnostic and therapeutic purpose, and that of information and communication technology (ICT), as medical and health computer science, electronic health, telemedicine and so on. Focusing on biomedical devices, at the moment, the spread on territory is not adequate either to needs or to economic criteria and fair employment, both in qualitative and quantitative terms. This is mainly due to a lack of a methodology for Health Technology Assessment, an essential base to define criteria of acquisition, spread and use of medical devices on territory. In this context and in consideration of a quick and continuous evolution, technological development in health environment has to foresee a plan of intervention for the acquisition of emerging technologies in many sectors, a compliance about the distribution of technologies among national territory and a modernization of obsolete technologies. The renewal of technologies has to satisfy an increasing need of innovative welfare and to aim at highly technological matter. The development and the renewal of technologies are closely related to the need of defining a market analysis in order to:

- define appropriate criteria for the spread of technologies and their type;
- accommodate both the purchase and the management cost of devices among national territory;
- rationalize resources through an excellent use even with mixed public-private management system.

Recently, Health Technology Assessment in Italy is gaining trust to orientate the goals of the 2011-2013 National Health Plan. However it is important first to understand how the management of technologies within a hospital is and why they are acquired. Teplensky et al. (1995) suggest that there are three different rationales for hospital adoption of technology: fiscal-managerial, strategic-institutional and medical-individualistic. Each perspective partially captures motivations for the adoption of a new technology when, actually, they are multifaceted and complementary, rather than being mutually exclusive. The first view suggests that financial return, in term of expected profitability, is the principal reason that explains the adoption of a new technology within the

hospital. The gap between projected and current costs and revenues is one of the determinant that have influence on the acquisition of a medical device. According to the second perspective, called also "technological preeminence", hospitals adopt new capital-intensive health technologies, aside from cost, in order to improve their image as technological leader, with the aim to attract doctors and patients. Consistent with this rationale, there is the differentiation strategy based on technological leadership, theorized by Michael Porter. The third perspective focuses on the supply of the needed services, as defined by doctors. This rationale is based on the hypothesis that hospitals and doctors request a new technologies based on the estimation of actual clinical need, aside from economical or competitive considerations (Teplensky, et al., 1995). Regarding the second perspective, Hofmann (2002) wonders about the various explanations of the technological imperative. He affirms that technological imperative is something that reduces human responsibility. People are responsible for all the aspects related to technology, from its design and production till its commercialization and application. This conception implies a correlation between technological opportunities and moral responsibility that leads healthcare professionals and decision-makers to recognize, in particular, the importance of assessing technology carefully and in detail (Hofmann, 2002). Since the profit maximization perspective suggests that technology acquisition within hospital is driven by administrative priorities, and the clinical excellence perspective highlights the role of medical priorities, both perspectives appear to partially capture factors of interest for technology adoption. On the contrary, the technological preeminence argument appears to be driven by both medical and administrative goals. In fact, adopting new equipment and medical devices, a hospital may expand and increase its current services increasing financial revenues and, at the same time, attract new doctors attracted by innovations, allowing a better image of the hospital with respect to its catchment area (Teplensky, et al., 1995).

Most part of clinical decisions and treatments performed in modern hospital are affected by medical technologies (Uphoff, et al., 1998). Therefore hospitals play a pivotal role in the definition of a fair planning of resources and investments with particular respect to technology adoption. In the last decades, various model of capital planning and technology assessment have been suggested. A typical example is a flowchart proposed in 1998 as a result of a study conducted by Uphoff and Krane about the importance of hospital-based technology assessment. The flowchart allowed the implementation of a multidisciplinary approach, based on the contributes of doctors directly involved and on the respect of criteria such as safety, costs, organizational impacts, etc. That model of decision-making, precursor of the current HTA, rapidly became a benchmark for clinical resources management since it allowed the integration of that process in hospital operations. We inferred that resource rationing and the appropriateness of a technology park within hospitals are serious

concerns and, among various actions, HTA is the suitable methodology to contribute to sustainability of the whole health system, including hospitals.

1.2 Goals of This Study

In the research context, we have highlighted those that are critical aspects of the National Health Service, which are possible areas of intervention and improvement. These challenges can be translated into one big problem, namely the excessive consumption of scarce resources. The relevant question is how to make economically sustainable the NHS, when the resources are not sufficient to meet the health care costs and to increase the level of service quality. The main objective of the NHS is to ensure its long-term sustainability, continuing to provide health services for prevention, diagnosis and treatment.

It is fundamental to have a balance between the health needs and the use of scarce resources, in order to ensure this, there is necessitate to filter and pass under careful evaluation of all that enters into the hospital, and then absorbs resources and makes changes of different types, organization, technologies used, the procedures in act, but also on the same path of life of the patient and hence the quality of the service. Resources must be submitted to a financial control to ensure the pursuit of long-term economic sustainability. We have seen then, that the NHS has more specific objectives relating to the excellence of health services, investments in strategic sectors, and increase the appropriateness and the quality of services offered.

Although the possibilities of intervention are many, the NHS has highlighted the need for careful management of investment since the technological evolution has led to the development of more innovations that are increasingly expensive. Therefore the purchase of a technology often results in the impossibility of buying another. This highlights the need to achieve a responsible choice that is the result of a balanced and comprehensive evaluation of different impacts, in order to enhance the benefits for the patients due to a correct assessment of innovative product, favorite by HTA. We have to consider also that hospitals acquired new technology in order to satisfy different needs and objectives. In the previous chapter, we said that there are three perspectives which are followed for a purchasing decision within the hospitals, and, based on these perspectives, three different criteria of choice between alternatives are defined (Teplensky, et al., 1995). For the first one, the choice depends on future expected profitability due to the new innovative product; for the second one, the choice depends on the capability of the new technology to improve the hospital's image and to attract physicians and patients; the last one perspective sees the actual needs of the hospital as the motive that determines the purchase of a new technology which does not depend on financial,

prestige or competitive considerations that could take to the choice of a different technological alternative.

In the current reality, these three perspectives are not mutual exclusive, in each hospital there is one of them that is prevalent, but in an ideal situation three perspectives should be integrated and the purchasing choice should be depend on a criterion which considers several aspects. HTA is the instrument that integrates these aspects in order to reach the best choice of acquisition and, hence, to define an appropriate technology park for the hospital. Despite the many possibilities of intervention, we decided to focus on the evaluation of innovations, because a very significant cost item in the budget of the hospitals is just attributed to investments in technology (that is any technological innovation, and also organizational procedures, drugs, devices, medical equipment).

Our decision is based on the fact that a reduction in investment to conserve resources is not possible, because of the ever growing need to increase the number, efficiency and quality of health services and technologies to replace obsolete with next-generation solutions that are often more expensive. Therefore, we must act on the rationalization of resources and, in this case, on evaluating innovative alternatives and choose those that from time to time are more useful and consistent with the objectives of the hospital. In order to understand how to increase the use of HTA within hospitals, we have found that the proponents for the purchase of technologies are the Head Doctors of the hospital, and then we want to know how they conduct the assessment and on which bases. Proposers who are responsible for technology assessment, are required to collect specific information about impacts that a certain innovation, if adopted, would have on the patient, on budget, on the organization, in order to support their request according to guidelines of HTA. Thanks to the literature, we know that they do not make the assess or they do it but not voluntarily and not in the correct way. We want to understand why and how proposals could change the actual situation and favoring the predisposition of the Head Doctors to do the assessment. One of the problem is certainly methodological, in fact there is not a technology assessment procedure used and shared. It follows that many claims are based, not on evidence in the literature, but perhaps on personal opinions or bias of the manufacturers. As a result, proposals are not accompanied by in-depth analysis and an appropriate assessment of alternatives, based on the actual need for the innovation and the context of inclusion. In these cases, the proposal should not be sent on the basis of personal desire to achieve a particular technology but it should be in line with business aims since avoiding the risk of introducing something that could cause damage rather than benefits should be an objective for the proponent. After discovering the responsible of the contextualization of a technology within the hospital, we believed to be able to identify what are the elements and characteristics that distinguish a proponent who is willing to conduct an evaluation of innovation , and who is involved in

the search of all information necessary to complete and provide a comprehensive picture, from another one who does not perform this analysis, but instead simply forwards the request to acquire what he/she wants, without an adequate information support. So, in this research project, the objective has been declined in the more detailed definition of what are the various individual factors, technological, social and organizational arrangements that may affect the preparation of the proponent to take the time to provide the proposal of purchase of a technology, based on a careful and appropriate assessment.

In fact, it was only after clarifying what and how these factors affect the provision of a medical evaluation of an innovation that we were able to propose technological, social, organizational and individual interventions, designed to encourage, support and motivate the proponent to adopt a specific behavior, that is to evaluate a technology, that must be contextualized in Head Doctors' working reality, making the analysis of all possible impacts and the search for scientific evidence. We wanted to discover those factors in order to propose to the managing board how it can intervene, avoiding system of economic incentives or coercive method. In order to be successful, the assessment of a technology should be fully voluntarily and its purpose completely understood.

1.3 Organization of Contents

Before starting to describe the contents of the chapters of this research, we want to show our flowchart we followed in order to find all information and to build this study.

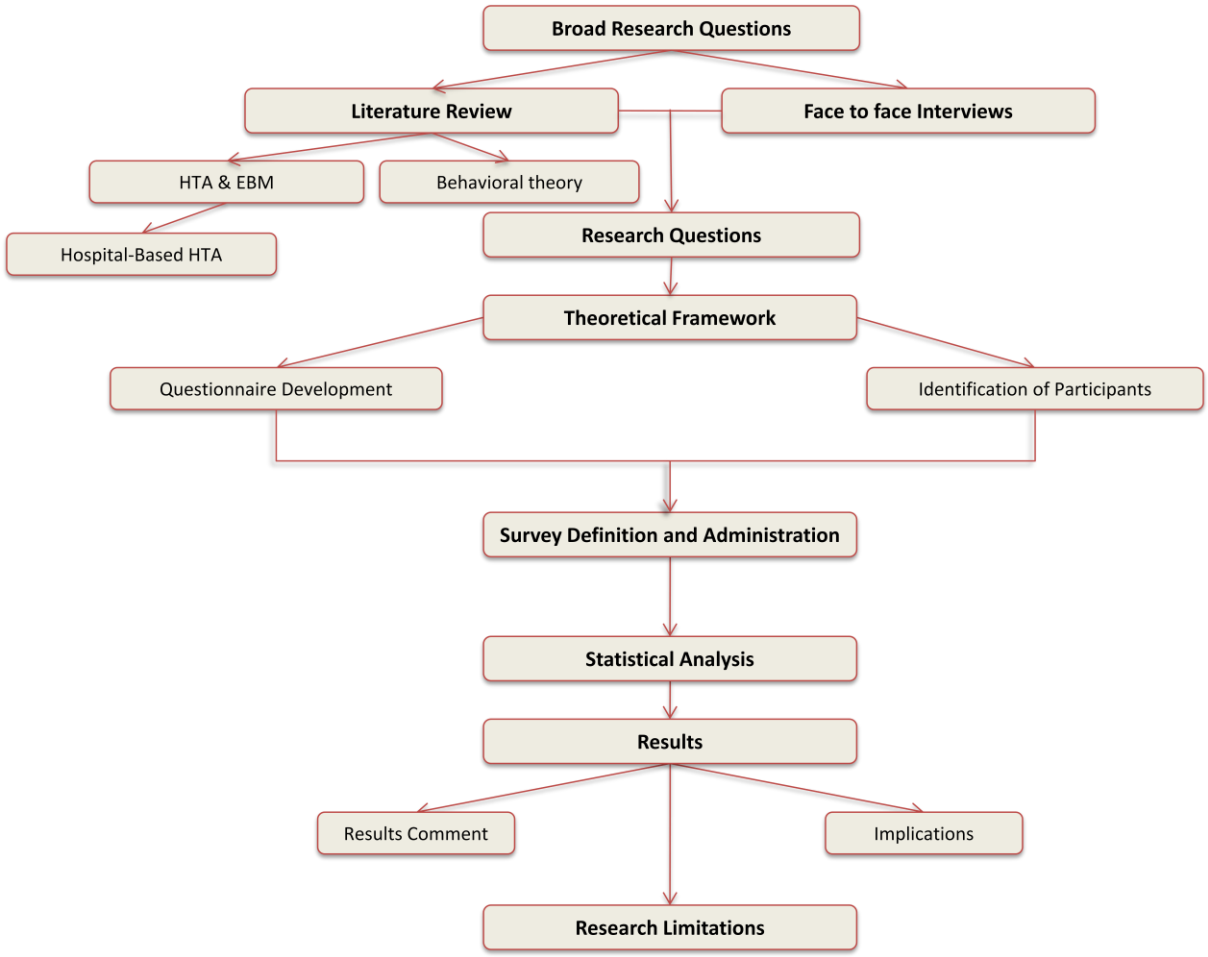

Figure 1.1: Research's flowchart

We started our research with the definition of the context at the current state. So the chapter 1 is dedicated in the first part to definition of the general characteristics of the Health Sector and NHS with its problem and its critical aspects. Once defined the context, we specified the objectives of this study in order to establish how we had to proceed with the research and so organize the contents.

In chapter 2, we started with the definition of the domains of the research and the research strategy because we wanted to give a specific order to the literature review, that was made searching, on the one hand, the information about Health Technology Assessment, Evidence Based Medicine and Hospital Based HTA and, on the other hand, on the behavioral and social theories adapt to our context of analysis. Literature review helped us to understand the context, in which the Head Doctor

operates, and the cognitive and social theories that usually are employed to explain similar phenomena. The chapter continues with a selection of two possible theory to apply to our study and the definition of the gaps we found in literature review and it ends with the presentation of the research questions.

The chapter 3 introduces the general framework that permitted us to depict the Macro-Micro problem thanks to the general solution of Coleman (1990). The literature review, however, was not enough to have a complete picture of the specific behavior. So a series of interviews with several exponents of an Italian hospital served us to frame the behavior and to build the conceptual framework ad hoc. In this way, thanks to the two contributions, we chose the theory which could explain more about the contextualization of a technology in the local reality in which Head Doctor works. In that framework, we inserted the model of the theory and then we explained all the hypotheses on which the model is based. These hypotheses were built on the contributes of literature and of the interviews we made with same professional figures of Health Sector.

Then (chapter 4), after the definition of the framework, we explained the methods used and the measures we followed for this study. The chapter starts with the definition of the sample we used for the research, the participants of the survey and then we described the measures used, the development of the questionnaire to submit to Head Doctors of a health company and the statistical methods we decided to use to evaluate the consistence of the hypotheses of the model proposed and to elaborate the responses.

The chapter 5 contains all the results obtained by the elaboration of the responses of the questionnaire collected. We used hierarchical regression in order to assess the validity of the model proposed.

Finally, in chapter 6, we reported the comments to the results obtained in the previous chapter, some considerations and implications for Head Doctors, achieved also thanks to the interviews to the four Head Doctor that had participated to the HTA nucleus and who met us in order to discuss together the results, and again for the members of managerial level of a hospital, which could intervene with some operative actions and act on factors that influence the Head Doctors' predisposition to perform the behavior. The last argument we treated was that of the limitations of our research, since this is a first explorative study that would be improved and expand in further studies.

2. Literature Analysis

2.1.Domains of Literature and Search strategy

The main objective of this study is to identify organizational and individual factors to encourage, support and motivate the Head Doctor, who intend to acquire a new technology, to search for scientific evidence and to evaluate within his/her context all possible impacts.
As a result, we identified three main issues that had to be deepen in literature: first, the wide framework of Health Technology Assessment in which the technology assessment carried out by the Head Doctor is included; second, given that the context of our research is the hospital, we had to analyze the process of HTA within the hospital that practically relates with the budget process; finally, the behavior of the Head Doctor is our unit of analysis and for this reason we had to identify those social and cognitive theories able to model his/her behavior.
We conducted a two-tier literature search to identify the most relevant articles dealing with the three previously presented issues.
We searched for full-text articles and abstract and, in this last case, those considered relevant were obtained.

On a first level of analysis, we searched for articles that helped us to understand the wide context of Health Technology Assessment in relation to technology innovation in healthcare.
On a second level of analysis, we refined the literature search according to the objective of our search. Therefore, we explore the following two issues: Health Technology Assessment at hospital level and behavioral models applied to health sector.
For each level we applied three complementary search strategies.

The first strategy was a systematic review of two important journals in Health sector, considered of value both for health policy-makers and professionals: “Health Policy” and “International Journal of Technology Assessment in Health Care” since 1990 onwards.

Our second strategy was an electronic literature search for the same period of time, covering the database “Scopus” to collect all the relevant contributions through specific keywords. For the first level of analysis we applied the following keywords to article titles, abstract and keywords: “health technology assessment, healthcare”. In the second level of analysis we refined our search adding some filters: “health technology assessment, healthcare” AND “hospital, budgeting” for Health Technology assessment at hospital level and “model, behavio*r, theory” AND “ doctor OR physician”

AND "technology assessment, healthcare" for behavioral models. In this last case we also search for the exact name of the theory (e.g., MOA, TPB, TRA and so on).

Finally, as third strategy, we checked the references and citations for each article considered useful for our research.

The result of this research are 69 articles included in this study since they were considered relevant to the objective of this work. The following paragraphs showed the State-of-Art of the main fields of analysis.

2.2. Health Technology Assessment (HTA) & Evidence Based Medicine (EBM)

Accordingly to the first level of our search strategy, we outlined the general framework of Health Technology Assessment as a starting point for our research objective. First of all, we defined health technologies as "the drugs, devices, medical and surgical procedures used in health care, and the organizational and supportive systems within which such care is provided'' (Banta, 2003). This broad definition emphasizes the pervasiveness of technology in healthcare. Goodman (2004) proposes a comprehensive framework of HTA starting from its origins in 1960s as Technology Assessment (TA), till the various definitions of Health Technology Assessment (HTA) that has been given since 1970s. Goodman highlights the key concepts of a health technology then applies them to Health Technology Assessment, giving his definitions and defining the purpose, all the aspects and the phases in details. In Goodman's words Health Technology Assessment is "the systematic evaluation of properties, effect or other impacts of health technology" (Goodman, 2004). Although direct and simple, this definition does not underline the linkage between HTA and decision-making at a policy-level. In fact, how is this association generated? In the last decades, factors as the growth of welfare needs due to demographical aging, the growth of expectations of patients, the desire for reputation of doctors, who increasingly require advanced technologies and the growth of technological innovation, have caused a strong growth of health expense. Besides the increase of resources required for welfare, international economies progressively fall down, not only for cyclical phenomena. The coincidence of those two opposed realities leads the attention of policy-maker on the use of health resources. Many Countries are implementing a transition from a mono objective (effectiveness or cost) problem to multi objectives one that correlates effective welfare to generated costs when it is properly applied on a population and that places all these information on a epidemiological, clinical, economic, social, political and ethical context of decision-making. The modern health policy strategy does not restrict the expense tout-court, but it wants to ensure to citizens, in term of health outcome, the best that a

rational employment of health resources can allow. The attention put to the fair allocation of public resources cannot put aside from an observation on technologies that represent a significant expenditure in healthcare and, also, a mean to warrant a gain in health to citizens. Hence the need to apply HTA to support decision-making for technology in healthcare at different levels: the individual or patient level, the level of the healthcare provider or institution, or the regional, national and internationals level (Ryynanen et al., 1999):

- Macro level: the government makes decisions on health care policy and resource allocation;
- Meso level: a hospital or a community makes decisions on arranging health care;
- Micro level: a doctor makes decisions on treatment of a patient;
- Patient level: patient chooses between different alternatives to seek medical consultation.

This concept of HTA is well-exposed in the 2011-2013 Italian National Health Plan that underlines the usefulness of Health Technology Assessment as a comprehensive and methodic evaluation of welfare, economic, social and ethic consequences caused by health technologies. The consequences could be direct and indirect, caused by new or existing technologies and they are assessed in short and long term. The contribution of HTA could extend from preemptive interventions to those diagnostic, therapeutic, rehabilitative and of telemedicine. Assessment phase considers some essential elements as the description of technology, the safety of patients, the fitting of the new technology in a specific organization and economic evaluations. These four perspectives (technology, patient, organization and economy) are a constant of HTA through its different levels of application. The process of HTA requires the collaboration of many actors: doctors, economists, epidemiologists, statisticians and so on, together with decision-makers. Beyond this technical assessment, the appraisal follows and the decision-maker enounces his conclusion about the possible acquisition of the technology and its possible constraints or extension of use.

In literature, we found a significant example regarding the application of HTA to a local or regional level, developed in 2005 in Denmark through DACEHTA (Danish Centre for Evaluation and Health Technology Assessment). It proposed the “mini-HTA” a flexible and dynamic tool adaptable to local conditions that could be easily incorporated into local and regional budget and planning process. This model is defined “mini” because it comprehends 2-5 pages of questions grouped according to the four HTA perspective (technology, patient, organization and economy) and it takes 5-15 hours, excluding the time spent on information retrieval and assessment and economic calculations. On most occasions, the choice between a complete HTA and a “mini-HTA” depends on a trade-off involving the quality of the assessment and the quickness that such a tool has to assure for decision support (Vestergaard, et al., 2005).

The Danish Centre for Evaluation and Health Technology Assessment (DACEHTA) summarizes the three basic principle of an HTA:

- it is based on evidence-based knowledge;
- it is a question of an interdisciplinary overall assessment;
- it is aimed at decision-making.

The output of HTA is to establish a well-documented and comprehensive overview of the consequences of the new technology in the health service.

The need to consider the consequences about the introduction of a new technology has grown in developed countries since decades. In fact, HTA at the international level is a widespread practice as witnessed by the creation of the International Network of Agencies for Health Technology Assessment – INAHTA – that gathers all the organizations around the world which approach to this theme in a systematic and specific way. With similar objectives, the Health Technology Assessment International – HTAi – links on a professional level all the people who deals with this theme at the university, at the Local Health Care Trusts, in the industry and in the voluntary service.

The European Commission has often recognized the importance of the Health Technology Assessment and, for this reason, the European Network for HTA – EUnetHTA – was created to coordinate 35 European organizations.

In Italy, in 2006, took place the "1° Italian Forum for Health Technology Assessment" involving all the organizations of the Italian Network of Health Technology Assessment (NI-HTA) and a paper named "Carta di Trento" was subscribed. This paper establishes a framework for a national HTA, inspired on the basic principles of the international experiences of HTA. It underlines the importance of an interdisciplinary assessment to all levels of healthcare aimed at decision-making. *Health Technology Assessment* is mentioned for the first time in the 2006-2008 National Health Plan where the need to promote the use of HTA and to gather all knowledge on the subject it is recognized as a priority, as witnessed by some pilot experiences in different Regions (Lombardia, Veneto, Emilia-Romagna, Piemonte, Toscana) (Favaretti, et al., 2009).

One of the problem in our Country is the unfair spread of health technologies among the territory. The aim of this methodology is to allow an equal, fair and rational distribution of technologies among the national territory, to avoid waste or harmful lack.

The 2006-2008 National Health Plan points out that Health Technology Assessment addresses to different levels of decision-making in order to support:

1. decisions about healthcare policy (adoption, spread and financing of new technologies);
2. managerial decisions about investments in new technologies at hospital level and the promotion of an appropriate use of technologies creating protocols;

3. clinical decisions about the spread of governance, e.g., qualitative and quantitative standards.

The principle objective is the creation of a national network defined at regional and hospital level to promote the sharing of information and knowledge to support decisions at the different levels, in order to have reliable, timely, clear and transferable information about health technology. The HTA activities have to be connected with the European actions to allow an effective exchange of experiences among the Countries. The 2011-2013 National Health Plan points out that in the last few years the interest for Health Technology Assessment is increased and this leads to a heated argument in health field. To a regional and national level there have been some attempts of concrete experiences but they remain fragmentary and in embryonic state. The Collaborative Interregional Network for HTA (RiHta) proposes the development and fixation of all HTA's activities in order to promote knowledge sharing. The consistence of RiHta will become fundamental to implement Evidence Based Practice. Nevertheless, the success of RiHta about knowledge sharing is bound to other initiatives as:

- The promotion of primary research to put in decision-makers hands data about effectiveness, costs and usefulness contextualized in Italy;
- The spread of culture and instruments of HTA to create a common language between scientists and decision-makers;
- The professional growth and the acquisition of skills for all the actors involved in the process of assessment;
- The development of informative tools supporting knowledge sharing;
- An impartial coordination able to define the mission, targets and strategic actions of RiHta and to convey engagement and experiences of each reality in a profitable way.

It is also important to define a normative intervention about the national management of technological innovation by recognizing:

- Authorities involved;
- Responsibilities for each part of the process;
- Role of stakeholders (economic and professional interests) and university;
- Outcome of the assessment and its influence on decisions about health policy.

In 2008, *Regione Lombardia* published its program of HTA. Following the guideline expressed in 2006-2008 National Health Plan, it identified three main processes that had to be accomplished to assess a new technology:

1. the identification of the priorities for the healthcare system and the need for assessments,
2. the systematic collection of the evidence about efficacy and effectiveness,

3. the assessment of the evidence and the final judgment on technologies.

The first step of the process of HTA is represented by an overview of all the request submitted by doctors to a Committee for Priorities Evaluation and Conflict of Interest. The importance of this phase comes out from the awareness that resources – money, human resources, etc… – are not allowable for all projects, requests or technologies in healthcare. The Committee has the task to arrange in order of importance all the request of assessment for technologies. Each request will be assessed toward eight criteria:

1. technical importance
2. safety
3. efficacy
4. effectiveness
5. economic impact
6. equity
7. social impact
8. organizational impact

Technical properties refer to performance characteristics and conformity (design, composition, manufacturing, tolerances, reliability, ease of use, maintenance, etc.).

Safety is a judgment of the acceptability of risk (a measure of the probability of an adverse outcome and its severity) associated with using a technology in a given situation, e.g., for a patient with a particular health problem, by a clinician with certain training, and/or in a specified treatment setting.

Efficacy refers to the benefit provided by a technology for a particular problem under ideal conditions, previously defined. *Effectiveness* refers to the benefit provided by a technology for a particular problem under the usual circumstances of a healthcare practice (Goodman, 2004). In order to compare all the requests with the criteria previously cited, the proposal forms has to be carefully fill in. The responsibility of this task is up to the proposer who, to a hospital level, matches with the doctor responsible for the adoption of new technologies.

The second phase is concerned with *evidence-based medicine*, that is the systematic research of evidence, guidelines and documents which bear out the efficacy and effectiveness regarding technologies. A new actor in involved in this process: “Technical Committee for Appropriateness of Medicine”. Together with the Committee, previously cited, it has to collect scientific documents and practical trial concerning health technologies for every criteria used in the definition of priorities.

The last part of the assessment is the final judgment about the technologies and the spread of disseminations for the whole healthcare system. “Technical Committee for Appropriateness of Medicine” and other accredited experts join this phase. The result is a database of recommendations

of use about healthcare technologies, updated and validated by region, in order to inform allocative, applicative and evaluative decisions.

The foundation of HTA is the coherence between resources and investments. In the framework for HTA of *Regione Lombardia* as in those of other experiences, national and international, this requisite is well expressed in the first phase of the process which requires to define priorities among the requests for the adoption of innovation. In general term, the process of priority setting in healthcare is aimed to distribute resources to different services in a rational way. This resource allocation takes place at all levels of the health system since it is part of Health Technology Assessment (Reeleder, et al., 2006). The need for priority setting arises from the consciousness that, in recent years, available resources for healthcare are no longer enough to cover all public expectations. This aspect has to face the aging of population that cause an increasing demand for health services. Health systems, especially those of western countries, have to rethink to their policies because nowadays the question is no longer whether rationing or not but how to do so. Priority setting concerns to ethical aspects considering that one of the challenge of many countries is to ensure equal access to healthcare for everyone. This matter affects health policy but it suggests that prioritization could not be a justification for solving financial problems and maintain only some services (Myllykangans, et al., 1996). A recent framework proposed in literature is that of Accountability For Reasonableness (A4R) applied to the healthcare sector. According to it, different authors have found that healthcare institutions engaged in priority setting are adherent to fairness if they satisfy four conditions:

- Rationales for priority setting decisions must be accessible for public (publicity condition);
- Rationales must be relevant to priority setting in the specific context (relevance condition);
- There must be a way to appeal for these decisions and their rationales (appeals conditions);
- The first three conditions has to be warrant by voluntary or regulatory means (enforcement condition).

The interviews conducted by the authors to members of two committees engaged in priority setting for new technologies in Canada, helped the author of the qualitative research to draw up different elements of fairness. Then, he links them to the framework of A4R. The decision-makers of the study confirmed the idea that fairness entails fair process. They also identified two general – *fairness equals fair process* and *fairness not all or none but relative* – and 11 specific elements of fairness in priority setting – seeking *multiple perspectives*, establishing *leadership*, creating an *opportunity to express views*, ensuring *honesty*, seeking *external consultation*, establishing *understanding*, ensuring *transparency*, achieving *consensus*, identifying *potential conflicts of interest*, *agenda setting* and creating *appeals mechanism* (Martin, et al., 2002).

Three different methods to prioritize have been identified in literature:

- External prioritization between patients or patient groups;
- Internal prioritization between different treatments for the same patient;
- Prioritization by tightening treatment criteria.

Regardless of the type of priority setting, there is a general tendency among politicians, healthcare providers and general public to consider that all prioritization decisions should be made by doctors. In fact many politicians admit that their resources, as knowledge and time, are too limited to set priorities on a macro level and that doctors have more influence on resources allocation. Thus, prioritization is lead at the micro level, which emphasizes the important role of doctors in decision-making at hospital level (Myllykangans, et al., 1996).

Focusing on what type of services to prioritize in case of cutback or increase (of the same size) in healthcare budget, the responses found in literature are not stable and are very context-dependant. Usually, home care is on the top of the services that must be prioritize, despite resources. Specialized care is also considered an important services among those prioritized, even in case of decreasing resources. This finding suggests the emphasis given to high technology care among doctors, nurses, clinicians, general public and politicians (Kinnunen, et al., 1998).

We can infer that doctors accountable for a given set of resources are primarily involved in priority setting for their level of responsibility. Technologies are part of resources that doctors have to assess following a fair and rational process as suggested by many contributions in literature.

Although different authors have addressed the problem of priority setting, many of them had focused on attitude toward prioritization among different groups of healthcare provider, general public and politicians and other on what type of services prioritize. However, results suggest a growing interests in the role of doctors in decision-making at hospital level or micro level. This result appears even more interesting if we remind the scarcity of resources and the fact that technologies are an increasing expenditure among healthcare costs. HTA is a solution to define formal priorities even if literature has not given the proof yet. In particular, there is a lack about the role of budget holders within the hospital in setting priorities and the instruments that they could use to fix them.

The aim of Evidence Based Medicine is to measure specific criteria for the quality of healthcare in order to improve the overall performances of the healthcare system. The need for EBM is due to the increasing number of available healthcare products, technologies and interventions together with economic pressure that force decision-makers to base their decision on evidence about the quality of healthcare. For this reason, EBM is considered a process for support decision through all levels of healthcare. In relation to HTA, the criteria taken into account in EBM are referred to, for example, safety, efficacy, effectiveness, costs, cost-effectiveness. EBM is an information process to

accommodate the best evidence from individual clinical knowledge with external clinical evidence from systematic research. The process of EBM follows four step:

- Establishment of a clinical question;
- Literature search for relevant clinical articles;
- Critical appraisal of the evidence related to its usefulness and validity;
- Implementation of useful findings in clinical practice.

The evidence could be obtained using different methods: from the ones more quantitative to a more qualitative ones. According to the methodology of retrieval, all the evidence could be classified in order of importance using different levels:

- Level 1: it is the highest level of evidence that can be obtained by systematic reviews of relevant randomized controlled clinical trials;
- Level 2: at this level, evidence can be obtained by a smaller randomized clinical trials, even if statistical results are not significant;
- Level 3: evidence is obtained by non randomized controlled trials, cohort studies or case controlled analytical studies;
- Level 4: evidence is obtained by non-experimental research;
- Level 5: evidence is obtained from studies or experts opinions.

Regarding evidences, recommendations and guidelines, many authors have tried to investigate doctors' intention and inclination to search for them and to apply them in their clinical practice. Limbert (2002) in his research identifies factors that influence doctors' use of clinical guidelines. In the first part of the study he conducts some unstructured interviews which reported a positive attitudes towards guidelines among doctors. Indeed, guidelines are considered useful for decision-making, especially in managing conditions with which doctors are unacquainted. In doctors' opinion guidelines have to be based on research evidence even if this can compromise the generalizability of the findings among patients. In fact, there is a quite widespread opinion that guidelines do not consider all the factors that constitute the problem of the patients, denying their individuality. In the second part of the research, he develops two questionnaire with the approach of the Theory of Planned Behavior (TPB) comparing two types of guidelines affecting junior and senior doctors. The results show that the intention of junior doctors to use guidelines, as opposed to that of more senior doctors, is influenced by social factors, as the opinion of colleagues and their experiences. On the contrary, senior doctors based their intention to apply guidelines in their clinical practice on their beliefs about the topic, for example the usefulness of the guidelines (Limbert, et al., 2002). Furthermore, doctors' intention to use recommendations in their clinical practice is influenced by

factors that are context dependant as the characteristics of the technology, the medical specialty and the environment in which they operate (Gagnon, et al., 2006). In some cases, these factors represent also a barrier to implement EBM. Especially referred to the environment, insufficient time is the most important barrier mentioned in various studies. Other limiting factors regard the difficulties in interpret a clinical need in a search question, performing a literature search and, then, translate the available literature in answers to a clinical need. Even if available aggregated clinical guidelines are increasing, put new evidence into practice remains a difficult task for doctors to accomplish. Doctors' habit and existing ideas are very hard to change (Van Dijk, et al., 2010). Many doctors perceive guidelines as a limit to their freedom and their clinical judgment (Jorm, 2004). Qualitative researches demonstrates that, in addition to a perceived limit in time and attitude, also a lack of skills and knowledge prevent doctors in apply EBM. The possible solutions proposed to improve the practice of EBM are training, pre-appraisal of resources, journal club, specially designed web sites assisting doctors in their searches, training in English language and translation of papers to overcome language barriers (Van Dijk, et al., 2010).

The concept of EBM could be easily applied to a broaden approach of Evidence Based Healthcare. In fact, the use of evidence in healthcare is a typical scientific method. Decision making cannot be established anymore on individual opinions or past experience but it has to be aimed towards more use of science, using research and evidence (Leys, 2003). This kind of approach could be directly linked to priority setting and HTA. In both cases, EBM represents a starting point, an input, for the processes. The evaluation of healthcare services (e.g.: interventions and technologies), the dissemination of the results and the final application of those findings into practice are phases that follow those of HTA, as previously seen. EBM and HTA, together, enable the definitions of priorities for every level of healthcare providers in the process of decision making. Hence, EBM is a keystone tying the three concept and their application to an hospital level where the single doctor is responsible for his/her own resources, accountable for how he/she decides to use it and the justification that he/she produce for this. Doctors, who are budget holder and cope with public resources, are responsible for decisions made at their Clinical Department and how resources are going to be employed. Even if limited to their area of accountability, they are called to defines lines of priorities, to retrieve certain evidence and to apply it in their context.

At this level of analysis, the search literature suggest that the most part of the contributions deal with the definitions of priorities and the process of EBM. That is, we decided to expand our search literature to a second level of analysis, deepening the concept of HTA applied to a hospital context and focusing on the role of the doctor as pivot figure of this process, especially in regard to the translation of certain evidence in his/her environment.

2.3. Hospital Based Health Technology Assessment (HBHTA)

According to the fact that HTA is aimed at decision making, a health policy could be implemented with two approaches: top down and bottom up. Policy making from the top down often presents two important problems: on the one side it threaten loss of power and control among the health care worker, on the other side what appears rational to the policy maker usually results irrational and very difficult to put in practice to doctors that must implement it in their everyday practice and gained a result from it. On the contrary, a bottom up policy making can have a significant long-term beneficial impact (Nobel, 1988).

The previous analysis of the literature suggests that doctors, in particular budget holder, has a fundamental role in defining resource allocation within the hospital. In fact, every year hospital administrators and doctors have to cope with the budget and one of the aspects that has to be face is technological acquisition. Every doctors responsible for a technological equipment is allowed to make his/her proposal for the adoption of a new technology. Afterwards, the Budget Committee will assess all the requests from the Clinical Departments. In the first chapter, we pointed out that the rationale underlying the request of adoption of a new technology suggested by Teplensky (1995) could be of three type: fiscal-managerial, strategic-institutional and medical-individualistic. In addition to these rationale, it is important to consider that the adoption of innovative process both technological and organizational in health services increase the health status of the population with respect to their quality of life. The effects derived from the adoption of an innovation on the one hand cause the substitution of the old technology by the new one; on the other hand, when the technology become effective under certain conditions, the demand for health services grow and the total medical expenditure increase (Garcia-Goni, et al., 2007). That is, it become of particular interest within the hospital assess new technologies following a well-established methodology as HTA. Three rationale that explains technology adoption at hospital level are the substitution of obsolete technology, followed by increasing capacity for health services that are already delivered by the hospital and, at least, discretional investments for launching new health services or reengineering current clinical paths. Each of them has its own sponsor that could be Clinical Engineering Service, Health Director or many others according to the specific need. These three actors attend in most cases the HTA Unit in their hospital, even if not formalized. Proposal forms guide the doctor in order to drawn his/her proposal. The domains covered in these forms are mainly: technology, patient, economic, organization and evidence. Findings suggest that often these information compiled by doctors are difficult to collect and to resume on a form. The Budget Committee can assess the proposal of new technologies adoption “collegial” or “sequential”: the first way is mainly used in small hospitals where all the members of the Committee reviewed co-temporally the request and

openly discuss till they reach a common evaluation; in the second way each member reviews the part of the request accordingly to his/her competence and if everyone agrees the technology will be selected for adoption. Feedbacks are given to the main sponsor of the proposal and explanations are given in case of rejection. The collegial approach is the one that best suits the framework of HTA that hope for multidisciplinary. EBM should be apply in both cases but findings suggest that this approach is more difficult to apply, even if necessary. Maybe, the availability of data and past experiences within the hospital could improve the process of evidence collection.

What happens in real application is that some aspect of the proposal form are not considered and those taken into account are usually technology, patient and economics. Furthermore the collegial approach is often substitute with the more immediate sequential method. The scarcity of resources, in terms of money and time, and a lack of skills are probably the cause for a partial implementation of HTA at hospital level.

Further researches are recommended about the role of the proponents of a new technology and the role of the Budget Committee to increase the accountability and fairness of decision-making. These implications encourage us to explore the issues related to the doctors who are called in first person to propose new technologies, support their requests with evidence and fill in the proposal form in order to submit it to the Budget Committee and, eventually, other HTA Committees.

One of the first contribution we found in literature about hospital based HTA suggests the creation of a Technology Assessment Committee (TAC) representative of several specialties both clinical and administrative within a hospital, in order to assess a new technology with a multidisciplinary approach (Uphoff, et al., 1998). Authors provided a list of 12 questions, that we below reported in the original format:

1. Does technology work?
2. Is it safe?
3. Is it an improvement over existing medical technology?
4. What will be the hospital-wide impacts of the technology?
5. How much the proposed technology cost, and will it be effective?
6. How does the proposed technology fit with the strategic plan for the hospital, and does it support the hospital's mission statement?
7. What are the effects on the patient and the community?
8. What are the risk management/legal liability issues and impacts?
9. Will the technology receive regulatory approval and what will be the regulatory constraints?
10. Will the technology assist the institution in moving into the managed care marketplace of the future?

11. What are ethical, political and social impacts of this technology?
12. Is there an urgent need for the new technology?

Answers to these questions support the final judgment about the new technology that a proponent wants to acquire. The acquisition requires a capital expenditure that, usually, is contextualize in a budget process performed by a Budget Committee, as previously claimed, or Capital Planning Committee, as suggested by Uphoff and Krane (1998). As a result, a model that integrate capital planning and technology assessment is recommended and we reported it in the first form of a flowchart (Uphoff, et al., 1998):

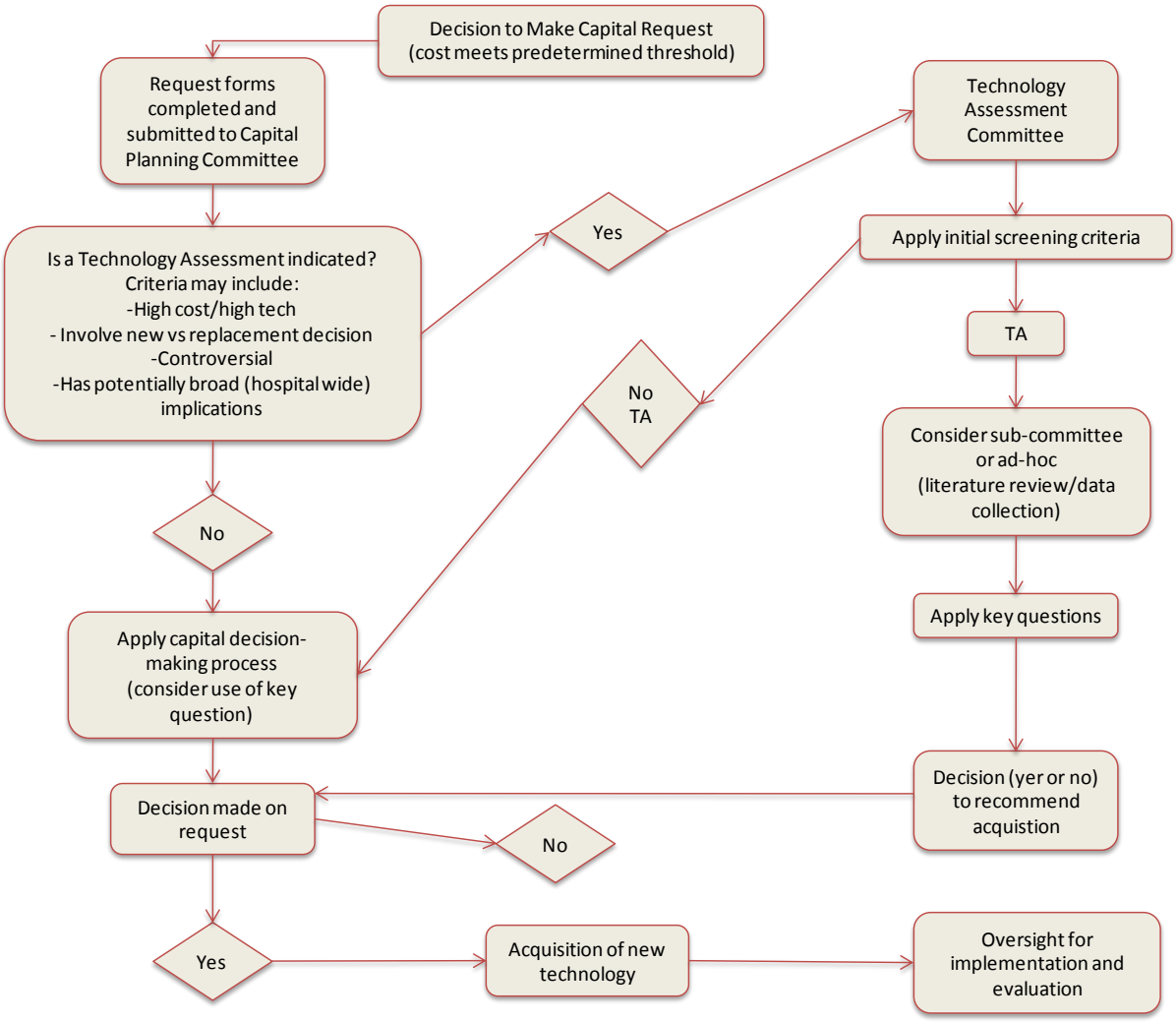

Figure 2.1: A flowchart for Capital Planning and Technology Assessment (Uphoff, et al., 1998)

With the same aim to support decision-making, mini-HTA is a flexible tool useful to assess a new technology, developed by the DACEHTA (cf. Chapter 2, paragraph 2.2). In particular, referred to hospital application, mini-HTA presents several advantages such as the use of local resources, the compliance with the specific context, the clear amount of work to assess the technology, the availability of evidence and documentation about new technologies. Furthermore, it motivates

hospital company towards a more complete approach to HTA. Questions are organized in 5 sections that we reported below:

- Introduction
    1. Who is the proposer (hospital, department, person)?
    2. What is the name/designation of the health technology?
    3. Which parties are involved in the proposal?
- Technology
    4. On which indication will the proposal be used?
    5. In which way is the proposal new compared to usual practice?
    6. Has an assessment of literature been carried out (by the department or by others)?
    7. State the most important references and assess the strength of the evidence.
    8. What is the effect of the proposal for the patients in terms of diagnosis, treatment, care, rehabilitation and prevention?
    9. Does the proposal imply any risks, adverse effects or other adverse events?
    10. Are there any other ongoing studies in other hospitals in Denmark or abroad of the effect of the proposal?
    11. Has the proposal been recommended by the National Board of Health, medical associations etc.? If YES, please state institution.
    12. Has the department previously or on any other occasions, applied for introduction of the proposal?
- Patient
    13. Does the proposal entail any special ethical or psychological considerations?
    14. Is the proposal expected to influence the patients' quality of life, social or employment situation?
- Organization
    15. What are the effects of the proposal on the staff in terms of information, training or working environment?
    16. Can the proposal be accommodated within the present physical setting?
    17. Will the proposal affect other departments or service functions in the hospital?
    18. How does the proposal affect the cooperation with other hospitals, regions, the primary sector etc. (for instance in connection with changes of the requested care pathway)?
    19. When can the proposal be implemented?
    20. Has the proposal been implemented in other hospitals in Denmark or internationally?

- Economy
    21. Are there any start-up costs of equipment, rebuilding, training etc.?
    22. What are the consequences in terms of activities for the next couple of years?
    23. What is the additional or saved annual cost per patient for the hospital?
    24. What is the total additional or saved cost for the hospital in the next couple of years?
    25. Which additional or saved cost can be expected for other hospitals, sectors etc.?
    26. Which uncertainties apply to these calculations?

These two contributions suggested that recent literature has focused on how to evaluate a technology, on correct measures in order to catch all salient aspects of health technology, omitting the aspect related to the proponent and his/her approach towards different mechanisms to evaluate a technology. A proper methodology has to be apply and put in practice in hospital in order to support decision-making. Since the application of these kind of instruments is voluntarily, proponents such as Head Doctors, should be encouraged with specific actions. Economic incentives are not a solution considering the context of public hospital. Nevertheless, the managing board has the faculty to use managerial and organizational levers to promote HTA approach among hospital's professionals.

2.4. Behavioral Theories

We have searched for several models among scientific literature from social and psychological disciplines in order to identify which model would be able to represent and explain the behavior we want to analyze in this process of argument.

Then, we chose and then describe seven of the most common and used theories in the interpretation and prediction of behavior in health, trying to highlight contexts of use, strengths and weaknesses. We can resume these models according to the their usual context of application:

- Explanation of the general behavior of human resource in the workplace: Valence-Instrument-Expectancy;
- Explanation of the punctual behavior when the object of study is if a person performs or not performs the specific behavior, that could be of several kinds and referred to a wide range of contexts: Theory of Reasoned Action and Theory of Planned Behavior and Theory of Interpersonal Behavior
- Explanation of several behaviors in marketing contexts (as consumer choice or information processing), in technology acceptance, knowledge sharing and many others: Motivation-Opportunity-Ability;
- Explanation of the employees' behavior in using and accept new technological instrument and innovation in their daily tasks: Technology Acceptance Model and Unified Theory of Acceptance and Utilization Technology.

The first model we intend to explain is Expectancy Theory, developed by V.H. Vroom. It is a model used in research on human motivation in workplace. It often relates to organizational behavior, leadership, compensation and, in recent years, it refers to aspects as turnover, productivity loss in group performance, goal achievement, goal level, goal commitment. In fact, results, obtained with the application of this model, should give cues for managerial implications. Vroom decided to restrict himself to problems of individual behavior and to restrict range of phenomena to behavior connected with workplace as job satisfaction and performance and occupational choice and he focused on behavioral explanation and not on its control. So individual performance derives also from elements as skills, experience, knowledge and personalities.

He wanted to find variables useful to explain individual behavior and discovered them which became components of his model:

- *Valence*: all possible affective orientations toward outcomes, it is interpreted as the importance, attractiveness, desirability, or anticipated satisfaction with outcomes (Van Eerde, 1996);
- *Instrumentality*: an outcome-outcome association and it has been interpreted not only as a relationship between an outcome and another outcome but also as a probability to obtain an outcome (Van Eerde, 1996);
- *Expectancy*: a subjective probability of an action or effort leading to an outcome or performance (Van Eerde, 1996).

If one of these variables is not high or positive, a person is not motivated. In fact, these three elements are together connected and they form what is called as Motivational Force which is represented by the following formula:

Valence of outcome x Expectancy act will be result in outcome (Instrumentality) = Motivation Force

Figure 2.2: Representation of VIE model

This model is based on several hypotheses: people believe to be motivated if there is a positive correlation between efforts and performance, that performance produces expected reward that satisfies a specific need and this need is desirable enough to motivate people to make efforts to reach that performance. If these hypotheses are not valid, Motivation Force is zero.

A basic condition is that people choose behavior between several possibilities in order to maximize their benefits and minimize their efforts. Outcomes can be divided into two level: the first level includes the behavior that results from effort by a worker on his job and the second level includes all results, good or bad, from a first-order outcome. In fact, outcomes considered by individual are associated to different level of performance and individual tends to choose the level that permits to him to achieve the best reward.

The perceived link between an action and an outcome can be a measure of *expectancy*. Indeed, *expectancy* could be interpreted as the subjective probability that efforts leads to the outcome of performance or second-level outcome, so in some cases there is a distinction between expectancy of an action an expectancy of second-level outcome (Van Eerde, 1996).

VIE has less predictive validity because of lack of important elements as social norm, habits and personality characteristics that could predict more completely the investigated behavior (Walker, et al., 1982).

This theory is useful for managers to understand what reward is expected by workers, how to help employees to carry out their job (increasing their capabilities to accomplish the tasks) and to create instrumentality. So the VIE variables are related to work-related criteria, but transforming these variables in utilities, as Vroom's model should do, does not seem to increase the relationship between them.

This theory of motivation is not free by critics, because it and its components are abstract and susceptible to different interpretations so that there is not a unique way to measure them. In fact, there were used many techniques and many criteria to measure model's variables and that has shown how the choice of criterion variable produces different results.

Another critics moved against this model is because of its simplicity: in fact it assumes that, if an employer gives reward and benefits, then he increases his productivity in order to reach this bonus, this it is true even if the reward satisfies employee's immediate desire, but only in an optics not of long period.

Despite these critical aspects, Vroom's theory is very significant when you want to highlight the differences between individuals with the aim of building an adequate motivating system especially in the workplace, but there are models that can give interpretation to a more wide range of behaviors. For example, Theory of Reasoned Action, developed by Ajzen and Fishbein, has many applications in social psychology and it is used to investigate the disposition to engage a very wide range of behaviors, but also determinants of those. The theory seeks to integrate cognitive, affective and conative determinants of behavior into a single conceptual framework in order to predict an individual's intent in a given situation (Walker, et al., 1982). This model is heavily used to predict consumer behavior in marketing. This theory is based on hypothesis that people can decide voluntarily if adopt, or not, the behavior in question and so it is adapt only for volitional behaviors.

The main constructs of TRA are:

- *Behavioral intention*: we intend a person's intention to perform a certain behavior, it sums up the person's motivations to perform the behavior and indicates the amount of time and effort necessary to ensure the behavior (Ajzen, 1991). It is determined by attitude and social norms.

- *Attitude*: people are more motivated to perform a behavior when its related outcome is highly valued. It considers positive and negative feelings connected with the behavior.
- *Social norm*: It is the people's perception of social pressure to perform or not that behavior, if people thinks that behavior should be performed or shouldn't.

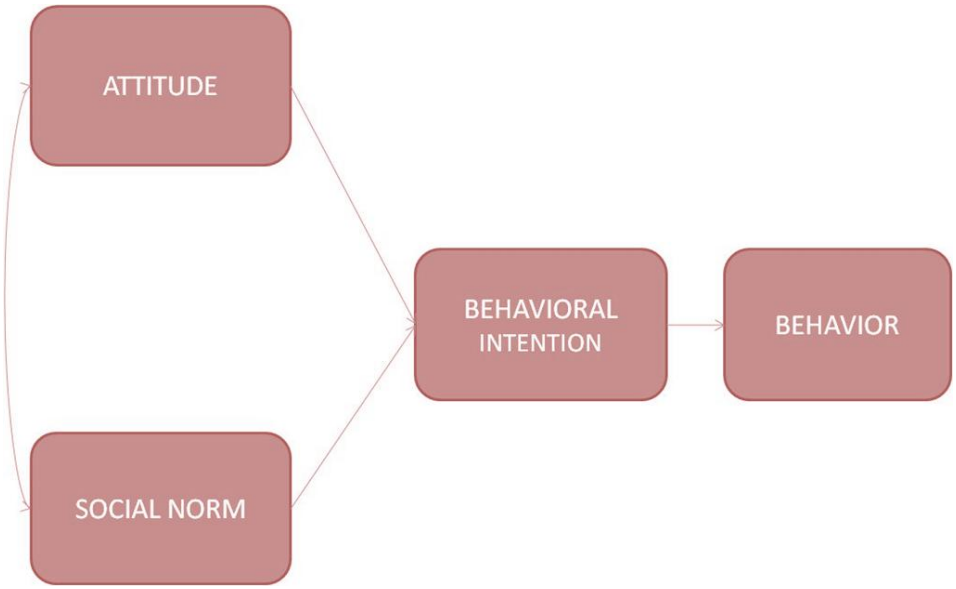

Figure 2.3: Representation of TRA model (Ajzen, 1991)

The relative importance of each construct changes depending on the behavior studied.

Although *behavioral intention* is more stable than *social norm* and *attitude*, it is necessary that period between the measure of *behavioral intention* and the measure of the *behavior* is short, otherwise the risk is a wrong prediction.

TRA evaluates impacts of social norms, attitudes and intentions on behaviors. The specific behavior is determined by *behavioral intention* which is the most immediate predictor of *behavioral*. Antecedents of *behavioral intention* are individual's *attitude* related to this behavior and *social norms*.

TRA does not consider some aspects that could be important in the prediction such as *moral norm*, that is people's sense of obligation to perform only ethical behavior, *experience,* that could influence *zttitude*, which increases with high experience, and *subjective norm*, which decreases when a person has familiarity with that behavior (Venkatesh, 2003). The last missing aspect of this theory is *voluntariness*, that increases *subjective norm* when there is low willingness to perform the behavior and it could increase variance explained in intention by the theory.

The problem is that a behavior, in most cases, involves people, resources, opportunities necessary to perform it with success. It means that there are few cases in which a behavior can be fully under control. It is in order to solve this problem that Ajzen extended his theory in Theory of Planned Behavior (TPB) which have another fundamental variable to explain and to predict behavior.

TPB was born to explain and to predict human behavior in particular situations and it accounts for conditions where individuals do not have complete control over their behavior (Taylor, et al., 1995). To predict human behavior is a very complex task and it is necessary to consider all factors that could influence human intention to perform it. The theory analyzes whole psychological process involved in the adoption of the behavior and started to find applications in the interpretation of many health behaviors and behavioral habits such as feeding, sexual behaviors, smoking and physical activity. Then, thanks to empirical evidences that have demonstrated the validity of this model, fields of applications of this theory increase, involving some aspects of health care and Information System and Technology.

Our literature search has extended to some articles that explain the application of others behavioral and cognitive models in the field of Health Technology Assessment, in particular the research and use of evidence and recommendations. In one of these articles, Godin et al. (2008), with his systematic review, investigates the gap between evidence-based practices and the routine clinical practice of healthcare professionals. The aim of this study is to review systematically the literature to quantify to what extent studies, based on social cognitive theories, explain intention of healthcare professionals to adopt clinical behaviors and predict health professionals' clinical behavior (Godin, et al., 2008). TPB appears to be an appropriate theory to predict behavior whereas other theories better capture the dynamic underlying intention. *Behavioral intention* represents all motivational factors which contribute to influence a behavior and the stronger they are, the stronger should be individual intention. Then the greater *intention* is, the more should be its performance.

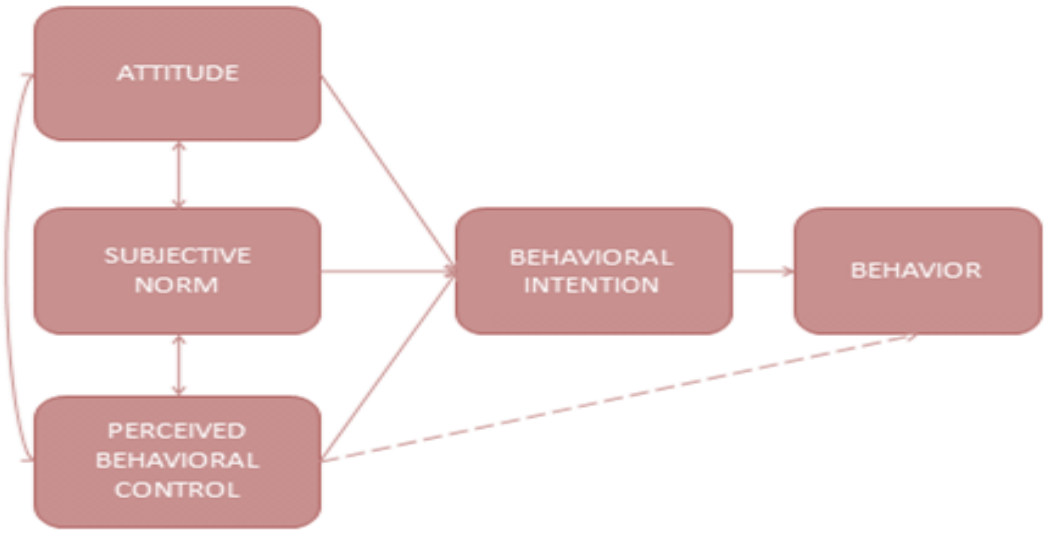

Figure 2.4: Representation of TPB model (Ajzen, 1991)

The elements used by TPB are the same of TRA (even if here *social norm* is called *subjective norm*) because it is an extension of the previous theory but adds an important element in the prediction of behavior:

- *Perceived behavioral control(PBC)*: it is the perceived ease or difficulty of performing the behavior (Ajzen, 1991). It is an additional determinant of behavior and intention.

While it recovers *subjective norm* and *attitude toward behavior* from TRA, it introduces a third factor that can predict intention but also directly the behavior considered: *Perceived behavioral control*. It is the most important difference between TRA and TPB, it is defined as "the perceived ease or difficulty of performing the behavior" and it reflects beliefs regarding access to resources and opportunities needed to perform a behavior, or alternatively, to the internal and external factors that may impede performance of the behavior (Ajzen, 1991). PBC encompasses two components: the first one is "*facilitating conditions*", which represents availability of resources needed to perform the behavior, the second is "self-efficacy", that is an individual's self-confidence in his/her abilities to adopt the behavior (Taylor, et al., 1995).

Behavior is jointly dependent on *intention* (sum of all motivational factors to perform a given behavior) and PBC that is comparable to Bandura's concept of Perceived Self-Efficacy "which is concerned with judgments of how well one can execute courses of action required to deal with prospective situations" (Ajzen, 1991). It is a better predictor of behavior when people know it deeply and it is a proxy of actual behavioral control which is represented by opportunities and resources available to perform a given behavior.

The stronger *attitude toward behavior*, *PBC* and *subjective norm* are, the greater should be individual's intentions to engage the given behavior. The relative importance between predictors of intention depends on specific behavior, we want to predict, and on specific context, and they could influence themselves: for example, a very low level of *PBC* might influence negatively the level of *attitude*.

Predictive validity depends on three elements: first, measure of *PBC* and *intention* must be compatible with *behavior* we want to predict; second, *intentions* and *PBC* must to be stable between the time of assessment and the time of observation of *behavior* and third, when *PBC* reflects actual behavioral control, behavior's prediction is better.

TPB is better than TRA when behaviors are not fully under volitional control, but for behaviors fully controllable TPB and TRA are both good theories. This difference is caused by the presence of *PBC* in TPB. In add, TPB is useful for behaviors for which the linkage between behavior and intention is strong and it is based on a principle of aggregation of attitudes and personality traits, that is adapt to specific behaviors in fact, it doesn't explain behavioral variability across situations. It means that attitudes and personality traits can be individuated only by looking at broad, aggregated, valid samples of behavior. For this reason, TPB is very useful for say and explain if a behavior is performed or not performed, for example in health care it is used to explain adoption of guidelines or recommendations by personnel of hospitals.

A limitations of this model is the lack of a antecedent as experience that is not explicitly considered even if in other follow on studies it is demonstrated that experience could act as a moderator between *subjective norm* and *behavioral intention*, in fact *subjective norm* should become less important with the increasing of experience.

Besides TPB solves a problem emerged in TRA: human behaviors, that TRA has dealt on, have not a complete volitional control. In fact, *subjective norm*, even if it was not tested, becomes less significant to predict intention when performing a given behavior is not a choice of a individual person but is a duty. It is clearly defined that Intention can find expression in *behavior* only if the behavior in question is under volitional control (Ajzen, 1991).

However, TPB has other limitations: it does not take into account age and gender as moderators of its constructs. In fact, Venkatesh (2003) found that *attitude* was more salient for men and Subjective Norm and PBC were more salient for women in early stages of their experience and again Attitude was more significant for younger workers while *PBC* was more significant for older workers.

TPB is similar to another theory: Theory of Interpersonal Behavior (TIB): both include expectancy-value constructs (*attitude* of TPB and *perceived consequences* of TIB) and normative belief constructs (*subjective norm*of TPB and *social factors* in TIB), and both recognize that behavior may be subjected

to the influence of environmental factors and is not always voluntary (Pee, et al., 2008). But now we have to focus on TIB.

Theory of Interpersonal Behavior was developed by Harry Triandis (1977), who recognized that social factors and emotions were very important to form intentions, and it is developed in order to study believes, attitude, and disposition to engage a behavior or action. TIB includes variables that are abstract and general enough to be adapt for different investigations and contexts. It is an attempt to connect variables from different disciplines of social science. Social factor and emotions were supported by past behavior. In fact, intention is the immediate antecedent of behavior but this connection is mediated by habit. According to Triandis (1977), behavior is a function of intention, past experiences (Habit) and Facilitating Conditions or constraint conditions.

TIB is formed by several constructs:

- *Attitudinal Beliefs* is a bipartite construct based on Affect, which refers to individuals' set of possible emotions (that include instinctive behavioral responses to a particular situations) connected to the specific behavior and Perceived Consequences, that refers to all outcomes that a person could expect by performing that behavior.
- *Social Normative beliefs* refers to the social pressure manifested by other social referents related to perform or not perform the behavior. It underlines subjective beliefs of a specific group that could influence intention of individuals to engage the behavior. It includes norms (social rules related to what should be done and what should not be done) and roles (set of behaviors that are considered appropriate for a person in relation to the position held in a group).
- *Personal Normative Beliefs* is formed by Personal Norm (that represents the perception of the duty to perform the specific behavior), Self-Identity (which refers to the degree of coherence between self perceptions and the characteristics associated with the achievement of the behavior) and Professional Norm (which refers to the rules connected with a specific profession).
- *Habit* refers to a sequence of situations or behaviors that have become automatic in response to environment's specific cues (Pee, et al., 2008). It is a good predictor of future behavior.
- *Behavioral Intention* refers to all acts to do that people assign to themselves in order to perform the behavior in certain way. It is a conscious plan to implement a behavior.
- *Facilitating Conditions* refers to all factors in individuals' context that simplify engaging the behavior and make easy to perform it. It includes two dimensions: situational, which is related to helpful external conditions, right settings, or access to resources, and internal or

self-efficacy, which is related to individual's skills and the judgment of what is possible to do with those skills and it is difficult to manipulate (Pee, et al., 2008).

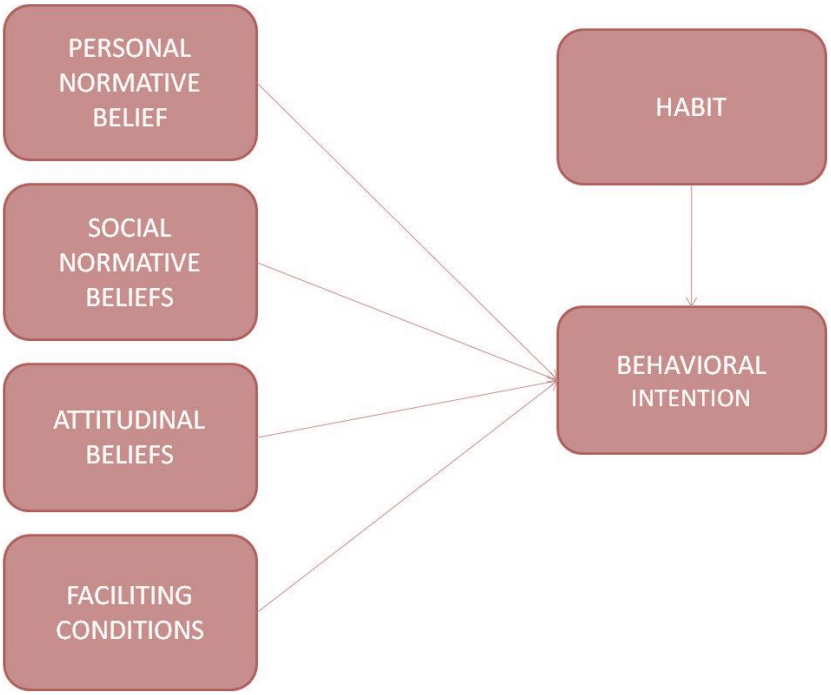

Figure 2.5: Representation of TIB model (Garcia-Goni, et al., 2007)

Intention is a function of affect towards performing the behavior, social factors and perceived consequences of performing the behavior along with their desirability (Pee, et al., 2008).

In accord with this theory, *habit* has a great importance in the influence on individuals' actual behavior. In many cases *habit* results more important than Intention in predicting Behavior.

In TIB, *attitude* considers two aspects: affective and cognitive. The first one is evaluated by Affect while the last one by Perceived Consequences.

Facilitating conditions is comparable to Perceived Behavioral Control of Theory of Planned Behavior: the difference is that the first influences directly the Behavior, the letter influence Intention and also the Behavior but this one only when it reflects actual behavior. That is because in TIB it is assumed that a person, who has already intention to act, must be supported by environment, otherwise he can't perform the behavior. TPB focuses on individuals' subjective perception, while TIB focuses on actual controls that exist, but both conceptualizations are likely to be closely related because individuals' perception of behavioral controls will be strongly influenced by what actually exists.

TIB includes all elements considered by TPB but suggests two additional constructs (*Habit* and Affect), important in understanding social behavior. Although TPB has been applied widely in understanding various illegal and unethical behaviors and several meta analyses have supported its

strong predictive power, TIB may be able to provide better understanding in contexts where habit and affect come into play (Pee, et al., 2008).

TIB is better than TPB when habit and affect are two important aspects of the context, it appears to have additional explanatory value over TPB, in fact we can say that TIB is a theory founded on TPB and other previous social theory.

TIB finds application in a field that is of very interest for our research: HTA. In fact, Gagnon, for example, focuses on the gap between the production of scientific evidence and its utilization to inform decision-making in the field of HTA. The article uses TIB and its aim is to explore the impact of HTA recommendations at the individual level, which has been conceptualized as physician intention to use HTA recommendations to support clinical decision-making. The major finding is that this theory well catches intention of physicians to use HTA recommendations in their practice, that is influenced by a different set of psychosocial factors, depending on the specific context. This difference can either be attributed to the characteristics of the technology targeted in the HTA recommendations, the social and cultural characteristics of the medical specialty, the specific context in which recommendations are implemented or a combination of these factors.

Another theory, which can be useful in health matters, but that has been developed and used much more in other disciplines, is the Motivation - Opportunity - Attitude's (MOA) framework, born in order to predict behavior and actions of consumers and to process their information about brand advertisement. Adapt to various management disciplines, it is used to discover constraints that influence the adoption of a certain behavior and it explains a wide range of behaviors such as knowledge sharing, consumer choice, social marketing, resistance to accept a new technology, consumer information processing, where the application of this theoretical model is based on two premises:

- a technological innovation is essentially new knowledge or information that can be employed for production or consumption purposes;
- an organization's decision to purchase an innovation is an information processing outcome (Bao, 2009).

This model is used to investigate behaviors in Information System contexts that cannot be addressed by acceptance theories and that may involve people outside the organizations, for example IT-empowered consumers, often in order to understand consumer behavior in electronic markets. So, MOA is useful for give answer to questions concerning the behavior outside the firm or organization that involves areas such as IT ethics and security, E-commerce and the digital device, it is good to answer questions that not consider acceptance and continuance of a technology, where other

theories, explained below, could be more adapt. This theory is proposed to respond to desire to address factors that influence consumers' choice about participation in e-markets beyond just minimization of transition costs (Hughes, 2007).

The origin of this model derives from theories of industrial psychologists, who saw the performance as a result of selection and training (that increase the ability of employees' performance), and research of social psychologists, who stress the importance of motivation in business performance. *Opportunity* is an element added later to explain that there are external factors that help or hinder the achievement of certain performance.

Kelloway (2000) helps us to comprehend this behavioral model applied in the context of knowledge work. He reviewed the existing literature then he proposed his model of knowledge work based on the suggestion that the use of knowledge in organizations is largely a discretionary behavior that can be encouraged but not demanded by organizations and their managers.

The model is based on three core concepts and below it is possible to see how these constructs are linked.

- *Motivation* captures people's disposition to perform a behavior, willingness or desire to act, and MOA underlines its importance as a driver of behavior because identifies how people can be motivate to assume the behavior.
- *Opportunity* refers to external and internal conditions and factors that prevent people from well performing. It considers situational and operational constraints and environmental and contextual situations that enable to act and it has a negative and a positive view based on the presence of situations that facilitate or obstruct adoption of a behavior.
- *Ability* represents individual's skills and competences that are related to the specific behavior analyzed and facilitate performing the behavior. It resumes all resources available for performing the behavior.

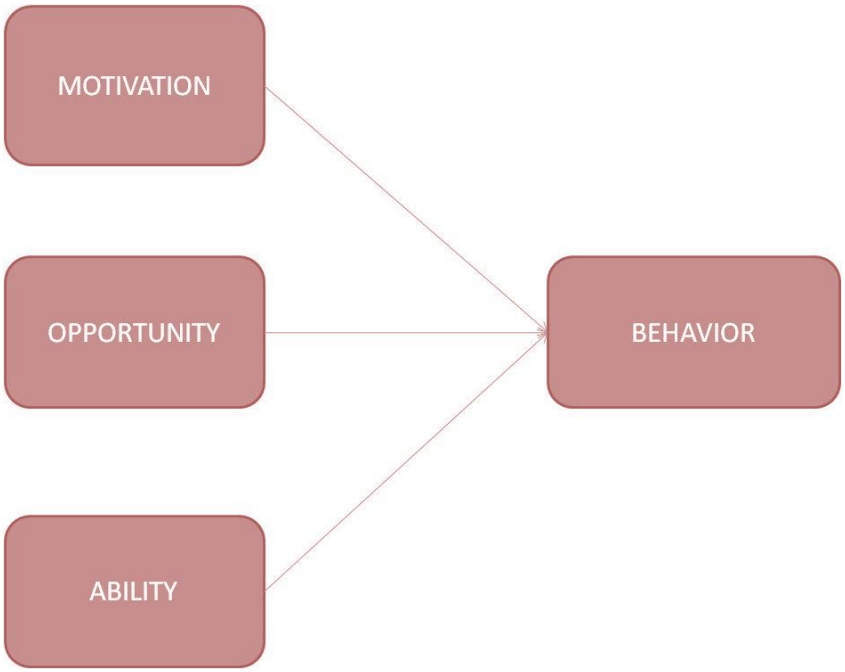

Figure 2.6: Representation of MOA model (Kelloway, et al., 2000)

These constructs influence complementarily the behavior and they are not independent by each others. For example a person, who has not enough skills to perform the behavior, could be less motivated to perform it. A low level of a*bility* and *opportunity* can have a negative influence on engage the behavior.

A variation of one variable as *motivation* can be linked to the manipulation of one of the other variable as *opportunity*, so it is necessary to evaluate the degree of dependence of these variables before to decide to manipulate constructs.

When it is established which behavior has to be studied, it is possible to try finding antecedents of *motivation*, *ability* and *opportunity*. Antecedents are divided between *situational* and *contextual*. The first type refers to antecedents related to a specific situation or event, instead the latter refers to characteristics that do not change if scenario changes and they remain stable for different situations.

This theory misses intention that could be important in some experimentations in which it is not possible to study and to collect data about the effective behavior but it is necessary to stop to the intention to perform the behavior. Another missing element, that seems to be relevant in prediction of the behavior, is social norm that considers other person's pressure about if the behavior should be or should not be performed.

A limit is that not all studies demonstrate a complementariness between *motivation*, *ability* and *opportunity* and that means a lack of empirical evidence of this model, in fact it may happen that a variable is independent by the presence of other variables.

Since the 1980s, the development of Information Technology and large investments on it have led up to a wide diffusion of its applications and possible use. Technologies have become increasingly important within the business environment, because they are often related to increasing productivity and improving business processes. In order to adapt organizations to the market needs, employees were asked to familiarize themselves with new technologies that find application in various areas within the organization. So understanding and creating the conditions under which Information Systems and Technology will be embraced by the human organization and explain user acceptance of new technology is considered one of the most mature research areas in contemporary information system literature. That demonstrates the past need to develop predictive and interpretative models of acceptance of technology by potential users to clarify what were and are the factors on which it was possible to increase the propensity to use. The focus of researchers was to study how and why individuals adopt new technologies. Understanding factors that condition people's intention can help organization to manipulate those factors with the intent to promote the technology and increase its use.

There exist some theories which we can use to explain user acceptance of a technology but two of these are most representative of others and they are: Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Utilization Technology (UTAUT), but the second one derives from TAM and other models already described, of which it integrates the essential elements.

In the context of healthcare organizations, individual physicians are called to use new technology but their formation and training is different from that of other business user groups and so it is important to understand their predisposition to accept and use it in their daily activity, which depends on physicians' general competences and learning capabilities because they are experts in their profession, that they have developed in their own way and style, so they often are less available to change their practice in order to introduce a new technology, in fact new instruments leads not only a technological challenges but also organizational and managerial changes. So many of last studies of Health IT are about its adoption (if clinicians, hospitals have bought and installed it and why) and end-user reactions (i.e. how and why implemented IT are used) (Holden, et al., 2010). With Health IT we intend:

- "the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision-making" (Holden, et al., 2010);
- "the knowledge, skills and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and promote health" (Holden, et al., 2010).

A problem is that TAM is not developed specifically in and for health care context, so if we use the general form of this model, that cannot capture many environmental features that indeed are important.

The theoretical model was developed by F.D. Davis (1989) and it is an adaptation of the theory of reasoned action (TRA) in the field of information system but it is less general of TRA. TAM is a theory adapt to explain acceptance of many technologies in healthcare institutions, where many samples of Information Technology and its applications could take place. It is used in order to try to predict and explain user acceptance of a certain technology and it is an intention-based theory of IT adoption, so It is useful to understand not only that a system is unacceptable, but also reasons and possible corrective interventions. With Technology Acceptance it is intended "an individual's psychological state with regard to his/her voluntary or intended use of a particular technology" (Chau, 2002). A technology often object of study is telemedicine. Telemedicine research concerns with developments and clinical applications, and it is of interest for the managerial question to understand user technology acceptance in health care organizations that wants to provide telemedicine-enabled patient care and services.

It suggests that individual intention to use a technology is sufficiently a measure of actual use. The connection between intention and behavior is evident from many evidences demonstrated in prior research about the Theory of Reasoned Action (TRA). In fact, assumptions, on which TAM is based, are obtained by Ajzen's theory and previous research dealing with variables and external factors that influence internal beliefs.

Below there is the TAM's representation and it is possible to see constructs that explain behavioral intention to accept a technology.

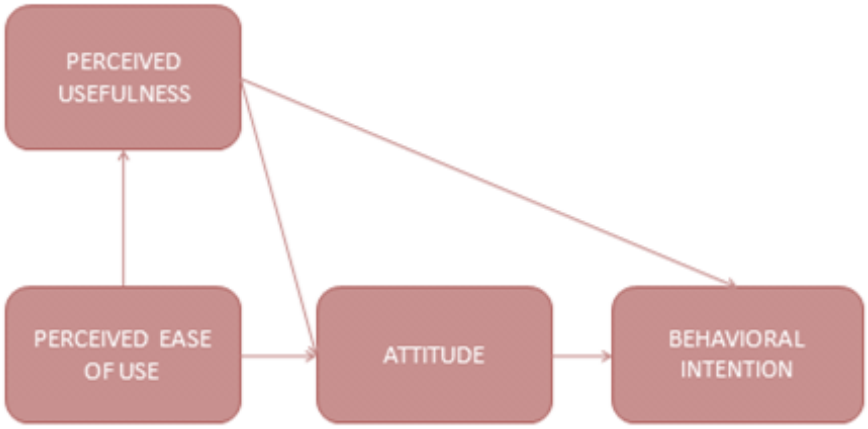

Figure 2.7: Representation of TAM model (Chau, 2002)

The constructs presented in the figure are:

- *Behavioral intention*: intention to undertake a clearly defined behavior, it is influenced by several motivational factors and it suggests indications of how hard people are willing to try, of how much of an effort it is planning to exert in order to perform the behavior (Ajzen, 1991);
- *Perceived usefulness*: the degree to which a person believes that using a specific application system will increase his or her job performance within an organization context (Davis, et al., 1989);
- *Attitude toward behavior*: it refers to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question (Ajzen, 1991);
- *Perceived ease of use*: the degree to which a person believes that using that technology could be made with minimum possible efforts (Davis, et al., 1989).

As it should be seen in the figure individual constructs are linked between them by connections of cause-effect, in fact behavioral intention is explained by attitude and perceived usefulness, and so the stronger they are, the stronger intention should be. Attitude is jointly influenced by perceived usefulness and perceived ease of use and the latter of which affects both attitude and perceived usefulness.

People find attributes that determinate if adopting a certain behavior is favorable or not and resulted perception forms intention to perform a behavior, this demonstrates the link between attitude and behavioral intention. The connection between behavioral intention and perceived usefulness is based on the idea that, if people believe that they could improve their performance thanks to a new

technology, the intention to accept this technology increases. The reason is probably that improve own performance is a method to obtain economic rewards or promotions.

Perceived ease of use includes two mechanisms that influence attitude: self-efficacy and instrumentality (Davis, et al., 1989). Self-efficacy is person's belief to have abilities and capabilities to perform a certain behavior or to accept to use a certain technology. The relationship between the construct wants to underline intrinsic motivation of perceived ease of use.

External factors act with perceived ease of use to influence perceived usefulness and they are all those variables uncontrolled by individual person that can simplify the use of a technology. They might be: training, system design characteristics, documentations and other types of support and decision maker characteristics (Taylor, et al., 1995).

The construct that seems to be strongest in many studies about the prediction of *behavioral intention* is *perceived* of *usefulness* and if Health IT is perceived as useful, acceptance and intention to use it increase.

Concerning the acceptance of physician towards new technologies, Chau presents his study in the field of telemedicine. Physician are among the principal users of this technology and have profound influences on its success (Chau, et al., 2002). We have studied this research mostly to compare the strength of predicting the behavior of acceptance among two behavioral models: the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). The study demonstrates that for this field of analysis TAM is more suitable than TPB.

Unlikely, this theory holds any limits. First, TAM does not include experience, but now there are empirical evidences about perceived ease of use. In fact, an extended TAM adds experience to the original theory and so perceived ease of use becomes not significant with increased experience (Szajna, 1996). Second, original TAM does not include explicitly voluntariness (Venkatesh, 2003), in fact It is necessary to evaluate if the model is conducted in a voluntary usage context because context influences results. Third, TAM does not include *subjective norm* as a factor that influences a behavioral intention, even if it could be important in some contexts, it depends on the target behavior studied. In add ,TAM does not consider that different gender could influence *perceived usefulness* and *perceived ease of use*, but there is empirical evidence that men are more influenced by the first, while women by the second (Venkatesh, 2003). In the end, TAM lacks in standardization, because for adapting theory to different contexts there is need to change or, in some cases, to add constructs, and that is a problem because it limits quantitative and qualitative comparison across studies. Even language is used incorrectly, in fact the words "adopt" and "acceptance" are used interchangeably but it is not correct.

In order to solve some of these critics to this model, it is developed a modified TAM than could have some different corrections. For example, it is possible to remove attitude from the model because it is a mediator between behavior intention and the two constructs perceived ease of use and perceived usefulness, or it is possible to add a variable that catches social influences that could be very important in specific behaviors (similar to subjective norm of TPB). And a special effort to unify the IT acceptance literature resulted in the Unified Theory of Acceptance and Utilization Technology (UTAUT).

Unified Theory of Acceptance and Utilization Technology is theorized by V. Venkatesh and it integrates constructs derived from eight theories that are: the Theory of Reasoned Action, the Technology Acceptance Model, the Theory of Planned Behavior, the Motivational Model, the Model of PC Utilizations, a model combining TPB and TAM, the Innovation Diffusion Theory and the Social Cognitive Theory.

This theory is adapt in the same context, where TAM finds its application, that is in which Information System and Information Technology innovation could be adopted at work in order to increase workers' productivity and individual and organizational performance so it is useful to investigate what elements are and in which effort they influence user's acceptance and the usage of an innovation. So it is a deeper model respect to the TAM, in which *perceived of usefulness* becomes a part of *Effort Performance* and *perceived use of ease* becomes a part of *Effort Expectancy*. Below there is a representation of the model.

Figure 2.8: Representation of UTAUT Model (Venkatesh, 2003)

The new construct for UTAUT respect to the TAM, but not respect to other theories, is Facilitating Conditions. So the core determinants of intention or usage are four:

- *Performance Expectancy*: it is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance (Venkatesh, 2003). This factor is formed by other five constructs:
    - Perceived Usefulness: the degree to which a person believes that using a specific application system will increase his or her job performance within an organization context (Aggelidis, 2009);
    - Extrinsic Motivation: the perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from activity itself, such as improved job performance, pay, or promotions (Venkatesh, 2003);
    - Job-fit: how the capabilities of a system enhance an individual's job performance (Venkatesh, 2003);
    - Relative Advantage: the degree to which using an innovation is perceived as being better than using its precursor (Venkatesh, 2003);

  - Outcome Expectations: they are related to behavioral consequences and are divided into performance expectations (job-related) and personal expectations (individual goals) (Venkatesh, 2003).
- *Effort Expectancy*: It is defined as the degree of ease associates with the use of the system (Venkatesh, 2003). it includes other three construct:
  - Perceived Ease of Use: the degree to which a person believes that using that technology could be made with minimum possible efforts (Aggelidis, 2009);
  - Complexity: the degree to which a system is perceived as relatively difficult to understand and use (Venkatesh, 2003);
  - Ease of Use: the degree to which using an innovation is perceived as being difficult to use (Venkatesh, 2003).
- *Social Influence*: It is defined as the degree to an individual perceives that important others believe he or she should use the new system (Venkatesh, 2003). It includes:
  - Subjective Norm: it refers to the perceived social pressure to perform or not to perform the behavior (Ajzen, 1991);
  - Social factors: the individual internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations (Venkatesh, 2003);
  - Image: the degree to which use of an innovation is perceived to enhance one's image or status in one's social system (Venkatesh, 2003).
- *Facilitating Conditions*: they are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system (Venkatesh, 2003). It is formed by:
  - Perceived Behavioral Control: it refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles (Ajzen, 1991);
  - Facilitating Conditions: objective factors in the environment that observers agree make an act easy to do, including the provision of computer support (Venkatesh, 2003);
  - Compatibility: the degree to which an innovation is perceived as being consistent with existing values, needs, and experiences of potential adopters (Venkatesh, 2003).

There are also four key moderators and in the figure it is possible to note which of them moderate the core elements found before. These key moderators are age, gender, experience and

voluntariness of use. In prior researches to be female or male, ore to be young or old, to have experience or not to have, to be in a voluntary context or to be in a mandatory one were aspects that could change results and influence prediction of intention or usage. Therefore it was important to consider them in a theory that summarizes the most relevant elements of other theories. Below we created a table with the intent to resume constructs pointed out before and then underlined differences and similarities between theories.

	VIE	TRA	TPB	MOA	TAM	UTAUT	TIB
Motivation				√			
Expectancy	√						
Attitude		√	√				
Attitudinal Beliefs							√
Personal Normative Beliefs							√
Performance Expectancy						√	
Effort Expectancy						√	
Opportunity				√			
Perceived Behavioral Control			√				
Instrumentality	√						
Self-Efficacy							√
Facilitating Conditions						√	√
Subjective Norm			√				
Social Influence							
Social Norm		√					
Social Normative Beliefs							√
Valence	√						
Ability				√			
Perceived Ease of Use					√		
Perceived Usefulness					√		
Habit							√
Behavior		√	√	√	√	√	
Behavioral Intention		√	√			√	√

Table 2.1: Comparison of models based on constructs

This table presents some important limitations. The first problem is that not all models are well comparable between them because of their diversity and because in some cases they give emphasis to different aspects. For example, VIE seems to be very less comparable to each other, the reason may be that it is created for a specific context such as of workplace and so the constructs that characterize the model are adapt to describe situations of that type but less useful for other phenomena or contexts because VIE has many lacks, on which we don't stop because we have already explained.

Another limitation is about names and means of some factors. Some theories called similar constructs with different nomenclatures, but in their essence they have the same means and indicates the same concept. In other cases, there are constructs which incorporates concepts expressed by different elements, for example, *effort expectancy*, which belongs to UTAUT, contains also *perceived ease of use* and *perceived usefulness*, which are two different elements of TAM.

Again *facilitating conditions* of UTAUT is a more extended concept of *perceived behavioral control* of TPB.

In order to make an interesting comparison between theories, we have made tables which report models much similar among them. This comparison is visible in the following tables.

The colors used to evidence constructs have the aim of underline constructs that are comparable.

	MOA	TIB	TPB	TRA
Behavior	√		√	√
Behavioral Intention		√	√	√
Attitude			√	√
Attitudinal Beliefs		√		
Motivation	√			
Opportunity	√			
Perceived Behavioral Control			√	
Facilitating Conditions		√		
Ability	√			
Subjective Norm			√	√
Social Normative and Personal Normative Beliefs		√		

Table 2.2: Similarities between some theories due to affine constructs

TPB seems to be better than TRA because integrates the last one with one construct more and so it makes more complete explanation and prediction of a behavior. So it is reasonable say that TPB seems to be preferable respect to the TRA. Watching TIB and TPB, we can say that they both use similar construct even if different namely, the only evident different is related to the behavior because TPB is more complete, in fact explains and predicts *behavior* passing by *behavioral intention*,

while TIB stops to *behavioral intention*; for this reason and in order to respect our aim, which is to explain a specific Behavior, we have to reject TIB.

Both MOA and TPB are good models applicable to a large range of situations and contexts, differences are that MOA does not consider social influence as important component to explain and predict the Behavior and does not recognize Behavioral Intention as important element. *Ability* and *opportunity*, which belong to MOA, are included in Perceived Behavioral Control that contains a concept similar to Bandura's *self-efficacy* (and then references to individual skills and competences) and references to internal and external conditions that facilitate or impede to perform a given behavior. TPB is more complete than MOA, but both appear adapt to our objective.

	TAM	UTAUT
Behavior	√	√
Behavior Intention		√
Perceived Ease of Use	√	
Effort Expectancy		√
Perceived Usefulness	√	
Performance Expectancy		√
Attitude	√	
Social Influence		√
Facilitating Conditions		√

Table 2.3: Similarities between TAM and UTAUT due to affine constructs

We separate these models from other for specific reasons. UTAUT and TAM are similar because the first one is the evolution of the TAM and integrates some elements from other theories. If we see the pink and grey highlighted part, TAM and UTAUT seem to study different but similar factors, indeed the constructs of UTAUT include those of TAM. In conclusion, from a comparison between TAM and UTAUT, the last one rises up as more complete than TAM, which results reductive and simplistic.

After this discussion UTAUT, TPB and MOA, between models we have analyzed, appear to be the best theories in order to predict a given behavior, nevertheless UTAUT, even if described the behavior in all its aspects, must be rejected. This decision is motivated by our intention which is not to describe the acceptance and use of a technology, that is the behavior which UTAUT focuses on.

2.5.Literature Gaps

One of the problem, that our NHS is dealing, is the growth of absorbed resources and one way to grant the sustainability is to pay attention on the allocation of investments in order to control public health expense. In light of this, technology and innovation are two great items of expenditure that have to be handle in order to improve the health system under the aspects of efficacy and efficiency. Health Technology Assessment is the framework proposed also in the Italian National Health Plan as a good methodology to define criteria of acquisition, spread and use of medical devices on territory.

Due to its nature, the assessment of an health technology involves many different actors of Health sector. In order to maximize the benefits of technological and organizational progresses in the provision of health services, all types of professionals at health institutions have to be motivated and involved in the innovation processes (Garcia-Goni, et al., 2007). According to the literature search, a pivotal role is played by doctors responsible for the resources of their own Clinical Department. The application of HTA at hospital level implies the importance of the figure of doctors, in particular heads of a department, who within the process have to arrange priorities for their department, propose the adoption of technologies selected and collect all the essential information and evidence to submit the request. The simple acquisition of evidence is not sufficient to justify the acquisition of a technology. Head Doctors have to demonstrate their willingness to put the relevant information in their context of work. These aspects in literature are not extensively explored yet. As witnessed by literature search in the previous paragraphs, there is evidence that HTA is a well known practice that in our national context is applied to some extent to a macro level of health policy, as suggested in National Health Plan. Nevertheless, this methodology is recommended also at hospital level, even if few contributions are available in order to explore the process of technology assessment at meso and micro level. In order to fill the gap of the literature and to extend the previous studies in the field of Health Technology Assessment at hospital level, we decided to focus our research on Head Doctor of a Clinical Department. According to the general framework of HTA, there is a wide spectrum of activities that Head Doctor could accomplish in order to propose the acquisition of a technology. From priority setting to the contextualization of the technology, Head Doctor could perform different behaviors approaching those tasks and we had to decide on which of them to restrict our research. Second, we had to decide what kind of social and cognitive behavioral model is the most appropriate and suitable for the behavior that we wanted to describe.

Regarding the behavior, we identified two main issues approached in literature: on the one hand, the aspect of evidence-based medicine implies the direct involvement of doctors who are called to collect evidence supporting their requests for the adoption of a new technology; on the other hand, the effort of doctors is not limited to a literature search but has to extend till the contextualization of evidences and guidelines referred to the new technology within their clinical practice, then considering costs (acquisition, maintenance, human resources, training), organizational impact, advantages and impacts for patients, assessment of the transient in the introduction of the new technology. First of all, many articles underline the need for studies assessing a behavior and not only the intention of doctors performing a specific behavior (Gagnon, et al., 2006). In this sense, our study is an extension of the current literature to identify variables explaining intention and predicting clinical-related behaviors (Godin, et al., 2008). Nevertheless, literature concerning evidence-based

medicine is quite wide and in particular different authors have explored through social and cognitive model the intention of health professionals to accomplish with this approach. Against it, there is a lack of studies addressing the translation of knowledge gained from evidences in a successful strategy in the process of assessment and acquisition of a new technology. Furthermore it could be interesting to understand the determinants of healthcare professional behaviors into specific intervention strategies and the evaluation of their effects on professional behaviors and, ultimately, on the effectiveness of the healthcare system. In particular, the body of literature regarding the process of HTA at hospital level suggests a reflection on the role of the proponent of the request of a new technology. This, once again, infers us to understand what are those individual, organizational, social and technological factors that could facilitate a Head Doctor in his/her technology assessment, giving emphasis on this specific clinical behavior. For these reasons, we decided to restrict our study on the behavior of a Head Doctor who first has to decide whether to assess a new technology or not. This behavior implies, secondarily, that he/she has to carry out different steps to reach a final comprehensive assessment of a new technology to submit to the Budget Committee. These steps are referred to costs analysis, assessment of organizational impacts, evaluation of benefits for the patient, assessment of the transient adopting the new technology. From a practical point of view, we are interested in knowing if a Head Doctor engage his/herself to fill in the proposal form for the adoption of a new technology and what are the factors within his/her organization that could promote this process.

After the modeling of this behavior, a social and cognitive model is required to enclose all the elements that we consider of interests to explain the concerned behavior. From the literature analysis, we compared different models in order to understand their field of application and their pros and cons. Our first choice was the Theory of Planned Behavior developed by Ajzen as an extension of the Theory of Reasoned Action. The most fascinating aspects of these theory were the constructs that could easily be adopted to our behavior and the integrity of the model. Unfortunately this integrity has also been the cause of its exclusion due to the required number of respondents that this kind of model would necessitate. Furthermore, a deeper study of the hospital structure where we were going to submit the research, has induce us to eliminate some aspects that could have weaken the TPB model (for instance the construct of subjective norm). For all these reasons we decide to move to the model of Motivation-Opportunity-Ability, a model similar to TPB but with the advantage of a more restrict number of constructs that allow us to collect less respondents. Besides, this model has been previously adopted in the field of health study related to clinical behavior not only from the point of view of patients but also from the perspective of physicians. The constructs of this model describe completely the behavior that we want to analyze without omitting any details.

An exclusive element is the addition of four antecedents to the constructs of MOA that lend distinction to our study and empower the description of the behavior. A more detailed analysis of the choice of model will be give in the next chapter. From the basis of the MOA model we have the opportunity to extend the current literature adding an empirical research that models a behavior and not only an intention of performing a given behavior.

2.6.Research Questions

As witnessed by the analysis of the gap in literature in the previous paragraph, there is a great concern regarding the process of Health Technology Assessment especially at the higher levels of the health system but less attention is given to the point of view of doctors. The methodological approach to HTA is often studied from the perspective of decision-makers and many articles help them in the definition of a health policy. Nevertheless, further studies are required to focus on the role of the proposer of a new technology who has the responsibility of a business unit, he/she holds a budget for his/her unit and so he/she have to cope with the annual budget handled by the Budget Committee. The Head Doctor who strives himself/herself to fill in the form for the proposal of a new technology helps the entire health system to allocate effective investments. The concern of decision-makers at hospital level pertain those factors that could support the Head Doctor in the process of assessment of a new technology. Furthermore, many social and cognitive models used to model a specific behavior have been often used on one hand to predict clinical behavior of a patient and, on the other hand, to predict the intention to perform a behavior but more rarely the behavior itself. For these reason this study is aimed at finding an answer to the following research questions:

1. How to model Head Doctor's behavior performing Health Technology Assessment?
2. What are the individual factors that affect Head Doctor's behavior?
3. What are the organizational levers that support or hinder Head Doctor's behavior?
4. How results change among different technologies?

National Health Plan indicates Health Technology Assessment as an hinge for investments planning and to spread innovation. Through an accurate literature analysis we identified Head Doctor of Clinical Department as the responsible of technology assessment, as proponent of new technologies that he/she intend to acquire. The first scope of our study was, thus, to model the behavior of Head Doctor who should evaluate the new technology following HTA methodology. According to this aim, we deepen the literature review, studying several behavioral models in order to identify the most appropriate. Furthermore, we realized our model in order to conduct an explorative and empirical analysis performed within an hospital company with the submission of a questionnaire. Results obtained allowed us to identify those individual and organizational factors that affect the Head Doctor as proposer of a new technology comparing evidences from the literature and the real case. In particular, organizational levers suggested to the managing board of the hospital what are the most appropriate interventions aimed at foster Head Doctor in the assessment of innovations. Then, with respect to the last objective of our study, we tested how results could vary depending on what kind of technology Head Doctor assesses. Due to the generalizability of the framework and

methodology, the suggested implications will be appropriate for many Italian realities in health sector.

3. Framework and Hypotheses

3.1.Theoretical Approach

The literature gaps presented in the previous chapter show that the increase of absorbed resources implies a remark on investments allocation, especially those referred to technology and innovation, detected as main cause for the growth of public expenditure. Addressing this macro problem, we found that HTA is the proper methodology that enable the fair resource allocation and, as a consequence, the definition of a suitable technology park. Although HTA is aimed at decision making at different levels, literature review suggests that a bottom up policy would be more effective than one imposed from top down (Nobel, 1988). In this view, the application of HTA to a meso level, in which every hospital takes decision about the provision of its healthcare services, should improve the macro problem of resource rationing. Managerial levers should be applied in order to promote hospital-based HTA and, as a result, to reach the goal of cost containment and technological appropriateness. Within the context of hospital, literature analysis made clear that the process of HTA comes along with the annual budget process. Accordingly, every budget holder plays a pivotal role in the budget definition. With respect to the typical organizational structure of a hospital, the budget holder is usually the Head Doctor of a Clinical Department who is accountable for technological equipment. Several articles confirmed that doctors are responsible for the definition of priorities among different choices of treatments, procedures and innovations as well as they have to justify them collecting evidence and information. The complex of activities performed by Head Doctors is technology assessment which is functional to the proposal for technology acquisition in order to submit it to the Budget Committee. In particular, we build our research around the individual behavior of the Head Doctor of a Clinical Department who assesses and contextualizes a new technology proposed for its acquisition. Since hospital-based HTA is bundle with the annual budget, Head Doctors are necessarily involved and to play just on managerial levers to obtain a correct definition of a technology park is not sufficient. Every health policy and strategy has to be headed to budget holders who are determinant in the fair definition of hospital expenditure. In this view, the expected outcome of resource allocation and appropriateness of technology park cannot be reached just through guidelines imposed by the hospital but it is the result of the complex of technology assessments carried out by Head Doctors, each one responsible for his/her Clinical Department. Anyway, factors belonging to the hospital can facilitate or, on the contrary, hinder the process of technology assessment, with consequently negative results on hospital performances. Accordingly, this phenomenon encompasses two levels: on the one hand the level of individual, on

the other hand the organizational-level. In order to explain this issue, we considered a framework developed by James Coleman which makes a distinction between a macro-level and a micro-level of analysis.

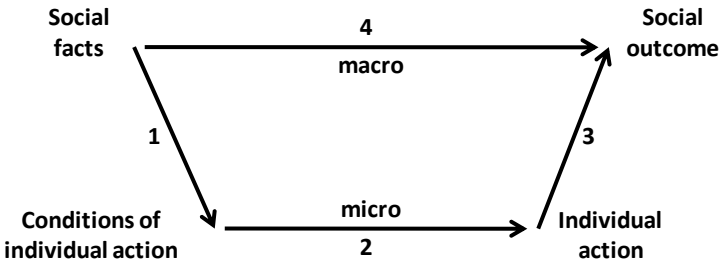

Figure 3.1: Coleman's framework

Macro-level is the point of view of an organization in which a *social outcome* is expected to be get through *social facts* that are factors characteristics within a specific context, i.e. organizational factors. Micro-level is the perspective of the individual in which the *individual action* is described and its *conditions* are explained. Usually this framework is used to explain a particular phenomenon (*social outcome* in Figure 3.1) grounded within an organization, e.g. a firm, that could be explained either by macro-phenomena (arrow 4) or by the aggregation of the actions of many individuals within the context (arrow 3). Arrow 4 confirms a link to a macro-macro level, whilst arrow 3 establishes a connection between the macro-level and the micro-level. Note that the beginning of each arrow is the group of explanations (i.e. the *explanans*) inferred to account for the phenomenon to be explained (i.e. the *explanandum*) (Rabbiosi, et al., 2009; Abell, et al., 2008). Actually, arrow 4 is mainly a theoretical representation of the correlation between variables of a macro-level rather than a real explanation of that relationship. In fact, usually a macro-level variables is not able to capture exclusively a macro-level phenomenon (Abell, et al., 2008). Causal mechanisms have to be found on a micro-level as witnessed with relation 3 between *individual actions* and *social outcomes* (i.e. macro-level phenomena). Furthermore, arrow 4 could be substitute with the relations 1, 2 and 3. Explaining *social outcome* through relations 1, 2 and 3 instead of relation 4 is preferable because to find data from a macro system, when this is broad, is very difficult. On the contrary, collecting data about individuals with surveys, interviews, direct observations and other methods is easier and then they will be aggregated and analyzed (Coleman, 1990). Since the most natural level of observations is lower (micro) than macro, interventions have to be implemented at lower levels. In fact, the implementation of any change, generally, takes place from the lower level that is, as a consequence, a determinant of the macro outcome. Finally, an explanation of the outcome to a macro-level based on the analysis of the individual behavior is more stable, more general and deeper than an explanation rooted on macro variables (social facts) (Coleman, 1990). Accordingly, arrow 1

represents the influence that *social facts* could have on the *conditions of individual action* (macro-micro). These conditions hereby have an impact on *individual actions* (micro-micro) as depicted by arrow 2. Indeed, gathering all individual actions produces an outcome in the macro-context (arrow 3) (Rabbiosi, et al., 2009). According to our research, we identified the *social outcome* as the better resource rationing, the cost containment and the definition of an appropriate technology park as the results of the application of HTA. We decided to approach Coleman's framework because it allows us to represent and explain the links between the expected *social outcome* to a macro-level and what initiatives, both to a macro and a micro level, could be done to support the individual behavior, object of this study. According to the theory of Coleman, the foreseen consequences of the application of HTA in the hospital context could be the result of different health policies applied to a macro-level (relation 4) or the outcome of the gathered individual actions (relation 3). As previously seen, the failure of relation 4 suggests that it should be substituted with relation 1, 2 and 3. In our study, we concentrated our attention on relation 1 and 2, since we thought that relation 3 required a single study. Starting from relation 1, the initiatives on a macro-level are intended as the *social facts* in Coleman's framework that, adapted to our research, are the complex of strategies that could be carried out within a specific hospital. These initiatives are translated in a set of organizational antecedents that represents the mechanisms that influence the *conditions of individual actions.* As a consequence, these conditions have a bearing on the *individual action* (relation 2). In detail, the *individual action* in the context of hospital-based HTA refers to the extent to which Head Doctors of Clinical Departments carry out the technology assessment on those proposed for the adoption. We believed that this complex behavior could be observed and measured; again it is the result of many internal processes that involve what the individual want to do and what he/she can do. These internal processes are the basis of the *conditions of individual actions* that we have related with the most suitable behavioral model between TPB and MOA (cf. Chapter 2), as we will further explain. In addition to the individual constructs, we added a set of distal antecedents that represent the mechanisms through which health policies and strategies of hospitals are perceived by the individual. This kind of antecedents are related to the context in which our behavior of interest is performed and catch aspects of organizational, technological and social nature. As a consequence we adapted Coleman's framework to our context and the result is reported in Figure 3.2

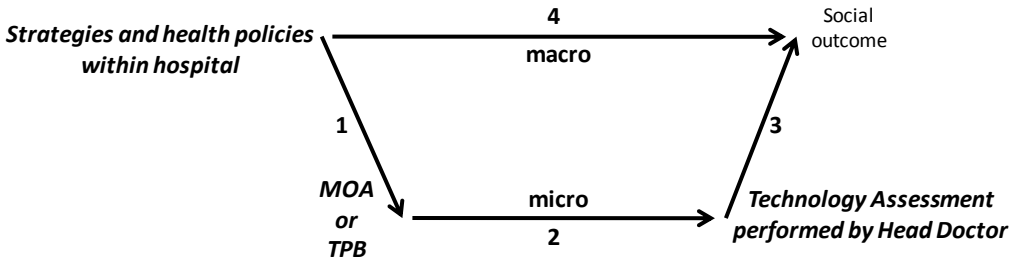

Figure 3.2: Adapted Coleman's framework

3.2.Hypotheses Development

We developed our conceptual framework around Coleman's model since it enables to explain a desired *social outcome* on a macro-level*,* in our context resource rationing and appropriateness of technology park in hospital, through the collection of *individual actions,* that is technology assessment carried out by Head Doctors of Clinical Departments. As previously seen, when certain *conditions* occur, the *individual action* is performed. The connection between macro and micro-level appears reliable since the organizational factors proper of a hospital affected the behavior of Head Doctor. In order to explore relation 1 and 2, we had to build a model that at once consider the organizational factors that create the *conditions* enabling the *individual action.* As a result we had three components to take into account: factors belonging to hospital context such as organizational, social, technological elements; *conditions* that explain the individual action, such as behavioral model, and, lastly, the *individual action* that is the behavior of Head Doctor performing technology assessment. In order to build our model on the basis of our context of analysis and to test it in an empirical analysis, we collected findings both from literature review and from some interviews to different actors involved in health services provision. A first exploration on the topic of Health Technology Assessment was done with the literature search and we concluded that there is a lack on the role of the proposer of a new technology, usually identified as the Head Doctor of a Clinical Department. This approach was helpful in defining the general context of HTA, its methodology and its level of application. Once we decided to deepen the aspects related to the hospital level and, in particular, that of the Head Doctor, we extended our literature search to behavioral models, since we comprehended that the correct approach is to model a specific behavior into a well-established framework. In the light of this, we decided to structure our study in an exploratory manner, focusing on a real case in order to expand literature search with concrete experiences on field. Hence, we decided to address to ICP (Istituti Clinici di Perfezionamento, cf. Appendix A), a healthcare company provider located in Milan. ICP includes four hospital (Buzzi, pediatric hospital; CTO, traumatic hospital; Bassini e Sesto S.G., general suburban hospitals) and the network of outpatients' departments in Milan. We chose ICP since it has a long tradition of HTA and education about technology and innovation begun with the previous Health Direction. In fact, at the beginning of 2011, the managing board of the company was renewed. We set up face-to-face interviews with the figures involved in the HTA Nucleus, belonging both to the administrative and the clinical departments within the hospital. The expected result of this comparison is the achievement of our model that will be used to establish an empirical investigation about how the technology assessment is performed by the Head Doctor and how it could be promoted through managerial actions. Therefore, we decided to arrange a set of interviews with the most characteristic figures involved in

the process of hospital-based HTA both from the administrative and the clinical side. First, we organized an interview with two representatives of the administrative level in order to understand the general application of HTA in the context of a hospital, the advantages and the criticality perceived from an executive level rather than operative one. The members who attended this first meeting were the Head of Management Control and the Head of Clinical Engineering. Management Control Department is responsible for the annual budget and it represent an interface between executive level and clinical departments. In the process of HTA its role become crucial since the acquisition of new technologies represents an investment that has to be scheduled in the annual budget from all the clinical departments. Later, Management Control Department has to express an opinion upon the proposed acquisitions. The point of view of Management Control Department is basically economic. Nevertheless, to evaluate the proposal for the request of a new technology is not a decision that could be based only on costs and revenues. For this reason, the complement of Management Control Department is Clinical Engineering which is responsible for rationing health technologies. In particular, it has to plan the acquisition of new technologies providing counseling on technical characteristics and considering to improve quality of health services, to evaluate the organizational impact and to contain costs. Besides all the elements useful for the construction of our model, these interviews were also useful to validate the concept of technology, previously defined "the drugs, devices, medical and surgical procedures used in health care, and the organizational and supportive systems within which such care is provided'' (Banta, 2003), in order to use an univocal meaning. The counter-party of the executive level are four exponents placed to the operative side. Those Head Doctors of Clinical Departments were interviewed separately in order to obtain relevant information from their individual point of view about HTA, as proponent for the adoption of a new technology. The four Head Doctors pair off in two hospitals belonging to the same company. For each of them, the interview was based on a pre-established scheme of four principal sections:

- the first section was about the personal background of the doctor as his/her professional experience and career;
- the second section concerned the Clinical Department which the Head Doctor is responsible for. The focus was on the type of technological innovations characteristic of his/her discipline in order to comprehend the frequency and the order of magnitude of the related investments;
- in the third part the attention was drawn to the concept of innovation and of technology assessment with the purpose to identify those phases considered useful for a proper and adequate technology assessment. Moreover we tried to recognize the predisposition of the proposer toward this activity that he/she has to accomplish.

- the fourth section was aimed to explore the complex of factors both internal or external to their hospital that could ease or hinder the technology assessment. Some of the factors proposed to the Head Doctors were the result on the one hand of the literature search and on the other hand of the meeting with the Head of Management Control and the Head of Clinical Engineering.

The first two sections were more descriptive and functional to made the Head Doctor comfortable with the research team and to have a clear framework of the context seen by the Head Doctor and in which he/she works. The third and the fourth sections together, with the information provided by Management Control Department and Clinical Engineering, were the input to build our model following the approach suggested by Coleman's framework. First, we defined the specific behavior performed by the Head Doctor in order to catch the most relevant aspects. Then, we developed the model both according to the literature in social and psychological science and to the contributions of the interviews. In the following paragraphs we developed our hypotheses for the choice of each construct that we proposed in our model in order to realize the survey, helpful for the further empirical study.

3.2.1.Behavior

The first step is to define the *individual action* within the framework of Coleman. It is the starting point on which the entire model is built and it is identified with the specific behavior we want to study and analyze.

As we said in previous paragraph, the selection of the behavior is the result, on the one hand of the research and the evaluations of articles in the literature, on the other hand of interviews with a sample of respondents which work in the Health sector.

The first meeting with the Head of Management Control and the Head of Clinical Engineering , although the contact with them was constant during our project, was focused on comprehend the specific aspects of HTA to the hospital level. Search literature suggested that HTA performed by Head Doctor of Clinical Departments is an interesting field of study, to a large extent unexplored yet. However we wondered how the whole process of HTA is really put in practice within a hospital and what are the most relevant aspects.

In literature, we found that the studies are based on behavioral patterns resulting from sociological, managerial and psychological matters that, through interviews and analysis of the context, enlighten what are the factors that explain the adoption of specific practices. The observed behaviors differ

from each other by precisely the profession practiced by the subjects of the study and by the phenomenon that we want to detect. We also observed that the most of the studies refers to:

- the acceptance of new technology by doctors in common practice: with the evolution of biomedical engineering, there is a need to evaluate the predisposition and the capability of a doctor to use technologies that are adopted because the success derived from their use depends in large measure on them, if doctors do not understand the potential benefits they are less available to change their practices and routine;
- the adoption and use of evidence-based clinical practice guidelines and HTA recommendations: many authors have tried to investigate doctor's intention and inclination to search for them and to apply them in their clinical practice;
- to introduce information technology and system technology in health care sectors and to share knowledge: with the development of IT, in order to adapt organizations to the market needs, employees were asked to familiarize themselves with new technologies, so understanding and creating the conditions under which Information Systems and Technology will be embraced by the human organization, but information and system technology could also be declined for the health sector where the employees are doctors.

Our aim is to look for a behavior that was not already fully investigated and reported in the literature, in order to include an original and interesting study that was contextualized in Italian reality. The Clinical Engineering helped us to understand the process of assessment of health technology and to figure out what the primary tasks of the hospital are and to determine the boundaries and responsibilities of the role of doctors in technology assessment. Furthermore, the consultation of Control Management allowed us to understand how the perception of the actual behavior of doctors is with respect to their task.

The interviews showed that it is possible to distinguish Head Doctors who perform technology assessment by others who do not accomplish this task.. Among Head Doctors who evaluate a new technology, it was possible to identify a bipartite behavior:

- The doctor, Head of a Clinical Department, conducting the evaluation of the technology in order to complete the request form, performs a literature research to find any studies that ensure effectiveness and positive results by using the technology in question (whereas technology means equipment, drugs and medical devices but also organizational procedures), therefore with a logic of Evidence Based Medicine (EBM).

- Starting from evidences found on a technology, in the performance evaluation the doctor contextualize and assess the feasibility of the project from several considerations on different types of possible impacts.

Once again, the literature recommended three perspectives of concern as already seen in the previous chapter, that is the definition of priorities among different requests, the collection of evidence according to the approach of EBM, the contextualization of evidence related to an innovation in everyday clinical practice. Nevertheless, in order to focus the study and produce relevant data, we had to defined only a perspective.

Given that possible behaviors, EBM and the research for scientific available evidences have been widely discussed, so we preferred to focus on the contextualization of evidence in a local reality. In fact, this issue related to technology assessment is a subject little studied and investigated by researchers and it would be interesting to try to understand on the one hand the current situation ("as is"), so if the assessment is currently conducted, and on the other hand what individual and organizational factors could urge Head Doctors into technology assessment.

After selection of the behavior, we wanted to confirm it and so we met the four doctors with the aim to understand how they live and see the whole process of technology assessment. These meetings have deepened and clarified the issues raised in the first meeting, showing us what elements could influence their predisposition to be pro-active in evaluation and, consequently, what were the elements that propel the individual doctor to make an assessment of a technology before making a purchase proposal. Therefore, these meetings had the result to give us the possibility to split the general behavior of technology's contextualization in subcategories and to find the information useful in order to construct the reference model.

So during the interviews, we tried to understand, according to the doctors, what steps had to be taken in order to conduct an appropriate and acceptable assessment of a technology, that is what aspects they had to consider to make a good assessment. The following table shows information that emerged from the answers of candidates:

	Head Doctor 1	Head Doctor 2	Head Doctor 3	Head Doctor 4	Management Control
Assessment of clinical efficacy		X	X	X	X
Assessment of economic impact	X		X	X	X
Assessment of organizational impact	X		X		
Assessment of technology impact				X	

Table 3.1: Tasks of technology assessment based on doctor's opinion

It is clear that the doctors' ideas to carry out the assessment of the technology are quite in line with the guidelines identified by HTA, in fact the literature shows that four types of impact assessments must be considered for a proper evaluation: economic, ethics - social, organizational and technological impacts.

Beginning from the considerations made before, we have finally confirmed and established that the behavior more interesting to study is the contextualization of the found evidences at the local level, therefore the assessment of practicality and feasibility of the technology by considerations of different types of impacts.

Through interviews and analysis of the literature, we have been able to divide the behavior shown, the contextualization of the introduction of a new technology, in four sub-elements:

1. Evaluation of the *organizational implications* about the introduction of the technology in terms of space, time and human resources. Introducing a new technology implies the need to consider the situation "as is" of the target ward and the changes that the investment would require ("to be"), or if there is enough staff available, how workload for the people involved changes, if the available spaces are sufficient or if the investment requires an expansion and how new activities will change the practices already established.

2. Evaluation of the *transition*: the time that elapses from the moment you decide to acquire the technology and when it becomes operative. The transition is not a negligible factor because , adapting the structure to a new practice involves many changes that must be prepared and therefore costs to be incurred before the technology lead in revenue.

3. *Economic assessment* of technology, considering the investment costs, but also the costs of additional human resource and possible training and maintenance costs of the technology.

4. Assessment of the *impact on patient management*: the introduction of a new technology implies changes involving the patient, so it is necessary to make some considerations on ethic and on the path of patient care: there is need to see changes such as the type of therapy followed, and consequently the level of information and the level of actual and perceived safety by the patient, the changes on the diagnosis and the quality of service provided.

In this way, we have established the starting point of our research, the specific behavior whereof we need to find the antecedents that determine it. For this reason, we have to search a social theory that could be useful to recognize and describe the conditions that explain individual action.

3.2.2 Individual Antecedents

In the literature analysis carried out in Chapter 2, we conducted an overview of the most relevant social and cognitive theories used to describe and predict a certain behavior in different context. The starting point of almost all theories is the precise definition of a behavior performed individually or collectively in order to model it and to find the causal relations that allow to predict it. In the previous paragraph we outlined our behavior of interest in the context of hospital-based HTA. Generally speaking, this kind of behavior identifies an individual performance accomplished in the health context, in particular the hospital dimension. In the light of these considerations, we reviewed the possible social theories, according both to the valuable aspects and the lack of each one. The aim was to find a model suitable for the objects of our study. Three essentials constraints limited the choice: first, we searched for a model already used in health context from the perspective of healthcare providers and not that of patients; second, the constructs had easily to fit to the aspects of our behavior of interest; third, the model had to be parsimonious in order to limit the number of constructs and, as a consequence, the minimum number required of responses. The comparisons made between theories, as previously reported in paragraph 2.4, showed that MOA and TPB are the most accredited theories according to our research. Even if their constructs are quite comparable, TPB accounts for *intention* and *subjective norm* which are not included in MOA. Although interesting in many fields of application, *subjective norm*, defined as people's perception of social pressure to perform or not that behavior according to their context, seems to have no influence within healthcare reality, in particular between doctors. The interviews conducted with four Head Doctors of Clinical Department, as already seen, highlighted a strong sense of self-confidence in what they do, both in their clinical and administrative activities. Therefore, we excluded *subjective norm* as a possible explanations for Head Doctors' behavior in technology assessment. Furthermore, the inclusion of *intention* among the antecedents constructs of behavior adds a step in the explanation of the behavior while MOA framework allows a direct causality between its characteristic constructs and the behavior. For the above explained reasons, we preferred MOA theory as the basis for our research. Resuming Coleman's framework, we overlapped *motivation*, *opportunity* and *ability* as the conditions that allow individual action to be performed, that is the contextualization of a new technology proposed for its acquisition considering the aspects of organizational impact, benefits for patients, economic impact and transition. In the next paragraphs we first defined the typical MOA constructs and then we identified antecedents that lead to *motivation*, *opportunity* and *ability.*

3.2.2.1 Motivation

Motivation is defined as the personal disposition to perform a behavior (MacInnis, et al., 1989). This willingness to perform a task has been widely explored in literature in different fields of application, not necessarily related to healthcare sector. Originally the constructs of *motivation* was used in MOA framework to explain the processing of external information made by consumers in recognizing a brand in ads (MacInnis, et al., 1989). Furthermore, *motivation* was considered a key factor influencing individual knowledge acquisition and use (Rabbiosi, et al., 2009), as well as knowledge sharing between employees (Siemsen, 2005). Another example of application was found in Information System, trying to comprehend the behavior of consumers in electronic market (Hughes, 2007). Several health-related behaviors were studied using MOA framework, for example those referred to healthy eating (Brug, 2008). Others studies focused on the individual action of healthcare professionals applied TPB in order to explain and predict a specific behavior which, in most cases, coincides with the implementation in the routine clinical practice of guidelines and recommendation drawn from the application of HTA (Ryynanen, et al., 1999; Gagnon, et al., 2006). According to that framework, the proximal determinant of the behavior is intention that can be considered as a consequence of *motivation* (Brug, 2008). Actually, one of the factors directly linked to intention in TPB is attitude which meaning is very similar to *motivation*. In fact, attitude is a personal judgment about the value of the behavior, including positive or negative feelings. Usually, two types of *motivation* are considered: intrinsic and extrinsic. A person is considered to be intrinsic motivated when he/she performs a behavior (i.e.: activity or task) just in order to satisfy his/her needs. It is relevant to notice that the presence of intrinsic *motivation* could compensate for the lack of skills and competence in performing some tasks. Furthermore, intrinsic *motivation* includes the aspects related to those norms and values peculiar of the environment in which the individual carries out the task (Rabbiosi, et al., 2009).Those aspects partially substituted the construct of subjective norm in TPB. In addition, extrinsic *motivation* explains the behavior of an individual when it is rewarded with economic incentives or increasing power and recognition. In the context of our research, we considered *motivation* as a single construct which still merge the two facets above explained. When the Head Doctor of a Clinical Department decide to propose the acquisition of a new technology, he/she knows that, in order to submit his/her proposal, he/she has to fill a form which requires specific knowledge about economic aspects, organizational impact, benefits for patient and the transition period until the technology will be fully implemented. We inferred that the willingness that leads the Head Doctor to gather knowledge on several subjects and to contextualize it in his/her context is similar to the concept of *motivation* as we found in the context of knowledge sharing or processes in which it is confirmed that individual *motivation* influences outcomes related to

knowledge positively (Minbaeva, et al., 2010). In addition, the interviews set up with four Head Doctors confirmed that a fair inclination toward technology assessment will increase the probability to obtain the technology proposed, leading on the one hand to an increase in innovation and, on the other hand, reducing the risks of a wrong technology assessment, such as the lack of utilization. This kind of predisposition is mostly referable to intrinsic *motivation*. On the contrary, Head Doctors interviewed affirmed that in some cases technology assessment is done in order to obtain personal status in front of colleagues and superiors. In this case, extrinsic *motivation* is not an economic reward but it is as well a form of satisfaction for the individual. Considering both literature analysis and findings from interviews we propose that:

Hypothesis 1: Head Doctors' motivation to perform technology assessment positively affects their level of assessment.

3.2.2.2. Opportunity

With respect to the findings came out from interviews, *motivation* itself is not sufficient to lead Head Doctor to properly assess the new technology he/she intend to propose for acquisition, considering that it generally requires an additional effort with respect to clinical routine. The complex of factors both internal and external that encompass Head Doctor and the activity he/she has to perform is generally indicated as *opportunity* (Siemsen, 2005).Those elements can facilitate or, on the contrary, obstruct the drafting of technology assessment. In the original framework of MOA, *opportunity,* together with *ability,* is a moderator of the *motivation* toward a particular behavior. We found the same use of the construct *opportunity* in knowledge sharing when organizations try to implement strategies in order to increase the *opportunity* to share and receive knowledge among their employees (Rabbiosi, et al., 2009). With this meaning, Rabbiosi et al. (2010) consider the *use of opportunities* that the organization enables to its employees, rather than the mere existence of *opportunities* to share knowledge. According to that, social interfaces and electronic network are two among the elements that characterize interaction strategies that organizations put into practice (Rabbiosi, et al., 2009). Studies about E-commerce and consumers' participation in electronic markets, propose the *opportunity* as direct and positively associated with the behavior of interest (Hughes, 2007). We decided to adopt this view for the purpose of our study, since both individual and organizational opportunities emerged as relevant from interviews with Head Doctor. The *use of opportunities,* as intended in Rabbiosi et al. (2010), mostly concern the instruments that a firm made available in order to facilitate a specific behavior. In our findings, those instruments coincide with the hospital intranet through which Head Doctor can collect information for technology assessment and the proposal form that Head Doctor has to fill in to finalize technology assessment in all its aspects.

Those tools are not the only *opportunities* that facilitate the behavior. In fact, to an individual level, time is considered the principal bottleneck to perform technology assessment. This kind of *opportunity,* together with that firm-related, constitute a construct that directly contributes to explain the activity of technology assessment. According to that, we identified two streams: a technological perspective related to firm that comprehends instruments made available by the hospital such as the intranet and the proposal form; an organizational perspective related to the role of Head Doctor and his/her working load. As a result we formulate the following hypothesis:

Hypothesis 2: Head Doctors' level of opportunities related to technology assessment positively affects their level of assessment.

3.2.2.3. Ability

Generally speaking, *ability* is the complex of skills, aptitudes and experiences that enable the successful achievement of a task (Minbaeva, et al., 2010). Adopting the definition previously reported in MOA framework, *ability* refers to that competences related to a specific behavior that facilitate its performing. These characteristic are associated to the individual level and, for this reason, are typically complementary to the *motivation.* There is evidence in literature that *motivation* and *ability* are firmly related, since even if an individual has *ability* to perform a task he/she will fail if his/her *motivation* in doing so is low (Minbaeva, et al., 2010). In the context of knowledge sharing, organizations can improve skills and competencies of their human resources both using a targeted selection and training. Nevertheless *ability* is not a sufficient condition for that behavior and a company has to orientate skills toward the achievement of an organizational goal (Kelloway, et al., 2000). In our context Head Doctor has a set of instruments provided by the hospital, such as the company intranet, and his/her own collection of knowledge and experiences. He/she could use these *abilities* in order to fill the form to propose the acquisition of a new technology. The collection of evidence and the consequent translation of that in his/her context, could be done if Head Doctor is able to do that, regardless of his/her willingness and his/her context of application. It is confirmed that a lack in competences or experiences limit the individual in processing information (Minbaeva, et al., 2010). The notion of *ability* is also connected to that of self-efficacy concerned with the perception of what the individual can do with the skills that he/she possesses, rather than the mere skills themselves. These two aspects are both important referred to Head Doctor since it is not sufficient to have a certain set of capabilities to perform technology assessment but it is necessary to be awareness of what instruments use, how to use them, what kind of information are required and what kind of knowledge is proper to obtain. Head Doctors interviewed reported a poor *ability* in the use of instruments for evidence retrieval such as PubMed and, in general, a poor knowledge in HTA

methodology, partially due to an academic education that do not rouse clinicians to open their culture towards that disciplines associated to clinical practice. From all the considerations made above we deduce that:

Hypothesis 3: Head Doctors' ability to perform technology assessment positively affects their level of assessment.

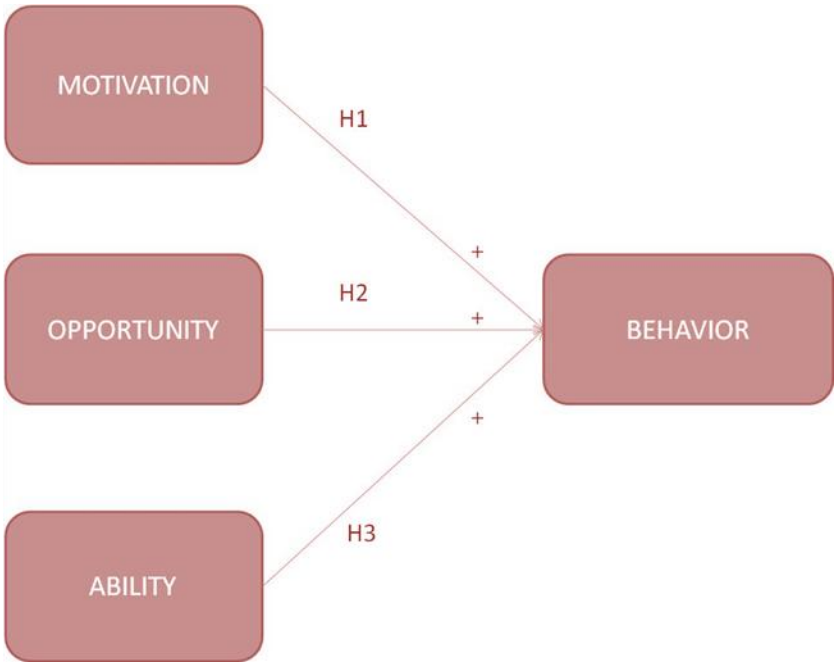

Figure 3.3: Attribution of hypotheses to MOA model

3.2.3 Organizational Antecedents

After describing the referential framework and defining the variables in play, called proximal, we have investigated if there were other variables that could indirectly affect negatively or positively the adoption of the behavior. During the interviews with a selected sample of Heads Doctor of Clinical Department , we showed a list of factors, found in the literature and considered in contexts different from the phenomenon we want to study, in order to discuss and to understand which of these would play an important role in performing the specific behavior. So thanks to the joint consideration of the scientific literature and information obtained from the interview, we got to define four main variables, which we call distal variables and we do not expect that they have direct influence on behavior, but instead that they are mediated by proximal variables.

3.2.3.1. Social Interaction

The concept of *social interaction* is very common in the literature and it is used in a wide range of situational phenomena, but especially in the widely debated issue of the knowledge sharing within the organization. There are numerous articles that discuss this issue with the main goal of understanding the factors that could increase the knowledge sharing and then creating an organizational culture. The basic idea involves that the ability to socialize with colleagues advantages the exchange of information and thus the transmission of knowledge, encouraging the possibility to identify opportunities, weaknesses and areas for improvement, and to discover the need to increase their skills and to create a relationship of trust and collaboration (Kelloway, et al., 2000). It is believed that an increase of confidence among colleagues and of interpersonal face to face relationships, both formal and informal, have a positive effect on knowledge sharing. In this context, therefore, it was observed that an increase in *social interaction* could have a positive impact on organizational and individual performance. In the same contest, the possibilities to interface with other colleagues permits to create a sense of membership in a group, in which increase trust in each other member and *social interaction* and the creation of bonds have the effect to enhance the *motivation* of individuals to share their knowledge (Kelloway, et al., 2000).

This seems to be interesting also in the issue we investigate, in fact we felt that the Heads Doctor of Clinical Department could be indirectly influenced, for the evaluation and contextualization of technology, if they had the opportunity to promote and exploit the interactions staff, with other colleagues and experts outside the company. The interviews with the doctors made possible to strengthen our opinion and to spread the hypotheses that will be tested in the phase of data processing. Again the interviews showed that doctors, who complete the proposed acquisition, are influenced by the interactions and relationships previously developed with companies proponents of new technologies or drugs. Indeed, a Head Doctor, that develops interaction with other doctors who practice the same medical specialty and with whom he/she could exchange opinions and information about a technology, succeeds in the creation of a relationships based on trust and mutual exchange of knowledge, and in so doing he could make himself more confident in the result of an assessment increasing his/her *motivation*. So, thanks to the dual contribution, we were able to hypothesize that *social interaction* could leverage the individual skills and abilities and could increase the frequency of the doctors' decision to take part in seminars and conferences and to dialogue with the high levels in order to comply with the requirements. The assumption are the following:

Hypothesis 4: Social interaction positively affects Head Doctors' ability to assess a technology.

Hypothesis 5: Social interaction positively affects Head Doctors' opportunity to assess a technology.
Hypothesis 6: Social interaction positively affects Head Doctors' motivation to assess a technology.

3.2.3.2. Perceived Organizational Commitment to HTA

We have previously shown that the existence of socialization mechanisms favors the adoption of a common behavior. But it is not enough considering the mere existence of opportunities to interact with colleagues the only element that promotes the adoption of a particular behavior, indeed it is important that there is an organizational climate shared and perceived. This factor was named in a previous study as *perceived organizational commitment to knowledge sharing* (Rabbiosi, et al., 2009), and seems to have a positive influence to the extent in which individuals use the opportunities of interaction provided by the organization.

We considered that this concept could be generalized and used in other contexts, and therefore we have adapted and contextualized it in the health field in order to explain a different type of behavior that it may be equally influenced, facilitated or hindered by the command line of higher levels. We have renamed it as *perceived organizational commitment to HTA* (POC) and we mean with it the perception of what is the behavior desired and considered important to hospital level.

In our view, the Heads Doctor of Clinical Department may be indirectly influenced to adopt the behavior described above, if the question of the introduction of health technologies, properly evaluated and contextualized, is considered one of hospital priorities by General and Health Direction.

Looking at the existing literature and thanks to the interviews conducted with some Heads Doctor of Clinical Department it has been possible to outline two scenarios that validate the relationship between the variable and constructs of the model chosen for our research. The first hypothesis is a positive connection with the *motivation*, while the latter establishes a relationship still positive with the *opportunity*.

Hypothesis 7: Perceived organizational commitment to HTA positively affects Head Doctors' motivation to assess a technology.
Hypothesis 8: Perceived organizational commitment to HTA positively affects Head Doctors' opportunity to assess a technology.

3.2.3.3. Trust in HTA Committee

The concept of *trust* in the organization, management, and more generally in the workplace is an issue widely discussed as related to many phenomena and processes, such as negotiation and the process groups (Mayer, et al., 1999). The need to raise the issue arises from the importance of *trust*

in any cooperative relationship at any level, then between colleague and colleague and employee and employer. Therefore it is a concept connected to the individual in a horizontal or vertical relationship and implies that the interest of the individual is subordinated to the interests of the community. Indeed, in the literature, there are different definitions of the concept of *trust*, and then, even if it is universally recognized as an important element within any organization, it has been interpreted with different nuances depending on the different approaches used. For example, according to the sociological approach, *trust* is a feature inside the factory environment that fosters the relationship between the parties and helps us to understand how to operate the social system (Mayer, et al., 1999); according to another definition, it is the willingness to be vulnerable to a third party and the risk is understood as the uncertainty related to the benefits of adopting a certain behavior (Siemsen, 2005). This definition highlights the importance of *trust* in all those situations where there is a potential risk arising from the actions of other parties. This can often be due to the fact that it is not clear what benefits you get when you decide to adopt a certain behavior. According again to this definition, *trust* may be differentiated in two dimensions, *trust* in the benevolence of a person and *trust* in competences and involves the expectation that the future actions of other people will be favorable to their interests. If there is no *trust* in the benevolence of a person, the intention to adopt a certain behavior lacks. In Siemsen's study, *trust* emerges as an antecedent of *motivation*, one of the basic constructs of the MOA. It is based on the following assumption: the greater the *trust* in the benevolence of a person, the greater the willingness to exchange information.

The problem is that *trust* is complex to be built, so it must be protected from opportunistic behavior that may compromise the relationship; in addition, when it is referred to employees and employers, *trust* is a concept indirectly related to productivity, therefore understanding how establish and build a relationship of *trust*, and then preserve it over time, becomes an important and interesting element to study (Mayer, et al., 1999). Trust is created when there is constant interaction with another individual.

This construct could be moved in the context of Health Technology Assessment: through interviews, we found that in the hospital there is a nucleus of HTA formed by different professionals which work within the hospital, including some Heads Doctor of Clinical Department, which deals with and consider the review of the proposal for acquisition of technologies sent by doctors. Therefore the nucleus of HTA approves or rejects the received acquisition proposals and the interviews showed that it is very important that a relationship of *trust* is established between those who fill out the purchase request and who assesses their suitability. The doctors would like to receive feedbacks regardless of whether they are positive or negative and in the latter case there is a willingness to understand the reason for refusing in order to do better and more adequate requests of technology

in the next time. After this introduction it is clear that the doctor should be able to have *trust* to nucleus of HTA and *trust* is based on the perception that the process of evaluation of the proposal conducted from the nucleus of HTA follows standard phases and it is impartial.

With these contributions we inferred that the *trust* to the nucleus of HTA is essential and therefore we made the following assumptions:

Hypothesis 9: Trust in HTA nucleus positively affects Head Doctors' motivation to assess a technology.

3.2.3.4. Psychological Safety

The concept of *psychological safety* is very close to that previously introduced, *trust*, but the difference is that in this case it refers to a climate where people feel themselves free to express their views without fear of any repercussions. So *psychological safety* refers to a group in which the individual is inserted and the peaceful climate in which individuals can admit mistakes and failures without produce damages. So often we speak of *psychological safety* in relation to the team, and it is intended as the belief that the team was safe from possible interpersonal risks. It includes the generic concept of *trust*, discussed above, but goes further because it refers to an organizational climate characterized precisely by interpersonal trusts and by mutual respect between members of teams where people are comforted of being able to be themselves (Edmondson, 1999).

Many applications of this construct are referred to the wide theme of knowledge sharing. It is assumed that it is possible to learn from the committed mistakes and therefore the error comes knowledge. So if there is the perception of being in a climate of *psychological safety*, the individual may be more inclined to the knowledge sharing; even within the work team *psychological safety*, seen as safe for interpersonal risk-taking, is an important part of knowledge sharing within the group (Siemsen, 2005). Also in Siemsen's individualistic perspective, the construct is defined as the individual perception of safety when he is talking about his mistakes with a colleague and it is identified as a direct antecedent of *motivation* (MOA) making the following hypothesis: the more is the *psychological safety* perceived in the relationship, the more the individual will be motivated to spread their knowledge.

The concept of *psychological safety* just described was not entirely suitable for our context, so we used the information in the literature as a starting point and then we integrated them with the information from the interviews and so we arrived to represent *psychological safety* in another way. The *psychological safety* is measured as the perception of lack of personal risks and impacts if the individual makes a mistake, but when we measure the *psychological safety*, instead, we want to measure the perception of a personal injury and a damage of prestige and professional reputation in front of colleagues and direction and so we could say that it is in practice the absence of

psychological safety. The rejection of a proposal in fact is sometimes mistakenly perceived as damage inflicted on who have made the proposal and this could undermine the will of the individual to assess the technology and contextualize it before sending and submit the request to the HTA nucleus. The connection between the two concepts allows us to consider the correct formulation of the following hypothesis:

Hypothesis 10: A lower degree of psychological safety positively affects Head Doctors' motivation to assess a technology.

After describing the variables, in the graph below we show the connection of distal variables with the hypothesized proximal variables.

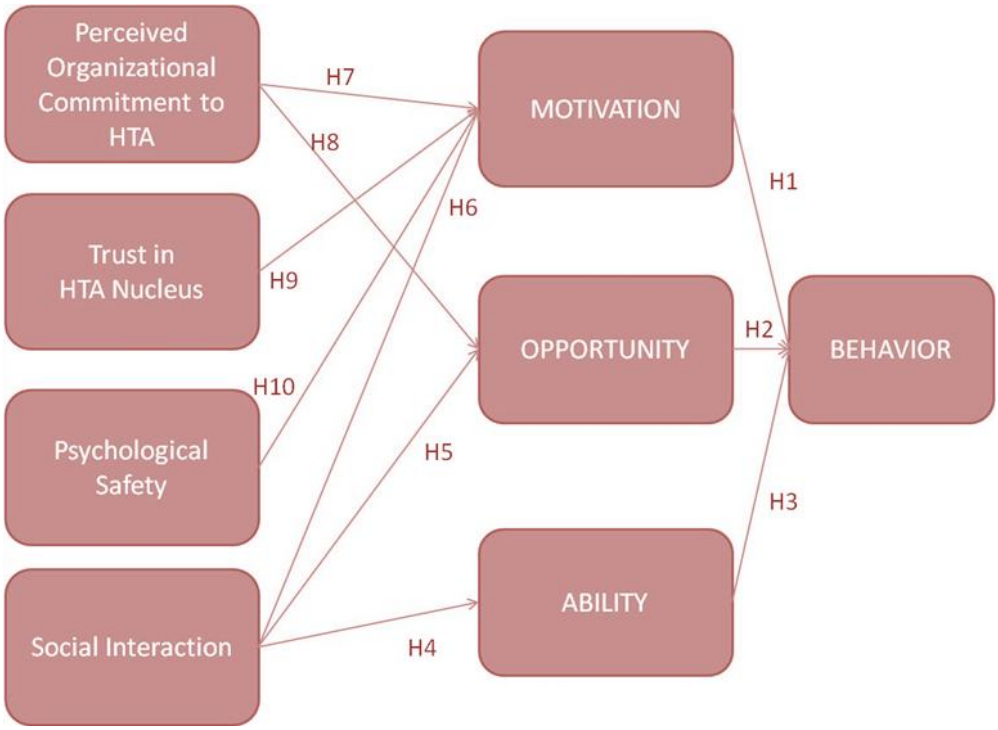

Figure 3.4: Graphical representation of our hypotheses

4. Materials and Methods

4.1.Participants

The data collected for our research were obtained through a questionnaire, involving ICP company. The survey was addressed to Head Doctors of Clinical Departments of the four hospitals, both including simple and complex departments since they all are accountable for technology acquisition in the annual budget process. We excluded administrative figures involved in budget process since they deal on aspects related to technology assessment from a different point of view compared to that of Head Doctors. Furthermore, we did not include outpatients' departments since they do not make decisions about technology acquisitions. Given the ongoing change of the managing board, all participants were asked to answer the survey referring to the past experience of HTA up to the end of 2010. The survey was submitted to Head Doctors between May and July 2011 sending an e-mail to all participants. In the text, the research team briefly explained the objective of the study, then the members conducting the research were introduced. Finally, the type of adhesion to the research was illustrated. In fact, Head Doctors could compile the questionnaire attached to the e-mail and return it with an e-mail addresses to one of the members of the research team, as indicated in the text. After ten days, since the first dispatch of the survey, we send a remind through e-mail on May 23, 2011. Two weeks apart, on June 6, 2011, we send a second remind in order to increase response rate. At last, between June 20 and 24, 2011, we called Head Doctors who did not provide yet to answer our e-mail. We delivered the survey to 63 Head Doctors and we collected 46 compiled questionnaires. The following table shows the number of responses collected for each contact established with all the professionals of the sample.

	Number of respondents after the 1° contact	Number of respondents after the 1° remind (e-mail)	Number of respondents after the 2° remind (e-mail)	Number of respondents after the 3° remind (call)
CTO	6	3	-	2
Bassini	7	3	2	1
Sesto SG	6	2	-	4
Buzzi	6	1	3	-
Total	25	9	5	7

Table 4.1: Number of respondents for each contact

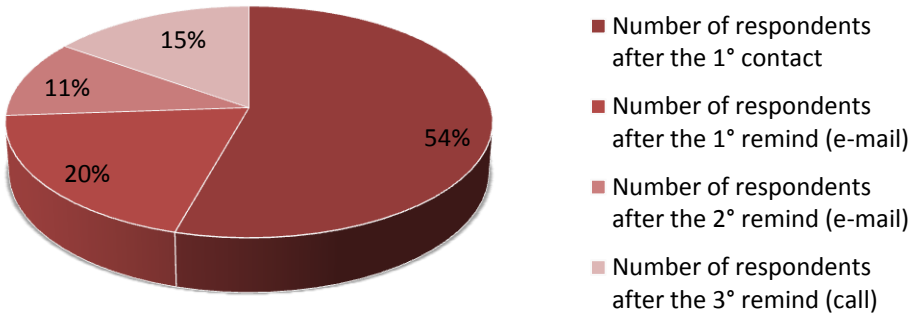

Figure 4.1: Percentage of respondents for each contact

Head Doctors who decided not to participate to the survey had, however, the same characteristics of participants since they belong to the same hospital company, with the same level of responsibilities and comparable ages. Furthermore, all Clinical Departments were represented in the final sample, demonstrating that doctors who did not attended the survey belonged by chance to different Clinical Departments.

4.2.Questionnaire Development and Administration

We developed the questionnaire on the basis of what we found in the literature. Our survey is structured in two sections. The first one refers to the constructs of the research model, while the second one refers to general information about the individual respondent. The most part of the survey provides items posed in a positive formula in order to evaluate the positive relationship between the constructs, in which the greater the independent variable is, the greater the dependent one will be, but there are also few questions which are posed in negative formula and so, when we proceeded with statistical analysis, we have reversed them in order to have the same scale for each item. After defining the constructs of model, we established a measurement scale in order to determine them with a set of items associated to each construct. The reliability of them will be evaluated in the next chapter, where we explain the results of our analysis.

In the generation of the scale, after defining the constructs, we had to look for existing scale in literature and when there was a lack of reference we built up new items consistent with the relative construct and with the information obtained by interviews.

Dependent Variable - Behavior

During the literature research of HTA and generally of technological innovation in healthcare sector, we did not succeed to find articles that already treated of the behavior we previously identified. Despite of this, we observed that there were articles which referred to the technology that used the model we described. These articles referred to the use and acceptance of a new technology within the organization and the company. In other cases, the model of MOA was used to understand consumer behavior in particular situations as in electronic market (Hughes, 2007) or in processing brand information from ads (MacInnis, et al., 1989). Observing these contributes and combining with our specific case, we were able to establish items which represented the behavior we investigated, *HTA contextualization*. We asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "I provide comprehensive estimates of the organizational implications (e.g.: spaces, tasks, workloads) of the new technology that I propose"(BEH1); (2) "I am very committed in estimating the costs associated with new technology that I propose" (BEH2); (3) "When I propose the adoption of a new technology, I provide comprehensive information on the benefits to the patient" (BEH3); (4) "When I propose the adoption of a new technology, I provide comprehensive information on any changes in the patient's path" (BEH4); (5) "Whenever I assess a new technology, I spend much attention to estimating the transitory (e.g.: time to speed, learning curves)" (BEH5).

We repeated them asking to the respondents who, according to them, has to engage himself in each tasks of the assessment. The items were inserted in order to evaluate if Head Doctors consider that the responsibility of each task is own or of other professional figures. For this purpose, the respondents are called to indicate in which extent Clinical Engineering, Health Direction and the Head Doctor of Clinical Department have to absolve determinate tasks. The items were:

- I believe that the estimate of the organizational implications (e.g.: spaces, tasks, workloads) caused by the introduction of a new technology is the task of…;
- I believe that the estimated cost (e.g.: purchase, maintenance, personnel, training) related to the introduction of a new technology is the task of…;
- I believe that the estimate of the impact that new technology will have on patient management (e.g.: location, safety, working hours) is the task of...;
- I think the estimate of the transition (e.g.: time to get up to speed, learning curves, progressive standardization) is the task of… .

In this case, we defined four questions instead five because we want only to have an idea of which the Head Doctor thinks about all tasks, while at the end of the section 1 of the survey, when we

intend to know what he really does, we have decide to utilize two items referred to the patient because this aspect should be the most relevant for him.

Proximal Variables

Motivation

The items of this construct have to represent why a Head Doctor should be motivated to perform HTA contextualization. In literature, *motivation* is indicated in the most case as an important factor in predicting different behaviors. It seems to be a key determinant of it. In the context of knowledge sharing, a great presence of abilities is not enough if the *motivation* to knowledge sharing is very low (Rabbiosi, et al., 2009). In our context, Head Doctors, with which we talked, explained that the perception of doing something that could ensure good results has a great impact in the predisposition to perform the behavior of the assessment. Also the contribute of Siemsen (2005) gives to us a scale measurement useful to predispose the items, and so we asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "I think that if I assess properly the new technologies, the chances that my purchase request is accepted increase"(MOT1); (2) "I am very willing to assess new technologies that I intend to propose for the purchase" (MOT2); (3) "I am motivated to properly assess new technology for the personal prestige that he would get" (MOT3); (4) "Whenever I propose a new technology, I try to assess the impacts that it produces" (MOT4); (5) "I have NO strong motivation to spend my time to the assessment of the introduction of new technologies" (MOT5R); (6) "I will try to consider the introduction of new technologies in an effectively way" (MOT6).

There are other items related to this construct and they are built following the items inserted in a survey in an article in which there is the intention to measure the intrinsic *motivation* of an individual to perform the behavior with the aim to increase value for him, for his department and for his company (Rabbiosi, et al., 2009); we adapted these items to our context: (7) "The advantages that the *company ICP* would obtain by a fair assessment of new technologies are a strong incentive for me" (MOT7); (8) "The advantages that the *hospital* would obtain by a fair assessment of new technologies are a strong incentive for me" (MOT8); (9) "The advantages that the *my unit* would obtain by a fair assessment of new technologies are a strong incentive for me" (MOT9); (10) "The advantages that the *patient* would obtain by a fair assessment of new technologies are a strong incentive for me" (MOT10).

Opportunity

The items we proposed follow in part a scale measurement present in literature and in part are built on the bases of the interviews. The items OPP1R, OPP2 and OPP4, following the scale proposed by Siemsen (2005), are concentrated on the aspect of the available time for carrying out the behavior. In Siemsen's context, the construct was applied to knowledge sharing, but it is a factor that could be translated in our context. The other four items refer to two instruments available for doctors. The first one is the budget form, a document that the doctor has to complete for annual budget, in which he has to indicate all implications of a technology proposed for purchase. The second instrument is the corporate intranet, a network in which a doctor could find different information useful for the assessment. Given that this two are the instruments offered by the company, it appears clear that the use of them could facilitate or hinder the assessment of a technology. For this reason, we developed two items related to the corporate intranet and two items to the budget form. We asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "My workload does not allow me to effectively evaluate new technologies"(OPP1R); (2) "During working hours, I have several times in which I can evaluate new technologies" (OPP2); (3) "The budget form shows very precisely the information needed to assess a new technology"(OPP3); (4) "I believe to have enough time to effectively assess new technologies" (OPP4); (5) "The operating instructions for completing the budget form do NOT support me sufficiently in the assess of a new technology" (OPP5R); (6) "Inside the corporate intranet I find a set of information useful for the assess of a new technology" (OPP6); (7) "The mode of activation of the HTA Committee is easily accessible through corporate intranet" (OPP7).

The construct appears to cover many aspects and, for this reason, in the next step we will consider if divide the construct could be interesting .

Ability

This construct have the role to measure the extent in which the Head Doctor has the capabilities and skills to perform the behavior of HTA contextualization. We found it in the context of knowledge sharing (Siemsen, 2005) and we replaced the items in our context, after identifying abilities that this behavior asks, which were recognized thanks to the interviews we made to the Head Doctors. From the literature, the capability to communicate with colleagues or other people seems to be an important measure of the *ability* and then also the perception of the doctor to have all the abilities to perform a specific behavior is an important aspect in order to explain it (Siemsen, 2005). Nevertheless, the context in which the items were developed is different respect to ours, they are

adapted also in the case of technology assessment and so we asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "I think to be able to perform the assess for the introduction of a new technology" (AB1); (2) "I often find the impacts that new technology will have on my unit difficult to estimate" (AB2); (3) "I trust a lot of my ability to use the corporate intranet for the assessment of the introduction of a new technology" (AB3); (4) "I trust a lot of my ability to use the budget form for the assessment of the introduction of a new technology"(AB4); (5) "I believe that estimating the impact that new technology will have on patients is relatively easy" (AB5); (6) "I am capable to perform independently the assess of the introduction of a new technology" (AB6); (7) "Often the rejection of my proposal was caused by my mistakes in the assess of new technology" (AB7); (8) "I am capable to explain to my *colleagues* why I want to introduce a new technology" (AB8); (9) "I am capable to explain to the *HTA committee* why I want to introduce a new technology" (AB9); (10) "I am capable to explain to the *Health Direction* why I want to introduce a new technology" (AB10); (11) "I am capable to explain to *Clinical Engineering* why I want to introduce a new technology" (AB11); (12) "I am capable to explain to Control *Management* why I want to introduce a new technology" (AB12).

As the *opportunity*, we could recognize the presence of principal aspects on which the items are concentrated, nevertheless the original set appears to be complete and we should subsequently consider if creating single subsets from the original could have sense.

Distal Variables

In Chapter 3, we have defined four variables as antecedents of Motivation-Opportunity-Ability framework. Each of them is used as independent variable in order to predict the *motivation* to contextualize the technology, or the *ability* in order to explain their relationship with the skills and competencies of a doctor, or the *opportunity* with the aim to evaluate their influence in individual use of external and internal factors which could facilitate or hinder the implementation of the behavior. So the distal variables become our independent variables in the hierarchical regression in order to predict and explain their relationship with *motivation*, *opportunity* and *ability* when they are used as dependent variables.

Social Interaction

Kelloway et al. (2000) indicates *social interaction* as one of the organizational antecedents that could predict the components of the model we used, Motivation-Opportunity-Ability framework, in order to explain Knowledge work as organizational behavior. According to the authors, *social interaction* is a good predictor of knowledge use and helps the individual to reach the objectives. They made a

review of existing literature in order to formulate an extended model to explain the organizational behavior and that permitted us to confirm the presence of a linkage between this construct and variables of MOA, but for the definition of the measurement scale was useful observing another contribute in the literature that deepens and unbundles *social interaction* in several components (Lechler, 2001) but we were not interesting in a further breakdown. We wanted to identify the items which defined the constructs and so we translated in our context the questions and the aspects that could be representative of HTA contextualization. We asked to assess on a seven-point Likert-type scale (1=”Strongly disagree” to 7=”Strongly agree”) the following assertions: (1) “I often get useful information to assess new technologies by industry experts” (SI1); (2) “I constantly exchange opinions on new technologies with the staff of my Unit” (SI2); (3) “I confront me with a large number of colleagues to inform myself of new technologies that I intend to propose” (SI3); (4) “I interact regularly with colleagues from other hospitals to obtain information on new technologies” (SI4); (5) “I have often exchanged ideas with the Health Department on new technologies to adopt” (SI5); (6) “I have often exchanged ideas with the Clinical Engineering on new technologies to adopt” (SI6); (7) “I have often exchanged ideas with the Control Management on new technologies to adopt” (SI7); (8) “I attend many conferences and seminars that give me the information necessary for the assess of new technologies” (SI8).

Psychological Safety

As we said before, we did not use the concept of *psychological safety* so how it is typically defined in literature, but we decided to pose all reverse questions and to measure the absence of it. With this aim, we looked for a scale not completely usable for our case, and for the reasons already described our construct was a little different, but we believed that the difference between them were not so marked to make impossible to give to us the inspiration to elaborate the information emerged from the interviews and so defined a new scale of which reliability will be evaluated in the chapter of results. The information useful to understand the *psychological safety* refers to the importance for the doctor to conduct the assessment without fear of a potential repercussion on his carrier or reputation. So we asked to assess on a seven-point Likert-type scale (1=”Strongly disagree” to 7=”Strongly agree”) the following assertions: (1) “I think that the possible rejection of my purchase proposal of a new technology represents a personal defeat” (PS1R); (2) “I believe that the possible rejection of my proposal might affect the outcome of future proposals that I will” (PS2R); (3) “I fear that the possible rejection of my proposal could damage my reputation in front of colleagues” (PS3R); (4) “I believe that the possible rejection of my proposal would lead me to lose prestige in front of the Direction” (PS4R).

Trust in HTA Nucleus

The scale measurement used for this construct items was proposed in order to represent the willingness of a worker to make himself vulnerable in front of his/her coworkers (Siemsen, 2005). In our context, the relationship between the Head Doctor with his staff or colleagues is important, but we considered more relevant understand the relationship with the HTA Nucleus. In fact, the last one is the committee involved in the assessment of the proposal request of the doctors, it has to evaluate the request and then to refuse or accept it, whereby it is clear that the relationship between the doctor and the committee has an impact on the doctor's predisposition to perform the behavior of HTA contextualization. So we asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "The HTA Committee is careful to what is important to me" (TR1); (2) "I am convinced that the HTA committee does not intentionally affect me" (TR2); (3) "I think the HTA Committee makes decisions in too discretionary way" (TR3R); (4) "The decisions of the HTA Committee are taken in full transparency" (TR4); (5) "I think the HTA Committee does NOT have the skills necessary to fully assess my proposals" (TR5R).

Perceived Organizational Commitment to HTA

It is a construct we have found in an article (Rabbiosi, et al., 2009) used in the context of knowledge sharing in order to study the modality in which items are built. Instead of a five-point Likert-type scale, we asked to assess on a seven-point Likert-type scale (1="Strongly disagree" to 7="Strongly agree") the following assertions: (1) "I believe that the set of shared values existents in the ICP gives much importance to the evaluation of new technologies" (POC1); (2) "The company ICP promotes the exchange of information relevant to the evaluation of new technologies" (POC2); (3) "The company ICP supports me in developing the skills necessary for assessing" (POC3); (4) "The company ICP does NOT recognize properly the effort I invest in assessing a technology" (POC4R).

Control Variables

We have defined five types of control variables, all transformed as dummies for statistical analysis, with the aim to underline if potential effects caused by the heterogeneity of the sample exist or not. We asked some information about the respondent as the Head Doctor of a Clinical Department.

Gender and age

Referred to the respondent, we asked the *gender* and the *age*. The last one was divided into five bands:

- Between 35 to 45 years old;
- Between 46 to 55 years old;
- Between 56 to 65 years old;
- Between 66 to 75 years old;
- Over then 75 years old.

We start from 35 years old because it is minimal age after which a doctor may become the Head Doctor of a Clinical Department.

Work experience years

Thisquestion referred to the work experience after professional qualification and it is measured in number of years of work and it contemplated four bands:

- Between 10 to 20 years;
- Between 21 to 30 years;
- Between 31 to 40 years;
- Over 40 years.

Type of technology

Considering the 100% of a Clinical Department purchase, we asked how they had divided the purchases, as a percentage, according to the following categories:

- Technologies to replace similar obsolete technologies;
- Technologies similar to other already present in the Clinical Department in order to increase the productivity;
- New technologies not yet existing within their company;
- New technologies not yet disseminating in Lombardia or Italy;
- Other.

Technology impact

The question posed is made in order to understand the type of impact considering all the purchased technologies, again in percentage, and so if the impact of those technologies is more organizational than economic or financial or vice versa.

Technology definition

Actually in the section 2 there is another question in the survey, not included for the statistical analysis, but useful for us in order to understand what kind of technology the Head Doctor thought about when he/she was compiling the questions. The categories of technologies are equipment, device, drugs, organizational procedures and services.

4.3.Data Analysis

In order to investigate the behavior of Head Doctors involved in the contextualization of technologies they intend to propose for adoption, we conducted two levels of analysis on the collected answers. In the first part, we checked the measures associated with the model we previously proposed. This study allowed us to understand whether or not the survey was well-established. In order to catch this aspect, we tested the reliability of each construct with Cronbach's alpha as suggested in literature (Nunnally, 1978). Then we explored the correlations between the constructs, calculated as average scale of the items belonging. At last, we conducted an Exploratory Factor Analysis (EFA) on the constructs *opportunity* and *ability* since we noticed from the survey that some items could be grouped and catch different aspects. On a second level of analysis, the hypotheses previously presented were tested using a multiple regression method. These kind of methods are usually employed to explain or predict a dependent variable with a set of predictors (independent variables) that, according to our study, are the behavior of Head Doctor in the contextualization of HTA as dependant variable and proximal (*motivation*, *opportunity*, *ability*) and distal (*social interaction*, *psychological safety*, *trust in HTA nucleus*, *perceived organizational commitment to HTA*) antecedents as predictors. Among the different methods of multiple regression, we decided to use hierarchical regression since it is typically used to examine the hypotheses grounded on a theoretical model. On the contrary stepwise and simultaneous regression are often used to maximize the prediction and have received a lot of criticism since they produce unstable results (Petrocelli, 2003). Furthermore given the object and the experimental theme of our research, we were more interested in testing the hypotheses and validate the overall model instead of obtain an accurate prediction of the behavior. The focus of hierarchical regression is to explain the relative importance of a predictor with respect to the dependant variable, on the basis of what it adds to the prediction compared to other

predictors computed earlier in the analysis (Petrocelli, 2003). Thus, this kind of recursive model evolves on an equation-by-equation basis in which at every step we tested an hypothesis or, in case, a block of hypotheses. As a result, change in R^2, its corresponding change in F and *p* values are the statistics of considerable interest, as we reported in every model we estimated in the next chapter. In recent years some problems emerged associated to the use of hierarchical regression. Generally, in articles it is possible to find four type of errors: a negligence in the theoretical basis for hierarchical regression, the violation of causal priority among predictors, the use of hierarchical regression in exploratory manner and the uncorrected interpretation of hierarchical regression results (Petrocelli, 2003). We checked the possible remedies to those errors in order to properly set up our analysis and avoid further worries. According to the first two errors, demographic and control variable were entered in the initial step of analysis, as suggested in literature. Subsequently, other predictors were computed individual or in blocks following the theoretical model previously presented. The criticism moved toward the use of hierarchical regression in exploratory research is mostly due out of prevention. Although our research is exploratory, we decided to use hierarchical regression all the same paying attention to the guidelines suggested in literature. The same was done in interpreting the result, mentioning the relevant statistics for each model run and interpreting them in comparative manner (Petrocelli, 2003). Each model was estimated with ordinary least square regression (OLS) and was run using STATA 9.2. The results of the two above explained levels of analysis were reported in Chapter 5.

5. Results

During the data collection phase, the questionnaire was administered to 63 Head Doctors of Clinical Department. 46 Head Doctors filled the questionnaire, allowing for a high response rate (73%). Table 5.1 illustrates a breakdown of contacts, respondents, and response rate for each of the four hospitals garrisons affiliated to ICP.

	Number of Heads Doctor of Clinical Department	Number Respondents	Response Rate for Hospital	Response Rate on four Hospitals
CTO	13	11	85%	17%
Bassini	18	13	72%	21%
Sesto SG	16	12	75%	19%
Buzzi	16	10	63%	16%
Total	63	46	-	73%

Table 5.1: Number of respondents and response rate

We reported a brief description of the sample through the control variables we collected with the survey. The first information is about the gender, in figure 5.1 we observed that the most part of the Head Doctors that adhered to the survey were male.

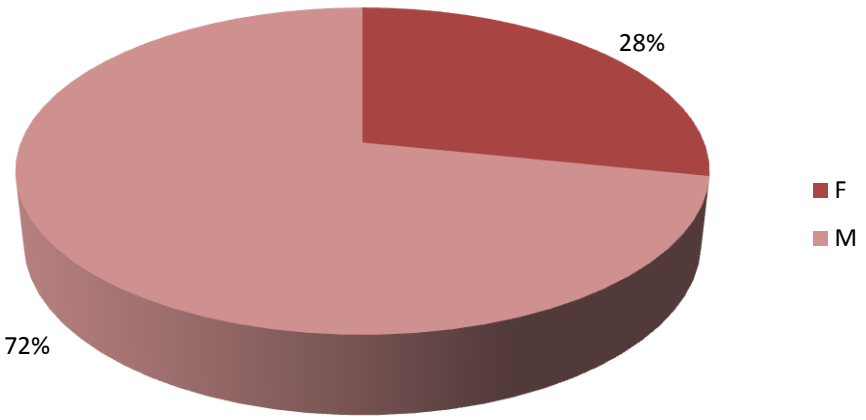

Figure 5.1: Percentage of respondents for each gender

Then, we present the composition of the sample considering the age bands we inserted in the questionnaire (cf. Figure 5.2). The Head Doctors who belong to the first and the last bands are few. In the first case, the reason is that it is difficult for a doctor to reach that position so soon, generally he/she works for more years in order to accumulate the necessary experience to deal with the typical responsibilities of the position of the Head Doctor. The low percentage related to the last

bands is due to the achievement of the pensionable age, and so the Head Doctors that decide to continue their job are very few.

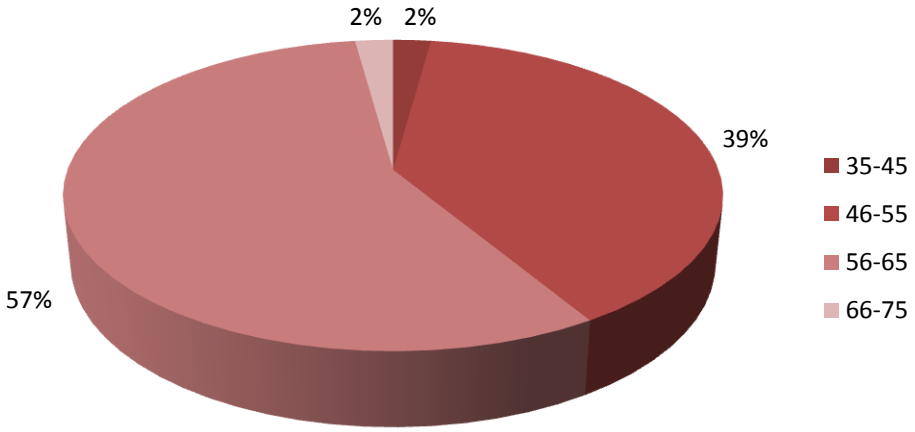

Figure 5.2: Percentage of respondents for each band of age

The information obtained thanks to the age bands is confirmed by the year of experience (cf. Figure 5.3). In fact, considering the age in which a person usually obtains the qualification to profess as a doctor, it is very uncommon that he/she performs over 40 years of experience trespassing his/her pensionable age.

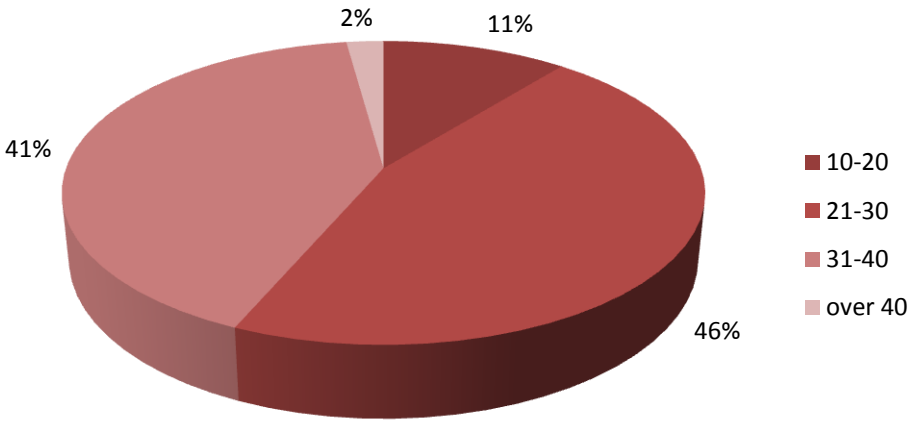

Figure 5.3: Percentage of respondents for each band of years of career

5.1. Measures

Before introducing the structural model and proceeding with statistical analysis, we assessed the reliability of each construct in order to verify that the items affiliated to a construct converge in their meaning.

The reliability of model's constructs

All constructs include multiple items, which are based on seven-point Likert-type scale. Before starting with hierarchical analysis, we have to test the reliability of the constructs, noted as: HTA Contextualization (BEH), Motivation (MOT), Opportunity (OPP), Ability (AB), Social Interaction (SI), Trust to HTA Nucleus (TR), Psychological Safety (PS) and Perceived Organizational Commitment to HTA (POC). Measurement properties of those scales were adapted from existing literature (cf. Chapter 4) and in order to test them we decided to use a technique generally widespread in literature, especially when social and behavioral theoretical models are applied: Cronbach's alpha. It is the ordinary criterion for assessing and checking internal consistency of a construct and the reliability of any construct is accepted when its alpha is higher than 0,7 (Nunnally, 1978). The greater it is, the more construct reliability is proven and this alpha value indicates that items within a construct have scores belonging to the same range and having the same meanings. It is necessary that any construct has homogeneity between the items inside. In table 5.2 we reported the items of the survey with relative codes, missing data, item-rest correlation and the alpha value of the construct in case of deletion of each item. Furthermore, the table shows the alpha (in bold) associated to any construct pre and post deletion of specific items, as we further explain.

SCALE AND ASSOCIATED INDICATORS	CODE	MISSING	SIGN	INTER-REST CORRELATION	ALPHA DELETING THE ITEM
BEHAVIOR: HTA CONTEXTUALIZATION **α_{POST}=0.8001**					**α_{PRE}=0.8001**
	BDUE1	3	+	0.5536	0.7667
	BDUE2	1	+	0.5538	0.7718
	BDUE3	2	+	0.6519	0.739
	BDUE4	2	+	0.7046	0.7138
	BDUE5	1	+	0.4235	0.8101
MOTIVATION **α_{POST} =0.8188**					**α_{PRE} =0.8188**
	MOT1	0	+	0.4185	0.8125
	MOT2	1	+	0.5631	0.7968
	MOT3	0	+	0.3007	0.8234

	MOT4	2	+	0.4485	0.8061
	MOT5R	0	+	0.2953	0.8225
	MOT6	0	+	0.3257	0.8196
	MOT7	1	+	0.7012	0.7808
	MOT8	0	+	0.7464	0.7761
	MOT9	0	+	0.7726	0.772
	MOT10	0	+	0.456	0.8063
					α_{PRE} =0.7331
OPPORTUNITY **α_{POST} =0.7331**	OPP1R	0	+	0.5684	0.6763
	OPP2	1	+	0.6782	0.6483
	OPP3	2	+	0.4068	0.7099
	OPP4	0	+	0.6805	0.6412
	OPP5R	4	+	-0.0489	0.7993
	OPP6	5	+	0.6947	0.6417
	OPP7	7	+	0.221	0.7454
					α_{PRE} =0.8014
ABILITY **α_{POST} =0.8449**	AB1	0	+	0.315	0.798
	AB2R	0	+	0.2946	0.801
	AB3	7	+	0.2341	0.8038
	AB4	3	+	0.3202	0.7966
	AB5	0	+	0.4277	0.7883
	AB6	1	+	0.4409	0.7867
	AB7	8	+	-0.3405	0.8449
	AB8	0	+	0.5476	0.7774
	AB9	1	+	0.8212	0.7485
	AB10	0	+	0.7842	0.7521
	AB11	0	+	0.7102	0.76
	AB12	0	+	0.7344	0.7576
					α_{PRE} =0.7035
SOCIAL INTERACTION **α_{POST} =0.7176**	SI1	1	+	0.4294	0.6697
	SI2	0	+	0.3999	0.6689
	SI3	0	+	0.5623	0.6366
	SI4	1	+	0.4443	0.6627
	SI5	0	+	0.3932	0.676
	SI6	1	+	0.3624	0.6844
	SI7	0	+	0.1879	0.7176
	SI8	0	+	0.3973	0.6763
					α_{PRE} =0.8058
TRUST IN HTA NUCLEUS **α_{POST} =0.8239**	TR1	11	+	0.8003	0.7128
	TR2R	3	-	0.296	0.8683

	TR3	11	-	0.6657	0.7509
	TR4	7	+	0.6048	0.7607
	TR5R	7	+	0.7272	0.7239
PERCEIVED ORGANIZATIONAL COMMITMENT TO HTA **α_{POST} =0.8158**					**α_{PRE} =0.8158**
	POC1	4	+	0.6591	0.7598
	POC2	2	+	0.8071	0.6721
	POC3	1	+	0.5287	0.8202
	POC4R	3	+	0.55	0.8049
PSYCHOLOGICAL SAFETY **α_{POST} =0.7726**					**α_{PRE} =0.7726**
	PS1R	1	+	0.3539	0.8272
	PS2R	1	+	0.6381	0.677
	PS3R	0	+	0.6626	0.6628
	PS4R	1	+	0.6213	0.6801

Table 5.2: Item, code, missing data, item-rest correlation and Cronbach's alpha

Important results are related to Cronbach's Alpha, in fact the alpha value is higher than the established threshold of 0,7 for all constructs. These results demonstrate that the items defined for each construct have an internal homogeneity and properly represent the construct. Nevertheless, we noticed that *social interaction* has a borderline value of 0.7035, which suggested the opportunity to intervene on the construct. The best solution was the deletion of item SI7 (cf. the pink-highlighted items in Table 5.2), which allowed a modest but appreciable increase in construct reliability (alpha= 0.7176). Also *opportunity* shows a moderate alpha value that could be improved with the deletion of the item OPP5 since it has a low *item-rest correlation* and its deletion could increase *opportunity*'s alpha to 0.7993. However, we decided to hold the item because we were interested to test it in association with item 3, since both items refer to budget form. With respect to *trust in HTA Nucleus* we eliminated two items. This choice was necessary since the sign associated to items TR2R and TR3 (cf. the pink-highlighted items in Table 5.2) is negative, suggesting that they are not aligned with other items belonging to the construct. The alpha of *trust in HTA Nucleus*, after our intervention, was 0.8239. With respect to *item-rest correlation*, which indicates how the item is correlated with all other items of that construct, we opted for the elimination of the item AB7 (cf. the pink-highlighted items in Table 5.2). The deletion was also appropriate because this item has collected a high number of missing data and also because it permitted to increase the *ability*'s alpha which became in fact 0,8449.

Correlations between constructs

The next step was to calculate the correlations between model's constructs. This analysis allows to underline a possible relation between two variables, in terms of common patterns of variation between two variables. The correlation between variables could be positive or negative. In the first case, a positive correlation means that if a variable increases then also the other increases, instead when the correlation is negative, it means that if a variable increases the other decreases. The correlation could involve more than one variable.

We have analyzed the possible correlations between the constructs of our model and below there is a table that resumes all combination. We consider that there is a meaningful correlation when the value is at least 0,40 or above.

Variable	Mean	Std. Dev.	HTA	MOT	OPP	ABIL	SI	PS	TRU	POC
HTA Contextualization	5.885556	0.830226	1							
Motivation	5.911352	0.7655375	0.5222***	1						
Opportunity	3.548759	1.237065	0.2882*	0.3689**	1					
Ability	5.061252	0.7825983	0.4021***	0.5315***	0.2166	1				
Social Interaction	5.244826	0.9326901	0.474***	0.59***	0.4443***	0.3424**	1			
Psychological Safety	5.75	1.077549	0.3437**	0.1239	0.0935	0.1888	0.2405	1		
Trust in HTA Nucleus	4.804167	1.457802	0.3945**	0.2504	0.3279**	-0.0451	0.2698*	0.1036	1	
Perceived Organizational Commitment to HTA	4.424073	1.342865	0.3602**	0.3056**	0.3504**	0.2261	0.3638**	0.1122	0.4846***	1

***p<0.01; **p<0.05; *p<0.1

Table 5.3: Mean, standard deviation, correlations

Observing the table, it is possible to highlight the following correlations:

- Proximal Variables:
  - *Motivation* has a strong positive correlation with the behavior (0,5222);
  - *Opportunity* does not seem to be correlated with HTA Contextualization;
  - *Ability* is positively correlated with the behavior(0,4021);

- Distal Variables:
  - *Social Interaction* has a positive correlations with the *motivation* (0,59), the *opportunity* (0,4443) and with the behavior of HTA Contextualization (0,474);
  - *Psychological Safety* seems to be uncorrelated with all other construct and the same is valid for *Perceived Organizational Commitment to HTA*;
  - *Trust in HTA Nucleus* hasn't strong correlations but is near to the lower limit of acceptation (0,3945) in relation with the HTA Contextualization.

The analysis of correlation was useful in order to explore the possible correlation between proximal variables with respect to the behavior and distal antecedents compared to proximal constructs. Besides a noticeable correlation between *motivation* and the behavior of HTA contextualization, we marked a certain ambiguity in the constructs of *opportunity* and *ability.* In the light of this, we decided to extend the analysis related to these constructs as presented in the following paragraph.

Exploratory Factor Analysis

The previous analysis allowed to identify two constructs - *opportunity* and *ability* - which present some problem in their correlation with the behavior. As observed earlier (cf. Chapter 4), both constructs include items that may seize different aspects of *opportunity* and *ability*. We anticipated the possibility that an all-encompassing construct may face some struggles. So we decided to test if a construct focusing on one specific aspect would be more representative and explanatory than a construct which encompasses all the aspects of opportunity or ability. Thus, we operated an Exploratory Factor Analysis (EFA) that allowed to identify the principal components in *Opportunity* and *Ability*, and which would be tested in alternative versions of the structural model.

EFA is used to search and underline the structure within a variable, through the correlations between the items of the construct. We used this analysis to realize and define different sets of variables internally correlated, which are called factors in order to create a new sets of variables from the original set. The three hypotheses necessary to apply EFA - i.e. internal homogeneity of the original variable, consistency of its observations and existence of a structure within the variable - are all respected. We applied a technique to find the new factors, the Principal Components Analysis (PCA). PCA is useful when the aim is to sum and to conserve the most of the original information held in a set of items and to obtain a construct internally consistent with a smaller number of items. In particular, orthogonal transformation converts the set of items into a set of several variables called principal components which number is less or equal to the number of components of the original variables. After this operation, we used only the components that explained the most portion of variance and then we made the orthogonal factor rotation on them in order to classify the items for each components and so made more understandable the output. For the rotation, several approaches exist, but we chose the VARIMAX criterion, that rotates the axes to maximize the sum of variance of the squared loadings and underlines which items belong to each components.

The final step was to test the reliability of each new variable calculating Cronbach's alpha.

PCA Opportunity

As it is, the construct of *opportunity* appears to be complete, but, reading the items and for the previous considerations, it is evident that it is possible to divide the *opportunity* in other factors. With this purpose we applied PCA obtaining the following table.

Principal components/correlation Rotation: (unrotated = principal)				Number of obs.= 33 Number of comp.= 3 Trace= 7 Rho= 0.8107
Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp 1	3.03552	1.59346	0.4336	0.4336
Comp 2	1.44206	0.24481	0.2060	0.6397
Comp 3	1.19725	0.563658	0.1710	0.8107
Comp 4	0.633588	0.302731	0.0905	0.9012
Comp 5	0.330857	0.0610319	0.0473	0.9485
Comp 6	0.269826	0.17892	0.0385	0.9870
Comp 7	0.0909057	.	0.0130	1.0000

Table 5.4: PCA on opportunity

The column "cumulative" indicate the portion of variance explained by each component and we recognized that the components 1,2,3 and 4 explain a large part of it. Nevertheless, the general criterion of choice depend on the eigenvalue associated to each component which has to be greater than 1 (Hair, et al., 2010). For this reason we decided to consider only the first three components, that, however, explain 81% of total variance. Then, in the next table, we applied the rotation using the orthogonal varimax method in order to identify the belonging of each item to each component.

Rotation: orthogonal varimax					
	Item	**Comp1**	**Comp2**	**Comp3**	**Unexplained**
OPP1R	My workload does not allow me to effectively evaluate new technologies	0.5330	0.1145	-0.2853	0.1529
OPP2	During working hours, I have several times in which I can evaluate new technologies	0.5652	-0.0986	0.0770	0.1799
OPP3	The budget form shows very precisely the information needed to assess a new technology	0.1102	0.2816	0.4653	0.3992
OPP4	I believe to have enough time to effectively assess new technologies	0.5794	-0.0751	0.1106	0.1079
OPP5R	The operating instructions for completing the budget form do NOT support me sufficiently in the assess of a new technology	-0.0123	-0.0586	0.8261	0.09949
OPP6	Inside the corporate intranet I find a set of information useful for the assess of a new technology	0.1751	0.5935	-0.0100	0.2025
OPP7	The mode of activation of the HTA Committee is easily accessible through corporate intranet	-0.1331	0.7325	-0.0384	0.1832

Table 5.5: Rotation of principal components

We interpreted the table recognizing the pattern which link each item to only one specific component and, on the basis of the meaning of each item, we were able to rename each component in order to catch a salient aspect contained in it. As a result we obtained the following factors:

- *Workload*: it contains the items referred to the time necessary to spend for doing the assessment, the time available during the work hours to dedicate to the evaluation and the workload; so the items OPP1R, OPP2, and OPP4 become part of this new construct.
- *Intranet*: it contains the items OPP6 and OPP7, which deal on the access to information in the corporate intranet.
- *Budget Form*: it referred to the questions related to the compilation of the budget form of the hospital and includes the items OPP3 and OPP5.

The following table contains the assessment of the reliability of each new component and, in order to make more intelligible the further analysis, we distinguished the components giving them a denomination.

Component	Item	Alpha	Name
Comp 1	OPP 1R_2_4	0.9035	Workload
Comp 2	OPP 6_7	0.7198	Intranet
Comp 3	OPP 3_5	0.3379	Budget Form

Table 5.6: Cronbach's alpha of new constructs

We could see that *workload* and the *intranet* are reliable because their alpha has good value, while the *budget form* component is not reliable and OPP3 and OPP5 should be considered separately.

In sum, the Principal Component Analysis provides a distinction of the Opportunity variable into 2 components. This distinction can be meaningful to evaluate if a component contributes more than others to explain the behavior or if a component has to be deleted because not explanatory.

PCA Ability

As with the *opportunity* variable, we searched for the presence of principal components through a PCA. The results are illustrated in the Table 5.7.

Principal components/correlation Rotation: (unrotated = principal)			**Number of obs.=** **Number of comp.=** **Trace=** **Rho=**	**39** **11** **11** **1.0000**
Component	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp 1	4.84851	2.67513	0.4408	0.4408
Comp 2	2.17338	0.640582	0.1976	0.6384
Comp 3	1.5328	0.531731	0.1393	0.7777
Comp 4	1.00107	0.500526	0.0910	0.8687
Comp 5	0.500541	0.0842621	0.0455	0.9142
Comp 6	0.416278	0.234552	0.0378	0.9521
Comp 7	0.181726	0.0389907	0.0165	0.9686
Comp 8	0.142735	0.026182	0.0130	0.9815
Comp 9	0.116554	0.0582172	0.0106	0.9921
Comp 10	0.583363	0.0302625	0.0053	0.9974
Comp 11	0.0280738	.	0.0026	1.0000

Table 5.7: PCA on ability

As Table 5.7 shows, out of the eleven possible components, three components permit to reach a good compromise between the rule of having an eigenvalue higher than 1 (Hair, et al. 2010), and the possibility to avoid components which only one item. Using three components allows reaching a good level of explained variance (0.7777). Also in this case, we did the orthogonal rotation with the aim to make more simple the understanding of the output.

	Rotation: orthogonal varimax				
Item		**Comp1**	**Comp2**	**Comp3**	**Unexplained**
AB1	I think to be able to perform the assess for the introduction of a new technology	-0.0986	0.5122	0.2416	0.2493
AB2R	I often find the impacts that new technology will have on my unit difficult to estimate	0.0345	0.4567	-0.1575	0.5188
AB3	I trust a lot of my ability to use the corporate intranet for the assessment of the introduction of a new technology	-0.0111	-0.0383	0.6605	0.1935
AB4	I trust a lot of my ability to use the budget form for the assessment of the introduction of a new technology	0.0338	0.0344	0.6662	0.107
AB5	I believe that estimating the impact that new technology will have on patients is relatively easy	0.0692	0.5097	-0.1554	0.3616
AB6	I am capable to perform independently the assess of the introduction of a new technology	0.0022	0.5103	0.0440	0.3846
AB8	I am capable to explain to my *colleagues* why I want to introduce a new technology	0.4120	-0.0556	-0.0623	0.2987
AB9	I am capable to explain to the *HTA committee* why I want to introduce a new technology	0.4354	0.0450	0.0698	0.09174
AB10	I am capable to explain to the *Health Direction* why I want to introduce a new technology	0.4558	0.0262	0.0265	0.05273
AB11	I am capable to explain to *Clinical Engineering* why I want to introduce a new technology	0.4665	-0.0176	-0.0139	0.0631
AB12	I am capable to explain to *Control Management* why I want to introduce a new technology	0.4454	-0.0082	0.0323	0.124

Table 5.8: Rotation of principal components

The three subsets of items and were renamed based on items' content:

- AB8, AB9, AB10, AB11 and AB12 refer to the doctor's capabilities to explain what he wants and why to different people of different level, we called this set *communication capabilities;*
- AB1, AB2, AB5 and AB6 refer all to the capabilities of the doctor to evaluate the technology and its impacts, we called this set *self efficacy;*
- AB3 and AB4 refer to the doctor's trust in his capabilities, we called this set *self-confidence*.

Before starting with all possible analysis we had to test the reliability of these new subsets of variables and we did it calculating Cronbach's alpha.

Component	Item	Alpha	Name
Comp 1	AB8_9_10_11_12	0.9547	Communication capabilities
Comp 2	AB 1_2R_5_6	0.7202	Self- efficacy
Comp 3	AB 3_4	0.8478	Self-confidence

Table 5.9: Cronbach's alpha of new constructs

All new components are reliable because their alpha is higher than 0.7, so we could proceed with hierarchical regression. It could be interesting evaluate the explanatory power of each component, in order to see which subset of the *ability* construct is more significant to explain the behavior.

5.2 Structural Model

Once established the reliability of the scales, the hypotheses (cf. Chapter 3) can be tested through a hierarchical analysis based on ordinary least squares regression. This typology of statistical analysis is suitable for recursive model in which estimation is done on an equation-by-equation basis (Siemsen, 2005).

The following steps were performed before the analysis:

- two control variables – *type of technology acquired in percentage* and *impacts of technology acquired in percentage* – were dropped from the analysis because of the high number of missing values. The control variables included in the model were converted in dummy variables in order to run the estimation.

- The dependant variable resumes all aspects that Head Doctors have to account for technology assessment. So the hierarchical analysis was run with respect to the behavior self reported by Head Doctors and this variable represents the average of the last five questions in Section 1. In contrast with the total number of collected responses, one observation was not used in the regression since the dependant variable was not available.

- For each variable, scale averages were used in the model.

Five models were tested to explain our dependant variable. Specifically: Model 1 represents the benchmark of hierarchical analysis since it incorporates only control variables. Model 2 adds *motivation* in order to test hypothesis 1. In model 3 we removed the influence of *motivation* to test the effect of *opportunity* in relation to the behavior. In model 4 we repeated hierarchical regression just for control variables and *ability*. Last, we combined the three constructs of MOA framework together with control variables to test hypothesis 1, 2 and 3 simultaneously in Model 5.

	Model									
	1		2		3		4		5	
	Control variables		Motivation		Opportunity		Ability		Combined	
Variable	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Gender	-0.416	0.291	-0.347	0.245	-0.445	0.281	-0.546	0.251	-0.455*	0.238
Age_2	0.194	1.003	-0.612	0.863	-0.121	0.980	-0.165	0.862	-0.642	0.827
Age_3	0.054	1.086	-1.037	0.948	-0.176	1.053	-0.809	0.954	-1.258	0.909
$Career_2$	0.267	0.542	0.556	0.460	-0.068	0.549	0.994	0.499	0.820	0.514
$Career_3$	0.453	0.660	0.804	0.560	0.096	0.660	1.249	0.599	1.084*	0.606
Motivation			0.712***	0.170					0.479***	0.190
Opportunity					0.228*	0.114			0.056	0.103
Ability							0.637***	0.162	0.386**	0.179
Constant	5.750	0.852	2.117	1.125	5.522	0.829	2.566	1.090	1.325	1.180
N	45		45		45		45		45	
R^2	0.066		0.360		0.155		0.336		0.449	
Adj R^2	-0.054		0.259		0.021		0.231		0.326	

***p<0.01; **p<0.05; *p<0.1

Table 5.10: Results of hierarchical regression of HTA contextualization (1)

According to model 1, none of control variables affect the behavior significantly and the resulting percentage of total variation of the behavior explained by the model appears very small (R^2=0,066 and F=0,55). Model 2 significantly increases the explanatory power, as the variance explained by the regression is much higher (R^2=0,360 and F=3,3). This increase should be attributed to the *motivation* variable (b=0,712; p<0,01). This result supports Hypothesis 1, i.e. the *motivation* of Head Doctors toward technology assessment improves their effort to the contextualize the proposed technology in his/her reality. In Model 3, we excluded *motivation* and we introduced *opportunity* as possible determinant of Head Doctors' behavior. The result is that *opportunity* has less explanatory power than *motivation*, but is still significant (b=0,228; p<0,1). This indicates the shortage of factors belong to the hospital that could facilitate the Head Doctors in performing a well-established technology assessment. Hypothesis 2 is thus supported, confirming a positive relation between the opportunities provided within Head Doctors' context of work and their commitment in technology assessment. Model 4 is close to Model 2 in terms of explanatory power, noticed (R^2=0,336 and F=3,20). *Ability* emerges as the most explicative variable in model 4 (b=0,637; p<0,01) supporting Hypothesis 3 - thus enforcing the idea that Head Doctors' *ability* are essential to perform a valuable technology assessment which could support an purchase proposal.

The results from Model 2 to Model 4 provides only a partial representation of the underlying hypotheses, because they still need to be validated in a comprehensive MOA framework which includes the control variables and all the three proximal antecedents of the behavior referred above. The results are shown in Model 5. With respect to the previous models, we noticed an increase in the

percentage of variance explained and in model fit (R^2=0,449 and F=3.66). *Motivation* and *ability* are confirmed as determinant in supporting Head Doctor committed to the evaluation and contextualization of the new technology he/she propose for the acquisition. We also observed the role of the *opportunity* that appears not influential. We inferred that individual predisposition and personal skills are enough to urge Head Doctors in applying for technology assessment.

According to the model presented in Chapter 3, we performed the hierarchical regression also on the distal variables – i.e., testing the hypothesis 4 to 10 in order to better understand the managerial factors that have an impact on *motivation*, *opportunity* and *ability*. For each model, we introduce *social interaction* (SI), *psychological safety* (PS), *trust in HTA nucleus* (Trust in HTA) and *perceived organizational commitment to HTA* (POC to HTA) as distal antecedents and we varied the dependant variable among *motivation*, *opportunity* and *ability*. We also evaluated the direct effect of the distal antecedents on the behavior in Model 9.

	Model							
	6		7		8		9	
Dependent variable	Motivation		Opportunity		Ability		HTA Contextualization	
Variable	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Gender	0.036	0.173	0.432	0.352	0.267	0.245	-0.278	0.260
Age_2	-0.321	0.241	0.992	1.216	0.292	0.812	0.760*	0.393
Age_3	(dropped)		0.224	1.329	0.962	0.882	(dropped)	
$Career_2$	-0.677**	0.314	1.461**	0.642	-0.845**	0.404	0.905	0.594
$Career_3$	-0.821**	0.389	1.669**	0.784	-0.947*	0.511	1.178	0.713
Motivation							0.290	0.282
Opportunity							-0.011	0.144
Ability							0.425**	0.197
SI	0.525***	0.104	0.485***	0.183	0.284**	0.120	0.120	0.204
PS	0.126	0.080					0.069	0.125
Trust in HTA	0.028	0.062					0.134	0.094
POC to HTA	0.020	0.082	0.215*	0.126			0.072	0.120
Constant	2.969	0.755	-2.158	1.354	3.501	0.951	-1.009	1.482
N	40		45		46		40	
R^2	0.614		0.422		0.293		0.559	
Adj R^2	0.514		0.313		0.184		0.385	

***p<0.01; **p<0.05; *p<0.1

Table 5.11: Results of hierarchical regression of HTA contextualization (2)

For each proximal variable we tested the distal antecedents that were supposed to have a direct impact on it. In Model 6, the hypothesis we made was a positive influence of all the distal antecedents on *motivation*. Only a strong positive effect of *social interaction* (b=0,525; p<0,01) on *motivation* was confirmed (with a high degree of explained variance, i.e. (R^2=0,614). This results

indicates that a high degree of social interaction between colleagues and other healthcare professionals has a positive effect on Head Doctors' *motivation* to evaluate a new technology. On Model 7, we set *opportunity* as dependant variable in order to test the hypothesis that put it in positive relation with *perceived organizational commitment* and *social interaction*. As with *motivation*, *social interaction* (b=0,485; p<0,01) is positively related to *opportunity* confirming the hypothesis that interaction between partners inside and outside the hospital increases the degree of *opportunity* that facilitate Head Doctor in technology assessment. *Perceived organizational commitment to HTA* (b= 0,215; p<0,1), even if to a lesser degree than *social interaction*, was also confirmed as a significant variable which explains *opportunity*. This result indicates that Head Doctor's perception that hospital is committed to HTA is translated in a higher perception of the opportunities related to promoting technology assessment. Moving on Model 8, we tested that *social interaction* (b=0,284; p<0,05) has a positive impact on *ability*. In fact, the more a Head Doctor share information with other healthcare professionals, the greater his/her *ability* increase on technology assessment subject. The variables associated with the professional experience of Head Doctors ($career_2$ and $career_3$) seem to explain a quite significant portion of *motivation*, *opportunity* and *ability* even if in different manners. In fact, an advancement in professional experience limit the *motivation* of Head Doctors toward technology assessment and his/her *ability* to perform it. On the contrary, the more years of professional career, the greater the opportunities Head Doctor exploited for technology assessment. Finally, in Model 9, we run a comprehensive regression with the behavior self reported by Head Doctor as dependant variable and all the antecedents, both proximal and distal, as independent variables. Among proximal antecedents, *ability* appears to be the most significant (b=0,425; p<0,05), whereas distal antecedents have no noticeable effect on behavior as we expected to be.

In order to complement the results from to the hierarchical regression, we used the F test in order to verify the significance of some constructs with respect to the behavior starting from the complete model. This test allows to drop at once those variables that verify the null hypothesis, i.e. their parameters are null and do not explain variations in the dependant variable. The null hypothesis is accepted when the p-value is higher than a threshold value (p> 0,1). We decided to use this test with the aim of discarding those variables which does not contribute to the explanatory power of the model. So we applied this test to Model 9 and we discarded the constructs of *opportunity, social interaction, psychological safety and perceived organizational commitment to HTA* (Prob>F = 0.87), this operation permitted us to do another regression on all the variables not deleted and the results are presented in the following model 10.

Model	
	10
Dependent variable	HTA Contextualization
Variable	Estimate SE
Gender	-0.346** 0.236
Age_2	0.751** 0.344
Age_3	(dropped)
$Career_2$	1.003** 0.464
$Career_3$	1.262** 0.556
Motivation	0.436** 0.199
Ability	0.458** 0.177
Trust in HTA	0.163** 0.077
Constant	-0.896 1.321
N	40
R^2	0.539
Adj R^2	0.438

Table: regression results

***p<0.01; **p<0.05; *p<0.1

Table 5.12: Results of regression of HTA contextualization after the F test (1)

The Model 10 shows that *motivation* (b=0,436; p<0,05)*, ability* (b=0,458; p<0,05) *and trust in HTA* (b=0,163; p<0,05) are strong correlated with the behavior, this is demonstrated by the p-values that indicate that these constructs are significant. This results shows that the hypothesis 1 and hypothesis 3, respectively related to *motivation* and *ability* are well founded. Another important linkage with the behavior is that of *trust in HTA nucleus*, since we did not hypothesized a relation between *trust* and behavior during the determination of the hypotheses in Chapter 3 but this unexpected result confirms a positive connection. Except for age_2, all control variables of model 10 are significant with a p-value inferior to 0,05.

Below(cf. Figure 5.4), we reported the graphical illustration of the confirmed hypotheses, verified with hierarchical regression (from Model 1 to Model 9).

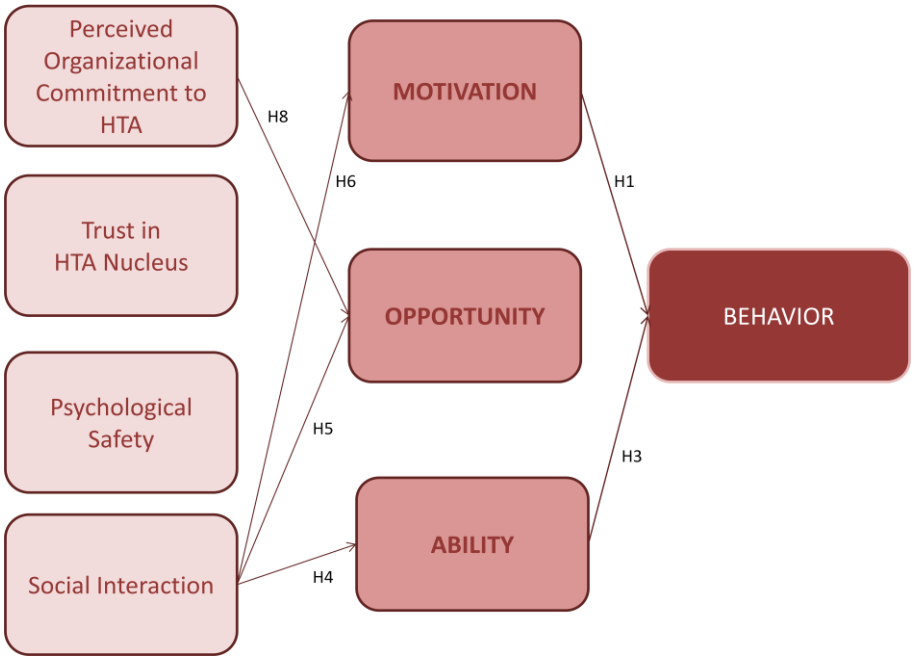

Figure 5.4: Graphical representation of the verified hypotheses (1)

Since Model 9 illustrates a weak relation between the behavior and its proximal antecedents, we decided to perform further analyses which would include the components of opportunity and ability as identified through a Principal Component Analysis (cf. Chapter 5, Exploratory Factor Analysis). From the *opportunity* construct, a reliable construct extracted was *workload* and we decided to maintain it in hierarchical regression. The *budget form* component has a poor Cronbach's alpha and was excluded from further analysis. The *intranet*, instead, while internally consistent, emerged to be of little interest during the interview with a sample of Head Doctor (cf. Chapter 3). With respect to the construct of *ability*, we maintained for hierarchical regression the components of *self-efficacy* and *communication capabilities* since the component *self-confidence* contains items with a low correlation to the rest of the construct (see table 5.2) and a higher number of missing data with respect to the other two extracted components. Reminding the combined Model 5 presented above, we run a hierarchical regression in Model 11 setting the behavior of HTA contextualization as dependant variable and using *motivation*, *work load*, *self-efficacy* and *communication capability* as independent constructs.

Model		
	11	
Dependent variable	HTA Contextualization	
Gender	-0.417*	0.245
Age_2	-0.590	0.861
Age_3	-1.203	0.949
$Career_2$	0.989*	0.511
$Career_3$	1.186*	0.604
Motivation	0.553***	0.201
Work Load	-0.033	0.070
Self Efficacy	0.218*	0.111
Communication capabilities	0.111	0.145
Constant	1.311	1.335
N	45	
R^2	0.440	
Adj R^2	0.296	

***p<0.01; **p<0.05; *p<0.1

Table 5.13: Results of hierarchical regression of HTA contextualization (3)

Results showed that *motivation* (b=0,553; p<0,01) and *self-efficacy* (b=0,218; p<0,1) are explanatory variables. There are some notables similarities with Model 5: in both models, *motivation* has a positive and strong effect on the behavior and *ability* was positively related to the behavior. Model 12, however, allows to specify that such *ability* is mostly referred to *self-efficacy* and not to *communication capabilities*. Following the scheme previously seen (cf. Table 5.11, Model 6, Model 7, Model 8 and Model 9), we finally tested the hypotheses between the proximal variables and the distal antecedents - except for *motivation* since the construct was not modified and the regression is the same reported in Model 6. We tested *workload* with respect to *social interaction* and *perceived organizational commitment to HTA* (as in Model 7) and *self-efficacy* and *communication capabilities* with respect to *social interaction* (as in Model 8). The results are below reported in Model 12, 13 and 14.

Model						
	12		13		14	
Dependent variable	Work Load		Self-efficacy		Communication Capabilities	
Variable	Estimate	SE	Estimate	SE	Estimate	SE
Gender	0.888	0.584	0.429	0.367	0.096	0.290
Age_2	0.861	2.019	1.040	1.218	-0.815	0.963
Age_3	-0.087	2.208	1.729	1.322	-0.505	1.046
$Career_2$	1.768	1.066	-1.555**	0.606	-0.315	0.479
$Career_3$	2.408*	1.303	-1.337*	0.766	-0.210	0.606
SI	0.664**	0.303	0.437**	0.180	0.156	0.143
PS						
Trust in HTA						
POC to HTA	0.150	0.210				
Constant	-2.924	2.248	1.690	1.426	6.177	1.128
N	45		46		46	
R^2	0.291		0.304		0.111	
Adj R^2	0.157		0.197		-0.026	

***p<0.01; **p<0.05; *p<0.1

Table 5.14: Results of hierarchical regression of HTA contextualization (4)

After testing the distal variables on proximal, as we made in Model 9, we wanted to show a regression that evaluate the contributes of the proximal variables, such as *motivation* and the new constructs of *workload, self-efficacy* and *communication capabilities,* and the contributes of all distal variables.

Model	
	15
Dependent variable	HTA Contextualization
Variable	Estimate SE
Gender	-0.188 0.277
Age_2	0.714* 0.391
Age_3	(dropped)
$Career_2$	1.004 0.615
$Career_3$	1.283* 0.748
Motivation	0.44 0.33
Workload	-0.078 0.091
Self-efficacy	0.180 0.135
Communication Capability	0.164 0.161
SI	0.063 0.223
PS	0.077 0.137
Trust in HTA	0.133* 0.096
POC to HTA	0.082 0.131
Constant	-0.004 1.641
N	40
R^2	0.55
Adj R^2	0.35

***p<0.01; **p<0.05; *p<0.1

Table 5.15: Results of hierarchical regression of HTA contextualization (5)

Unlucky, in model 15 only two control variables and one construct, *trust in HTA* (b=0,133; p<0,01), seems to be significant and this result could suggest that EFA and the following definition of new constructs were not a good intervention.

As previously seen (cf. Model 10), we decide to apply also in this case the F test in order to discard some variables with respect to the behavior. With a high p-value (Prob>F=0.794), the null hypothesis is accepted and we could delete *social interaction, psychological safety* and *perceived organizational commitment to HTA*, among the distal variables, *workload* and *communication capabilities,* among the proximal variables. After this deletion, we made another regression with the remaining constructs. We obtained the following results.

Model		
	16	
Dependent variable	HTA Contextualization	
Variable	Estimate	SE
Gender	-0.323**	0.243
Age_2	0.599*	0.343
Age_3	(dropped)	
$Career_2$	0.893*	0.471
$Career_3$	1.072*	0.559
Motivation	0.523**	0.195
Self-efficacy	0.230**	0.109
Trust in HTA	0.157*	0.079
Constant	0.092	1.27
N	40	
R^2	0.51	
Adj R^2	0.403	

***p<0.01; **p<0.05; *p<0.1

Table 5.16: Results of regression of HTA contextualization after the F test (2)

The Model 16 present similar results of the Model 10. Despite the necessity of not consider some variables, also in this case, the same construct of Model 10 seems to be the more significant. Therefore, this time, we do not have the entire construct of *ability*, but only the part renamed *self-efficacy* (b=0,230; p<0,05). This result shows that the EFA was useful to understand what part of *ability* was correlated with the behavior. *Motivation* (b=0,523; p<0,05) and *trust in HTA* (b=0,157; p<0,1) are confirmed, as in the Model 10, for their good explanatory power.

Figure 5.5 shows the verified hypotheses obtained after the application of EFA through Model 11 to Model 15.

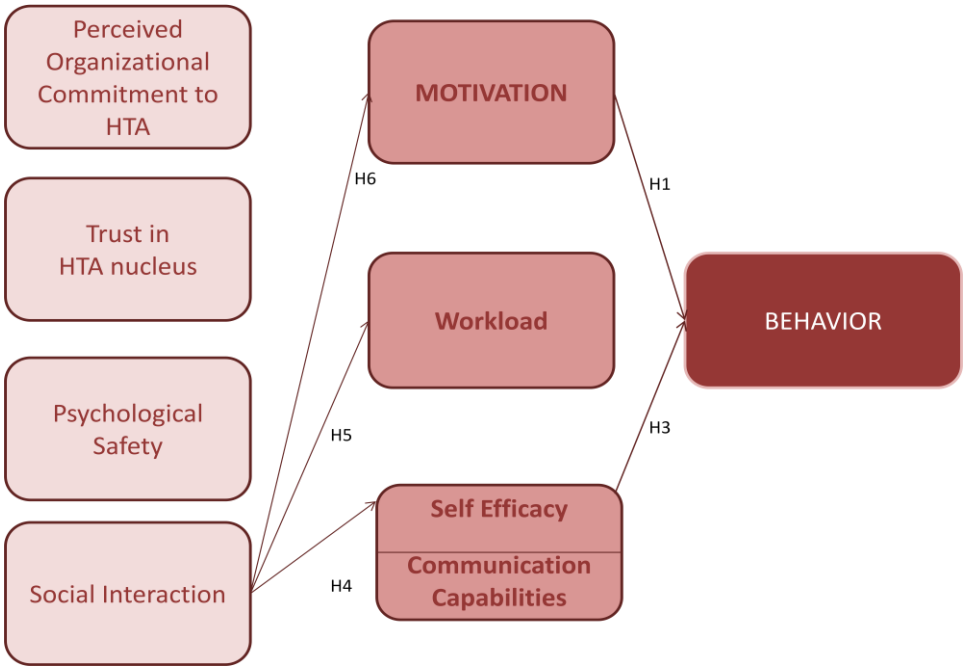

Figure 5.5: Graphical representation of the verified hypotheses (2)

At the end of hierarchical regressions, we made two tests on the results with STATA in order to observe if the hypothesis of the normality of errors is respected and to proof the absence of multicollinearity of the independent variables.

The first one is called Breusch-Pagan / Cook-Weisberg test for heteroscedasticity, in which hypothesis null indicates the presence of homoscedasticity that refers to the assumption that the variance of error terms is constant over the range of values of an independent variable (Hair, et al., 2010). Homoscedasticity is a good result because it means that the variance of standard error is constant for all observations, if this condition was not true it means that the model is not stationary when the independent variables change.

In the following table we resumed the results of the test for all regressions previous made. Only the Model 6 presents heteroscedasticity ($p< 0,1$).

	chi2(1)	Prob > chi2
Model 1	0.70	0.401
Model 2	2.48	0.115
Model 3	1.02	0.311
Model 4	0.87	0.350
Model 5	1.14	0.286
Model 6	2.97	0.085
Model 7	1.64	0.201
Model 8	0.29	0.593
Model 9	0.37	0.544
Model 10	0.58	0.445
Model 11	2.50	0.113
Model 12	0.56	0.454
Model 13	0.17	0.679
Model 14	0.62	0.432
Model 15	0.44	0.507
Model 16	0.5	0.479

Table 5.17: Test of heteroscedasticity

The last one, instead, measures if the model presents a multicollinearity. The presence of multicollinearity indicates that the estimated coefficients of regression are inaccurate and it means that the significance of the model is compromised because there are at least three independent variables which are correlated and share variance. It is estimated with the calculation of the Variance Inflation Factor (VIF) and if the VIF is greater than 5 then the independent variables are collinear.

We calculated the VIF after every regression and we found that the results of all independent variables are under five, the only problem is about control variables which present high values of the VIF. However, we expected this result because control variables are dummy and so it is reasonable think to existent of correlations between them.

6. Conclusion

6.1 Comments to results

Health technologies represent an essential component in health services provision since a greater availability of medical devices and their purchasing cost are assuming higher importance that requires a correct balance (Uphoff, et al., 1998). Since hospitals have to manage scarce resources and at the same time to provide high quality care to patients, HTA is recognized as the correct methodology to define an appropriate technology park. Indeed, HTA is a tool aimed at decision-making that ensure a complete evaluation of the properties and impacts of a health technology (Goodman, 2004). Literature review previously discussed, allowed us to define the general framework of HTA and its fields of application, in particular at the hospital level. Really, we found out that the process of assessment and acquisition of a new technology is related to the annual budget process. In this process, usually, three figures are involved: Clinical Engineering, Management Control Department and Head Doctor of a Clinical Department. In particular, Head Doctor is responsible of the technological equipment of his/her department. According to the first research question of this study, we identified Head Doctor accountable for proposals acquisition of new technologies, which are hence submitted both to Management Control Department and Clinical Engineering during the budget process. Literature review together with interviews to key figure committed to healthcare provision helped us to define the boundaries of the task accomplished by Head Doctor, defining it as the contextualization of a new technology in a specific environment, such as a Clinical Department of a hospital. Behavioral theories allowed us to frame the behavior of interest performed by Head Doctor in a model of attested reliability, such as MOA model. Then, in order to satisfy the second and the third research questions of our research that is to identify individual and organizational factors that support Head Doctor in his/her request, we realized our model on the basis of MOA theory and we tested it through an empirical survey submitted to ICP hospital company. Once again, the contributes of literature and interviews were useful to define the conceptual framework in which our empirical analysis lays. We provided a micro approach focused on the behavior of Head Doctor that contributes to the macro problem of resource rationing and appropriateness of technology park. This approach is coherent with the framework proposed by Coleman since the mere application of managerial levers would not be sufficient to obtain a suitable technology park. On the contrary, strategies addressed to the individual action of Head Doctors, directly involved in the proposal of new technologies, would allow to achieve tangible results. Hence, we developed our hypotheses defining a set of proximal variables, drawn from MOA model, explaining the individual level and a set

of distal variables related to organizational factors that represent the mechanisms through which managerial levers are applied to promote or hinder the individual action. The number of Head Doctors of the departments in ICP was of 63 physicians, of which 46 had participated to the survey. With respect to the typical response rate of the surveys developed in this sector, the rate we reached, 73%, is a very good result and we consider it as a success of our work. Perhaps, the approval and sustain obtained from General Direction and Health Direction of each hospital garrisons, thanks to Clinical Engineering and Control Management, contributed to reach an high response rate as we had.

For the most part of the survey, the reliability of the scales used were already proven in previous literature contribution, but there were some items added thanks to the contribute of the interviews with Head Doctors and others adapted from some constructs used for different behavior or situation unlike our concept of HTA contextualization. Calculating the Cronbach's alpha, we proved the reliability also of these items, demonstrating so that they well represented the means of construct. The obtained alpha were all over the lower limits of 0,7 (Nunnally, 1978), that suggested the confidence and validity of our questionnaire.

The missing data regarded mostly the construct of *trust in HTA nucleus*, that is because the existence of HTA committee for many Head Doctors is scarcely known. During an interview to a Head Doctor, it emerged that HTA and the presence of an HTA committee were not sufficiently publicized and so some doctors do not know how the process of HTA works and who is part of this committee. For this reason, his opinion is that there is lack of trust in people that participate to the evaluation of the purchase proposal and there is the need to have a transparent and standardized process of HTA, that should be shared and widespread through training courses which teach to conduct a correct and deepen assessment of the technology that the Head Doctor wants to introduce it. The presence of missing data in this construct is partly due to the recently change of General Direction, Administrative Direction and Health Direction and due to the recent union of the hospitals of Bassini and Città di Sesto SG, which became part of the ICP company since 2009. The previous Direction, that changed at the beginning of 2011, was careful and sensitive to the HTA concept and it begun to spread the importance of the assessment of health technology in order to have an appropriate technology park, meeting patient's needs, but also considering the objectives of the company, in an optic of long period. It introduced the importance of limiting the power of a single Head Doctor who requested technology without motivating it but only for his/her desire, starting to underline the need of considering the consequences of an acquisition in various aspects, from the impact on patients to the impact on organization, besides its economic impact. Even if the HTA concept was only at first stage of development and it needed to be spread as much as doctors need to increase their

knowledge about it and its advantages, HTA nucleus was more known in those hospitals that were parts of the ICP company beforehand than Bassini and Città di Sesto SG. In fact the integration between all hospitals has been still standing and it will be necessary to uniform the health system, the Information and Communication Technology and the service delivery to the general aims in order to create a sense of company's belonging.

The first step was to understand if the linkage between some constructs was reasonable, therefore we estimated their correlations with the use of a statistical analysis' program. The correlations emerged were the following:

- *motivation, social interaction* and *ability* resulted strong correlated with the behavior of HTA contextualization; there was also a correlation between the *trust in HTA nucleus* and the behavior but it was hardly under the lower limit that indicates the presence of a linkage;
- *social interaction* seemed to be the only distal antecedent correlated with a proximal antecedent, that is the *motivation.*

The correlations, however, presented only a first idea of connections between the variables. The real pattern emerged with the statistical analysis of hierarchical regression based on ordinary least square. Once we did the analysis, we decided to recall Head Doctors we met during the phase of survey's editing, in order to discuss the results with them. This confrontation permitted us to have a second opinion about some of the unpredictable results we obtained. Furthermore, the discussion based on the results allowed us to identify the underlying factors affecting HTA process, according to the second and the third research questions of our study.
Finally, results allowed us to consider if different kinds of technology cause significant variations on Head Doctor's behavior, meeting the fourth research question of our study.
In the following paragraph we presented an exhaustive discussion about research questions, based on empirical results obtained through the administered survey, and the succeeding managerial implications inferred by both the discussion and interviews with a representative sample of Head Doctors.

6.2 Discussion and Implications

R.Q. 1: How to model Head Doctor's behavior performing Health Technology Assessment?

The dependent variable, *HTA contextualization*, is the behavior we investigated. Its modeling is the result of a long process of information's acquisition. It was defined after a deepen literature review and thanks to the interviews we made, both the starting point in order to model the framework and

so the questionnaire. On the one hand, we considered the basic principles of HTA instrument, that recognize the impact on patient's life, technological, economic and organizational impact of the technology when it is introduced in an hospital; on the other hand, by the interviews with different professional figures, all involved in the same sector but with different tasks and positions, we collected the opinion on what these people considered that an evaluation should be. All of them recognized the same aspects that HTA underlines, so we had divided the general concept of contextualization of a technology inside a local reality in its fundamental components. In fact, it resumed all kinds of implications of the introduction of a technology (organizational, technological, economic and on patient's life impacts) that should be estimated by the Head Doctor. Once defined the principal components of the *behavior*, we moved on the determination of what effectively the impacts are, since in the assessment of the technology the Head Doctor has to find all important consequences of the technology's introduction within the hospital:

- the *patient's life impact* is evaluated as the change that technology causes on safety, clinical route and time spent by the patient inside the hospital;
- the *organizational impact* is estimated as the changes that technology has on the workload, the spaces' management and tasks;
- the *economic impact* considers the costs of acquisition and maintenance of the technology but also the cost of the necessary personnel and the relative training;
- the *technological impact* is intended as the transitory that the technology needs before arriving to steady state operation: the necessary time, the standardization process and learning curve.

Thanks to the dual contribution of literature and real case with the collaboration of ICP, we were able to model the behavior of Head Doctor and to frame it in a well-established social theory, that is MOA theory. We considered this model a successful element of our project since this exploratory approach allowed us first to set the behavior of the contextualization of a technology performed by a Head Doctor within a behavioral theory previously used for several different behaviors. Hence, we considered our study a first contribution in the field of hospital-based HTA in order to explore even other issues from a behavioral perspective.

R.Q. 2: What are the individual factors that affect Head Doctor's behavior?

R.Q. 3: What are the organizational levers that support or hinder Head Doctor's behavior?

The method we used to explain this behavior was the hierarchical regression because it permitted to us to understand the contribution to *HTA contextualization*, construct by construct and, in this way, we could see if the hypotheses were confirmed or not. The first regression was based only on the

control variables with the aim to discover if personal characteristics had influences on the behavior. The low coefficient of determination demonstrated that these variables, which were gender, age and years of work experience were found not significant in order to predict the behavior. Then we started with the introduction of one proximal antecedent at a time. The first one was the *motivation* and we found that it had a significant explanatory power (b=0.688, R^2=0.384), this result was consistent with our hypothesis 1, *Head Doctors' motivation to perform technology assessment positively affects their level of assessment.* The average response to the items of this construct is high enough to suppose to discard the idea that *motivation* is low. Head Doctors seems to be motivated to assess the technology thus the lack of commitment in assessing is not a problem of *motivation*. Nevertheless, a mean to increase the possible action of propaganda of the Direction could be to generate a strong message about the importance of technology assessment and its relatives advantages. If results and implications of doing an assessment would be evident for each doctor, probably there will be a greater awareness of its necessity and so a greater predisposition to perform the behavior than before. If the belief that a better assessment could increase the probability to obtain the technology is strong, a doctor could feel more motivated to make the evaluation. This assumption is put in crisis if the doctor believes that the assessment will not be useful for his/her intent to have the technology because the acceptance of the request follows other criteria, in this case the *motivation* will be low. Even the interviewed doctor considered the communication a means to increase individual motivation to assessment. It was opinion of another doctor that HTA instruments are a good methodology for all doctors to understand how a technology assessment should be, and if all the staff knows HTA principles, a purchasing proposal becomes a stimulating challenge because they could understand before critical aspects which could cause the rejection of a proposal. He also said that HTA could solve project's problems because doing the assessment of a technology with other people of Head Doctor's staff could make the evaluation more objective and get into the reality of the hospital. On the contrary, when Head Doctors made technology assessment by themselves, they had more personal or professional interest connected with the technology and so they could not be totally impartial and objective in their evaluation. By the interviews with Head Doctors, another aspect that could increase *motivation* was emerged, that is the bidirectional communication with Clinical Engineering and Control Management, respectively experts of technological aspects and economic considerations. They thought that the possibility to interact with them could facilitate the assessment because in this way it is possible a mutual confrontation receive support to make the evaluation.

Then, we estimated if the *opportunity* had explanatory power on the behavior. We found that the hypothesis 2 (*Head Doctors' level of opportunities related to technology assessment positively affects*

their level of assessment) was confirmed (b= 0,228; R^2= 0,155) even if less stronger than *motivation*. We attributed this result to some items of the construct concerned with the time available for doing the assessment. In fact, the general trend of the questionnaire's responses showed that the workload was not a limitation in conducting the assessment because that is perceived as one of the Head Doctors' task and the most part of them considered to have time to make it.

The last proximal antecedent of the behavior was *ability* and it resulted a powerful explanatory factor (b=0.607, R^2=0.348), so the hypothesis 3 (*Head Doctors' ability to perform technology assessment positively affects their level of assessment*) was confirmed. The result was influenced by the doctor's perception to be completely able to do the technology assessment and not to have lacks in this matter. We think that it is not completely true because of the information we collected before with the interviews with Management Control and with Clinical Engineering that explained how few Head Doctors send proposals of acquisition. Perhaps the erratic perception is due to the wrong opinion about what Head Doctor has to do in completing the purchasing proposal, maybe he/she does not know exactly what kind of information he/she needs to make the assessment and he/she reputes himself capable to present and explain why he/she wants the technology and for what the technology serves. This is brought back with the lacks of information and communication that convinces about the necessity of an evaluation. By the interviews, we had known that there was an attempt to spread the importance of HTA and to invite the doctors to participate, to join HTA nucleus and to interest in the HTA principles, but it was an attempt made by the previous Direction that tried to make the HTA as one of the company's priorities. Actually, the new Direction has not defined the priorities and the orientations yet and so we do not know if HTA process will be or not an important aspect. In the construct of the *ability*, the concept of the capability of Head Doctor to communicate and to explain to other people why he/she wants to obtain a new technology emerged as a strong attribute of the individual, but the capability to use corporate intranet in order to find useful information for the assessment did not seem to be explanatory. By the interviews, awareness of the existence of the intranet, and so the use of it, emerged as a big lack. The motive may be reportable to few information about it and few training courses that teach how and for what the doctor could use it. Also in this case, the presence of a feedback's system could help Head Doctors to improve and develop their own capabilities.

After testing this three hypotheses, we made a regression with all three antecedents and we found that *ability* and *motivation* confirmed their explanatory power in predicting the behavior, and the *opportunity* had not a not determinant role. With respect to the role of *opportunity*, we thought that problems are related to the instruments made available to Head Doctors by the Direction. About the use of the corporate intranet, the Direction should try to increase the perception of its utility by

sponsoring it, in fact Head Doctors do not know very well the instrument and its features and consider themselves capable to assess the technology searching the information they need in other way but if they fully understand the potential of the intranet they could save more time and complete their task. The opportunities offered by Direction could be better exploited if feedback about the request of acquisition of a technology return. Understanding why a request is refused permits to the Head Doctor to define his/her mistakes and lacks and so intervene consequently improving his/her own method of research of information and of compilation of the proposal. A feedback's system could improve the communication and bring to a climate of trust in the workplace, favoring the diffusion of HTA instrument. Even if the *opportunity* did not explain very much the behavior, this result suggested that our choice of MOA model was correct and the part of variance explained by the model was increased with the introduction of all constructs (R^2=0.4612). Moreover, this result give emphasis on factors related to the individual rather than those belonging to the hospital company, hold in the construct of *opportunity.*

Nevertheless, exploring factors related to the hospital, the following step was to introduce the distal antecedents and made the regression using as dependent variables the proximal antecedents. We made a regression for each proximal antecedent, using as independent variables distal antecedents we supposed in the hypotheses: *social interaction* (SI), *perceived organizational commitment to HTA* (POC), *psychological safety* (PS) and *trust in HTA nucleus* (TR). This analysis had the aim to evaluate what distal antecedents influenced each proximal variable. For the first regression we used *motivation* as dependent variable and we saw that hypothesis 6 of SI (*social interaction positively affects Head Doctors' motivation to assess a technology*) was confirmed (b=0.525, R^2=0.613) and that the hypothesis 7 of POC (*perceived organizational commitment to HTA positively affects Head Doctors' motivation to assess a technology*), hypothesis 9 of TR (*trust to HTA nucleus positively affects Head Doctors' motivation to assess a technology*) and hypothesis 10 of PS (*a lower degree of psychological safety positively affects Head Doctors' motivation to assess a technology*) were not verified. SI was considered as a very important aspect that motivates the Head Doctor to perform the behavior, since the interaction with colleagues and other people supports the assessment, thanks to the possibilities of find information and have a confrontation about the technology. This simplifies the task and the interaction is seen as an incentive to knowledge sharing. By the interviews, we understood that the interaction is more developed with colleagues and the other member of the staff of the doctor but there is a lack of interaction with the high level of company's hierarchy. Maybe, this last problem could be caused by a lack of trust on their competences because Head Doctors have clinical skills, while members of company's high level have skills on economic and organizational matters, and so the difference in their perspective skills creates a difficulty in

communications and expectations. This aspect should be improved and a communication with the top management should be incentivized in order to better understand the mutual needs.

On the contrary, PS seems to be not important in the explanation of the *motivation* to HTA contextualization. This is an unexpected result because, if a doctor who makes an assessment feels himself/herself safe by potential repercussions due to a wrong evaluation of technology, it suggests that he/she will be more motivated to contextualize the technology. The fear to wrong an assessment should not be a problem because there are different competences and if a Head Doctor has problems in doing it he/she could be helped by Clinical Engineering or Control Management or other kind of professional figures to complete his/her request and so he/she should feel himself/herself always supported and safe. If a doctor thinks to be safe in doing the assessment, he/she does not think to be penalized, but this aspect is also connected with the trust in people who evaluate his/her proposal and with the existence of a codified and ruled process, in fact when a standardized process of assessment of the purchasing proposal exists a doctor feels safe because the final decision will not be under arbitrary or subjective wish or opinion of the decision-maker but it follows steps that have the aim to determine the necessitate and the feasibility of the proposal in the specific context. The absence of explanatory power of PS suggested a real and complete faith of Head Doctors in their own competences and that the rejection of a proposal generally is due to a lack of available resources to purchase it or a decision to purchase another technology because it satisfies a more important priority, but not due to their own mistakes in compiling the proposal.

An unpredictable result was about *trust in HTA nucleus*, in fact we supposed that trust in the committee responsible to assess the purchasing proposal made by the Head Doctors could be a relevant aspect in the motivation towards HTA contextualization. The reason was that if a doctor believes in skills and competences of who evaluates his/her proposal, he/she is more intentioned to perform the behavior because he/she knows that the response about his/her proposal, negative or positive whatever it will be, is based on opportune motives. The absence of TR is due to a lack of awareness of the existence of an HTA committee: new hospitals entered as a part of ICP company do not know it and for this reason it is correct thinking that the Direction should increase the participation to HTA activities and publicize it with opportune information campaign. In fact, the communication and information seem to be the most problematic aspect that the Direction should treat and solve. Currently, the existence of HTA nucleus is known only by who presents a proposal or by who, when the possibility to enter in the nucleus was offered, decided to adhere to it. Indeed, again, a standardized process of HTA should be create in order to be known and shared by all human resource. In fact, another problem, is the perception that the HTA nucleus is a further obstacle and filter to pass in order to see the proposal accepted.

The last unverified hypothesis is about POC. We hypothesized that if Head Doctor perceives the company's commitment in favoring the adoption of the behavior, he/she would be more motivated to perform it. The problems connected with its not significance are the same we explained before for the other hypothesis not confirmed: even if previous Direction was dedicated to HTA issues, poor communication did not allow the perception of Head Doctors of a real and intensive commitment of the company in the matter of HTA and so it is not considered a factor that could act, also indirectly, on the behavior.

Then, we tested distal antecedents using *opportunity* as the dependent variable. The regression showed the confirmation of the hypothesis 5 (b=0.504, R^2=0.435) of SI (s*ocial interaction positively affects Head Doctors' opportunity to assess a technology*) and the hypothesis 8 (b=0.241, R^2=0.435) of POC (p*erceived organizational commitment to HTA positively affects Head Doctors' opportunity to assess a technology*). The possibility of interaction with other people, inside and outside of hospital, seems to increase the degree of the *opportunity* and so to simplify the Head Doctor's task to assess the technology because the possibility of confrontation would facilitate the identification of the critical aspects related to a specific technology, favoring in this way a deepen consideration about the feasibility of its application in the local context. A high degree in Head Doctor's perception that hospital is committed to HTA is translated in a growth of internal factors that promote technology assessment.

The last variable used as dependent in the regression was the *ability*. In this case, we tested only the hypothesis 6 of SI (*social interaction positively affects Head Doctors' motivation to assess a technology*), and it was confirmed (b=0.262, R^2=0.306). We supposed that an increasing interaction with other people, also of different skills, could have a positive effect on the individual competences of a Head Doctor because skills and competences could be developed with the time. The interaction could generate the possibility to see other perspectives and approaches to the same matter and so the doctor could improve his/her capability to assess a technology, in a more complete way in respect to what he/she did before, and could be more careful to the needs in progress.

After the regression on proximal antecedents, we desired to see how all variables together, proximal and distal antecedents, were related to the behavior. As we expected, distal antecedents had not significant explanatory power directly on behavior. Among the proximal antecedents, only the *ability* had impact on the HTA contextualization. In addition, we decided to apply the F test in order to see whether we could delete several variables from the regression combined with all constructs, in order to keep only that have impact on behavior. After this test, between distal variables, we preserved only *trust in HTA* and, between proximal variables, we discarded *opportunity*. We tested the remaining constructs, obtaining a model which parameters are positive and with good explanatory

power. The hypothesis about *motivation* (b=0,436; R^2=0.539)and *ability* (b=0,458; p<0,05) are confirmed and *trust in HTA nucleus* (b=0,163; p<0,05) emerges as a variable that has a direct effect on behavior and not mediated by proximal antecedents.

Observing the correlations between the variables with respect to the behavior, we noticed that we could try to divide the constructs of *ability* and *opportunity* and to explore how their parts could individually contribute to explain the behavior. We think that the items of the original constructs were well posed and representative of the aspects we investigated, but we considered interesting also a deepen analysis of them. For doing it, we used the method of Exploratory Factors Analysis (EFA), that permit to find new factors starting by the originals. Beginning with the *opportunity*, the Principal Components Analysis (PCA) permitted us to obtain three new factors that we renamed according to the meaning of the items included:

- *Workload*, that contains the items referred to the time necessary to spend for doing the assessment and the time available during the work hours to dedicate to the evaluation and the workload;
- *Intranet*, that contains the items dealing on the access to information in the corporate intranet;
- *Budget Form*, that refers to the questions related to the compilation of the budget form of the hospital.

Again with the method of Cronbach's alpha, we tested these new constructs and we proved the reliability of *workload* and *intranet*, so for the next analysis we discarded the *budget form*. During the interviews, the intranet is appeared as an instrument of low interest dot the doctors. It is not considered a mean with which they could find useful information about the technology assessment, in fact many of them do not know even its existence. Because of this, we decided to proceed with the analysis only with the construct of *workload.*

As with the *opportunity*, we used the same method with the *ability* and in this case we found the following new factors:

- *Self efficacy*, that refers to the capabilities of the doctor to evaluate the technology and its impacts;
- *Communication capabilities*, that refers to the doctor's capabilities to explain to people of different level why to adopt a specific technology;
- *Self-confidence*, that refers to the doctor's trust in his/her own capabilities.

In this case, we proved the reliability of all these constructs, but we decided to discard the component of *self-confidence* after calculating the new correlations between all the variables.

After this operation, we inserted them in the hierarchical regression, in order to study any possible difference with the original model.

The first regression was complete of all proximal antecedents, the old unchanged antecedent of *motivation* plus the new factors found after the EFA. *Motivation* (b=0.545, R^2=0.449) and *self-efficacy* (b=0.198, R^2=0.449), with different levels of p-value, appeared the only significant constructs in the explanation of the HTA contextualization. Respect to the original complete regression, we found again that *motivation* and *ability* are the significant factors, but in this case we saw that the part of the ability related to *communication capability* have not explanatory power. This result is not negative because we considers that the capability to well communicate what and why the doctor wants to obtain the technology is an aspect important because it demonstrates the capability to interact with the other people, but it is not determinant in relation with the behavior.

After the complete regression, we tested also the linkages between distal antecedents (using the same hypotheses tested for the original model) and the proximal antecedents considering *self-efficacy*, *communication capability* and *workload* instead of, respectively, *ability* (for the first two) and *opportunity*.

In the first regression, we used *workload* as dependent variable, and we found that the hypothesis related to the SI was verified, but we lost the explanatory power of POC. The connection between SI and *workload* seems to be consistent (b=0.691, R^2=0.302) because interaction with other people has the effect to reduce the time to spend for the assessment, simplifying it. Instead, the POC does not seem to have effect on *workload*, this is probably due to the fact that the orientation toward HTA of the company does not diminish or increase and neither influence the time necessary for the assessment.

The following regression used *self-efficacy* as dependent variable and we tested the same distal antecedent used before for the *ability*, that is *social interaction*. The hypothesis was confirmed (b=0.395, R^2=0.328).The reason is the positive effect of the interaction with other people, having different skills, on the competences of the doctor, hence the interaction constitutes an opportunity of personal growth.

The last regression on distal antecedents was done with respect to the other factor obtained from the *ability*, *communication capability*, and so we tested again the SI. In this case, the distal antecedent resulted not significant. The possible reason is that the interaction is not a determinant factor affecting doctor's capability to communicate because it is a competence already acquired thanks to the long experience of the Head Doctor with the continuous contact with other people, both patients and colleagues, for reasons different from the HTA.

After these analyses, the last operation to do was the test of all together antecedents, distal and proximal, using the *HTA contextualization* as dependent variable, but the results showed that there were not variables with significant explanatory power. This demonstrated that the last regression before the Exploratory Factor Analysis explains better the adoption of the behavior than the modified model. Also in this case, we applied the F test in order to delete constructs that make weak the model. As in the previous case, we deleted PS, POC and SI among distal variables and also two of the new constructs obtained with PCA, *communication capability* and *workload*. In particular, with respect to the drop of *communication capability*, this result is positive because the mere ability to explain why the Head Doctor wants to acquire a new technology should not be a determinant factor in deciding to perform or not perform technology assessment. Also the deletion of *workload* was not a problem because a Head Doctor should assess the technology independently from his/her available time, since the evaluation is one of his/her task. So the last regression was made on *motivation*, *self-efficacy* and *trust in HT nucleus*, and obviously with control variables. The results are good (R_2=0.51): *self-efficacy* (b=0,230; p<0,05), *motivation* (b=0,523; p<0,05) and *trust in HTA* (b=0,157; p<0,1) show the similarity of the results with the regression after F test made for the original variables. Here, the difference is that the ability was divided thanks to the EFA and so we discovered that only a part of it is significant in the prediction of the behavior. The component is related to the individual capability and skills in assessing the technology, that is *self-efficacy*.

R.Q. 4: How results change among different technologies?

Among control variables included in the questionnaire, type of technology acquired and impacts of technology acquired were not included in hierarchical regression due to the high number of missing data. Nevertheless, according to the fourth research question, we decided to verify if a relation exists between these variables and the behavior. First of all we noticed that Head Doctors mostly require technologies for substitution of obsolete devices. In this case the value associated to the behavior are in line with the mean of the construct. On the contrary, doctors who evaluate a technology in order to expand activities of their Clinical Department or technologies new for the hospital company are in general more committed to technology assessment. This result is intuitive since an upgrade of an obsolete technology requires less effort in assessment with respect to evaluate a brand-new equipment. Anyway, in both cases advantages for patients is the main issue considered in the assessment process. Considerations about costs of the acquisition and organizational impacts are equally considered by Head Doctors during the evaluation of the technology suggested for the purchase. Implications about transient period are considered harder to assess and, for this reason, Head Doctors assigned lower values to that question. Considering impacts

of technology, those organizational are prevailing with respect to economic factors. This result was quite unexpected since we understand from interviews with Head Doctors that usually they perceived stress on costs as a constraining factor for their choice. However, results from the survey suggests that, apparently, the most part of Head Doctor is all the same committed to organizational aspects. Furthermore, thanks to the last question of the survey, we were able to identify what Head Doctors intend with the general term of health technology, choosing among equipment, device, drugs, organizational procedures and services. We inferred that equipment, devices and organizational procedures are the main elements that characterize purchases for each Clinical Department. Drugs and services are less requested technologies even if they are not attributable only to certain Departments but they are transversal to different area within hospital garrisons.

Implications

Previous results allowed us to finally propose some implications about strategic interventions that the board of the hospital can carry out in order to support Head Doctor accomplishing his/her task. First of all, results suggested a preeminence of individual factors among the variables that explain the behavior of Head Doctors. As witnessed by hierarchical analysis the attitude of doctors toward technology assessment and their ability and skills have a pivotal role which is dominant with respect to those factors that characterized hospital company. In particular aspects, such as workload, the availability of a corporate intranet and the appropriate budget form for the request of a new technology, have no impacts on the behavior. In the first case, the result is positive since technology assessment is a formalized task of Head Doctors, so lack of time and excessive engagement are not reasonable justifications to not apply in that activity. On the contrary, the lack of interest towards instruments such as corporate intranet and a poor perceived usefulness of budget form arouse concern since both were expected to ease doctors' task. Moreover among those factors typical of the context of our analysis, we found *social interaction* and *perceived organizational commitme*nt to HTA accounting for the most part of variance of proximal variables. In agreement with those results, we suggested to Direction to reconsider the communication toward Head Doctors about HTA in order to involve them in the process. A better communication would allow a greatest spread of issue such as technology assessment among all hospital garrisons since we found that two out of four were recently annexed to ICP and they are scarcely aligned to the processes of the hospital company yet. Furthermore communication and, as a consequence, social interaction, should be stimulated in every directions, that is horizontal to facilitate exchanges among same professional levels and vertical to promote knowledge sharing between doctors and managerial levels. A greater degree of social interaction among hospital company would probably enhance a better climate and perception of

values shared in the company. Among them, HTA could be sponsored as one of the leading methodology that would allow positive effect on all Clinical Departments arousing Head Doctors that, currently, are discouraged about the limited economic resources. This negative perception does not foster the development of a well-established and grasped HTA process. As a result Head Doctors show little interest that has repercussions also in the knowledge of HTA nucleus, as witnessed by results of the survey. A feedback mechanism could on the one hand favor the knowledge of HTA process to Head Doctors that might comprehend also the reason of a possible rejection of their proposals; on the other hand it would also guarantee a traceability of results and a collection of evidence useful to increase knowledge overall the company.

6.3 Limitations

Our research presents some limitations that will be overcome in further studies.

The first of them is related to the dimension of sample. We decided to administer the questionnaire to only one high specialized public hospital company in Milan, the Clinical Institutes of Improvement (ICP, Istituti Clinici di Perfezionamento). The Head Doctors of ICP company are 63, and, even if we have succeeded in collecting a high number of questionnaires (46), the only statistical method of data analysis we could use with a low number of respondents was the least-squared regression. The largest sample is, the higher is the robustness of obtained results and the greater is the possibility of using others statistical methods. This study was a first attempt to establish a framework adapt to explain the behavior of HTA contextualization and a survey that catches all significant aspects connected with this behavior.

Another limit necessary to underline is the structural complexity of the company chosen for the study, in fact, ICP is a company formed by four very different hospitals garrisons which became part of it in different years, so there is an intensive heterogeneity in the company.

In further research, it will be useful to amplify the boarders of the sample to other hospitals, and to collect data from many hospitals in order to have results linked to a provincial or regional level. In this way, it will possible to depict a complete picture of how HTA contextualization is developed as a practice in the several zones of Italy in order to understand where the diffusion of the HTA instruments should be increased.

An aspect that will be interesting to investigate is the difference between private and public company. We treated of a public company with the difficulty related to access to public investments and founds. The private sector has different way to get funding and so it has generally more economic availability than the public sector, but another characteristic is that a private hospital often has priorities different from a public one, that could regard the prestige and the image of the hospital

more than the possibility of guarantee medical care to everyone. This aspect could be traduced in the choice of a technology that could improve the image of the company, attracting new human capital or patients, even if the investment could not be the better one or convenient in front of other alternatives. The reason is the difference between the objectives of private companies respect to public companies, and that produces different purchase strategies, that often do not consider the necessitate or the convenience of the technology as a base for the choice. In the end, HTA process is more useful in the public sector that really could reach positive results, but for having a more complete picture of how HTA is considered, a similar research extended to private hospitals could be interesting.

As we said before, our intent was to develop a first explorative analysis about a behavior not yet investigated, so we decided to focus on the Head Doctor who decide to assess or not assess a technology. We did not provide information about how the evaluation is made, so we did not check on a qualitative dimension. Nevertheless, we consider that studies on the quality of Head Doctor's assessment could give a positive contribute to his/her task and for this reason we suggest to try to study this aspect in order to give information to Head Doctors on how they have to conduct an assessment well done.

Despite these limitations, the thesis presents a well structured model able to identify prevailing variables that affect hospital-based HTA process. Furthermore, results demonstrate how individual factors are at the bottom of the success of HTA initiatives.

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Annex

A. ICP Case Study

ICP (Istituti Clinici di Perfezionamento), is a high specialized public hospital company of national relevance located in Milan. It also collaborates with the University of Milan. The relevance of this hospital company comes from its three types of complexity:

- *Organizational*: it comprehends four hospital garrisons (Bassini, Buzzi, CTO and Sesto S.G.) and the group practices network in a wide geographical area densely populated;
- *Clinical*: it offers several high skilled health services both in hospital and outpatient;
- *Managerial*: it integrates many clinical, academic and geographical problems related to each hospital garrison that has different cultural, managerial and organizational background.

Therefore, the mission of the company ground its basis on:

- To guarantee both high skilled services and academic activities and research, with particular regard to pediatrics, orthopedics, rehabilitation and neurology;
- To guarantee high performances also for all others specialties in order to provide its services for the Nord area of Milan with its 300.000 users;
- To guarantee high specialized outpatient services for the City and the Nord area of Milan;
- To assure specialized training and research development in collaboration with the University of Milan.

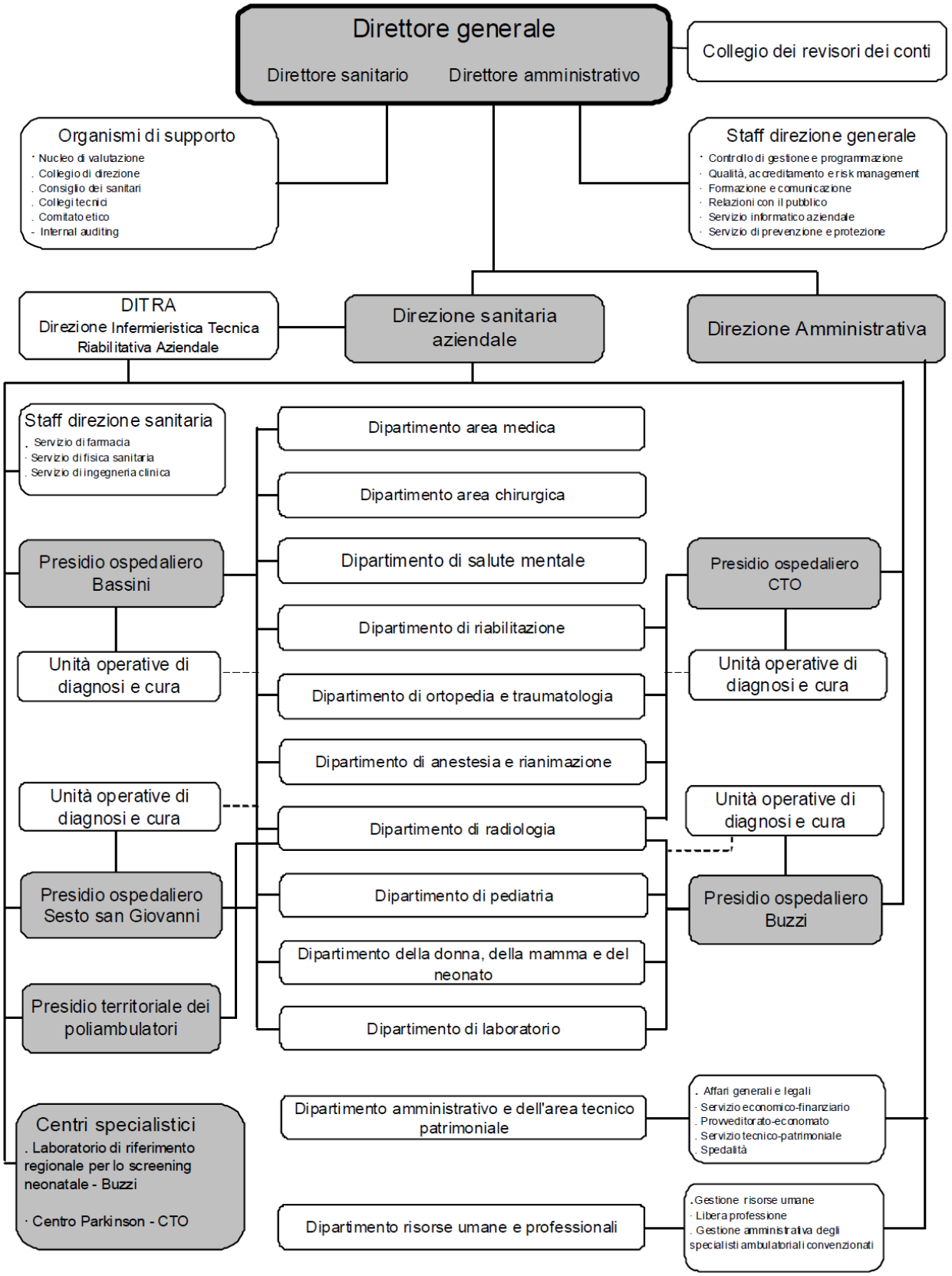
In order to accomplish to its mission and to support its development and innovation, the company commits itself with all its available resources in order to follow effectively the following directions:

- To promote the quality and the safety of treatments, with regard to professional aspects;
- To support the sharing of clinical and managerial *know-how*;
- To rationalize the use of resources, also enhancing the professional qualification and the contribute of every person;
- To promote innovation and to encourage a customer-oriented policy in all hospital garrisons, including group practices;
- To guarantee care continuity, developing means of integration both intra-company and with external institutions;
- To collaborate for the integration between health services and social-care services in the area of Milan and neighboring municipalities.

The boundaries of ICP have changed since its foundation till to define the present institutional structure of the company. By the time of its foundation, ICP comprehended several academic structures (Mangiagalli, De Marchi, Clinica del Lavoro, Odontostomatologia) to which afterwards hospital companies as CTO, Buzzi and Regina Elena were included. In 2005, the hospital garrisons of Mangiagalli, De Marchi, Regina Elena, Commenda e Medicina del Lavoro were hived off and assigned to Fondazione IRCCS Ospedale Maggiore -Policlinico. In 2006, ICP assumed the administration of all specialized treatments for all the City of Milan. In 2009, the hospital company has further redefine its boundaries merging two peripheral hospitals, Bassini of Cinisello Balsamo and the hospital of Sesto San Giovanni, then it transferred the dental clinic Commenda to Fondazione IRCCS Ospedale Maggiore - Policlinico.

We briefly reported some important highlights update on 2009 that characterize the dimension and complexity of the hospital company. Ordinary hospital bed are 908 and 121 day-bed. Employees are 3.100 in addition to 350 outpatient specialists, it gets a 300 millions of Euro. Every year 34.800 ordinary hospitalizations and 11.900 day-hospital , with over 5.000 birth. Furthermore, it provides over 4.700.000 high specialized services with hospital garrisons and the group practices network. Surgery room are 18 for a total of over 18.000 operations.

The figure below shows the organization chart.



Given that ICP is a high specialized hospital company, also linked to the University, refurbishment, management and maintenance of technology park is one of the key objectives of the company. Every

year, a purchase plan of new technologies is drawn according to efficacy, efficiency and cost criteria. Other initiatives, such as HTA, are set up in order to promote a rational and efficient use of existent technologies, together with the spread of multidisciplinary guidelines based on the best scientific evidence. Finally, testing, maintenance and management procedures are defined, turning also to specialized external suppliers.

General, Health and Administrative Directions changed at the beginning of 2011. With the previous management board, initiatives such as HTA were highly sponsored and promoted among professionals. In particular Clinical Engineering, annexed to Health Direction Staff, and Management Control Department were two figures involved in the application of that methodology, since on the one hand Clinical Engineering has the responsibility of all health technologies and medical devices within the hospital, and, on the other hand, the purchasing plan is part of the annual budget arranged and drawn by Management Control.

We started our collaboration with ICP since its long tradition of training and culture on HTA issue made it a proper context in which to build our research. The first interview made with Clinical Engineering and Management Control confirmed our hypotheses since we recognized a high commitment and inclination toward the issues of innovation and technology assessment. Although the new Directions have not yet expressed a formal line about HTA, the Head of Clinical Engineering and the Head of Management Control expressed a favorable assent toward our research. The manifested high degree of knowledge about HTA helped us to define the boundaries of our research and, also, to point out several aspects of our study, such as the focus of the analysis and the interpretation of the results, besides the administration of the survey to all Head Doctors of Clinical Departments of the four hospital garrisons. In particular, we decided to focus our attention on the behavior of the single Head Doctor since the main concern of both Clinical Engineering and Management Control was the poor commitment of Head Doctors in technology assessment, confirmed by low participation to HTA related initiatives and discussion, such as the adhesion to HTA nucleus for the multidisciplinary evaluation of all the acquisition requests submitted by Head Doctors, and the inadequate quality of the filled form for technology assessment submitted in the budget process. Exploring this issue with Clinical Engineering, Management Control and a sample of four Head Doctors, we defined the multifaceted approach that proponents have to consider in order to submit their request of acquisition of new technologies. In fact, each proponent has to support his/her request with scientific evidence, filling in a request form which take into account four complementary perspectives: the patient, the organization, the transient period and the costs. All requests are subsequently reviewed by a specific committee, called HTA nucleus, composed by

persons belonging to different disciplines in order to evaluate each one for his/her competence all the aspects referred to the new technology proposed for the adoption. Finally, the HTA nucleus expresses its final judgment accepting or rejecting the request of acquisition. As previously said, technology assessment is a process that interfaces with the process of budget. In the following paragraph we described it in order to frame HTA at hospital level within the context of ICP.

The budget process represents the current method to manage the hospital company. A set of objectives to achieve is given to each Business Unit (managerial, technical or clinical) and the Head of BU is the responsible of the success. Every year the top management identifies business directions related to level of healthcare, quality of treatments, managerial and organizational innovations, investments, costs, revenues and it proposes a comprehensive budget. This suggested budget is submitted and negotiated with the Manager of Business Departments and Head Doctor of Clinical Departments in order to promote the coordination in resources employment and the coherence of actions to achieve the objectives. The objectives are structured in three area:

1. *Level of healthcare provided*: performance indicators for this area are based on revenue and costs. In particular, they are: outpatient production value, hospitalization production value, direct costs (excluding human resources costs), health costs/1000€ of production value, internal treatments/1000€ of production value. For each performance indicator the minimum value to reach is 90% with respect to the agreed value.
2. *Appropriateness and quality*: it indicates the adherence to requirements for institutional accreditation, with regard to the fulfillment of medical records and discharge letter. With respect to quality objectives, performance indicators are the respect of wait period, the adhesion to projects about quality and clinical risk management, the respect of regional projects.
3. *Overall company performance*: each BU contributes to reach company objectives according to regional interests and it engage itself for the prompt and correct dispatch of healthcare information flows.

With respect to the acquisition of new technologies, that represent an investment, the purchase requests are often due to the technical/functional obsolescence or to the absence of spare parts. In this case, usually, the device is replaced with the latest version of the same medical product. This process does not require a specific technology assessment. Since to promote innovation is one of the goal of ICP, new technologies are more and more requested. Generally, the requests come from Head Doctor of Clinical Department who can put forward two types of proposal: on the one hand the acquisition of a new technology already applied in other context but never used in ICP, on the other

hand he/she could be interested in the adoption of a brand-new technology to experiment it in his/her context. In both cases this kind of proposal requires the implementation of the HTA process that implies both the engagement of the proponent motivating his/her request and the activation of HTA nucleus in order to evaluate the request. HTA nucleus evaluate the request of acquisition based on the alignment with the company strategy with respect to the need to increase or extend the activity for the applicant Clinical Department. In fact, an increase or an expansion of the activity for the Clinical Department presuppose an overhaul that affect organizational and economical aspects, beside the impacts on patients. Those aspects, together with an estimation of the effects on the transient period between the adoption of the new technology and its top functioning, are all considered in the request form that Head Doctor has to compile and a final priority from 1 (high) to 4 (low) is given to each proposed technology. The accepted requests are collected by Clinical Engineering usually in November and that with higher priority are included in the purchasing plan.

When the budget is finally accepted by all Managers of Business Departments and all Head Doctors of Clinical Departments, they can supervise their monthly results in terms of performance indicators through the corporate intranet. With a secure and customized access, each Head Doctor is able to monitor the performances of his/her Clinical Departments in order to correct promptly his/her action and achieve the agreed objectives in the annual budget. The reported results are consolidated and uploaded by Management Control which also creates different views and reports of data. Aggregated results of each hospital garrisons are available only to the Direction of each garrison that is able to spread them with its Managers and its Head Doctors.

The most critical aspects of budget process are related to the low employment of the intranet by Managers and Head Doctors. In fact, with the tool provided by Management Control, they should be able to notice possible gap with respect to the budget and they could revise their objectives with the Management Control and the Direction during the year. Furthermore, with respect to new technologies, recently budget cuts hardly allow obsolescence replacement, so it becomes difficult for a Head Doctor to propose new acquisitions.

B. Survey

PROGETTO DI RICERCA COLLABORATIVA
POLITECNICO DI MILANO - ICP

Il presente progetto di ricerca – promosso e condotto dal Dipartimento di Ingegneria Gestionale (DIG) del Politecnico di Milano – ha finalità scientifiche e non ha ricevuto alcun finanziamento né da parte degli ICP né da parte di altri soggetti pubblici e privati.

Precisiamo che il progetto di ricerca ha ricevuto il benestare sia della Direzione Aziendale sia delle quattro Direzioni Sanitarie di Presidio.

Le Sue risposte al questionario che segue sono confidenziali e pertanto saranno trattate solamente dai membri del gruppo di lavoro, che li elaborerà in forma aggregata.

La preghiamo cortesemente di rispondere a tutte le domande, limitando per quanto possibile l'utilizzo della risposta "*Non so*". La ragione è che i questionari compilati parzialmente potrebbero non essere utilizzabili per le analisi statistiche, riducendo così la significatività dei risultati.
Grazie per la gentile collaborazione.

TEMPO STIMATO PER LA COMPILAZIONE = 15 MINUTI

ISTRUZIONI

Il questionario è strutturato in 2 sezioni. La sezione 1 è relativa ai costrutti del modello di ricerca, mentre la sezione 2 è relativa a informazioni generali sul rispondente. La sezione 1 prevede risposte su una scala da 1 a 7, dove [1] indica il completo disaccordo con la affermazione enunciata, mentre [7] indica il completo accordo con l'affermazione enunciata. Di seguito è riportata la scala utilizzata.

1	2	3	4	5	6	7	*Non so*
In completo disaccordo	Molto in disaccordo	Abbastanza in disaccordo	**Indifferente**	Abbastanza d'accordo	Molto d'accordo	**In completo accordo**	

La invitiamo ad assegnare a ciascuna affermazione il punteggio che meglio esprime il Suo livello di accordo. Qualora ritenga di non essere in grado di esprimere un'opinione sull'affermazione riportata utilizzi la casella "*Non so*".

Cordialmente La ringraziamo per il Suo contributo alla nostra ricerca.

Emanuele Lettieri, Nicola Spiller, Giovanni Radaelli, Lia Paola Fumagalli, Simona Solvi

SEZIONE 1

Le affermazioni seguenti fanno riferimento all'introduzione di una nuova tecnologia nell'unità operativa. Il termine **tecnologia** è utilizzato in senso ampio e include **apparecchiature, dispositivi, procedure organizzative, farmaci e prestazioni di nuova introduzione**. Il concetto di **nuova** tecnologia fa riferimento a una tecnologia già presente nel mercato, ma **nuova per gli ICP**.

	In completo disaccordo						*In completo accordo*	
	1	2	3	4	5	6	7	Non so
1. Ritengo che la stima delle **implicazioni organizzative** (es. spazi, mansioni, carichi di lavoro) provocate dall'introduzione di una nuova tecnologia sia compito:								
- della Direzione Sanitaria								
- dell'Ingegneria Clinica								
- dei Responsabili di Unità Operativa								
2. Credo che la stima dei **costi** (d'acquisto, di mantenimento, del personale, di formazione) connessi all'introduzione di una nuova tecnologia sia compito:								
- della Direzione Sanitaria								
- dell'Ingegneria Clinica								
- dei Responsabili di Unità Operativa								
3. Reputo che la stima degli impatti che la nuova tecnologia avrà sulla **gestione del paziente** (es. percorso, sicurezza, orari) sia compito:								
- della Direzione Sanitaria								
- dell'Ingegneria Clinica								
- dei Responsabili di Unità Operativa								
4. Penso che la **stima del transitorio** (es. tempi per andare a regime, curve di apprendimento, progressiva standardizzazione) sia compito:								
- della Direzione Sanitaria								
- dell'Ingegneria Clinica								
- dei Responsabili di Unità Operativa								

	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Ritengo che se valuto correttamente le nuove tecnologie, le probabilità che la mia richiesta di acquisto venga accettata aumentino								
2. Sono fortemente intenzionato a valutare le nuove tecnologie che intendo proporre per l'acquisto								
3. Sono motivato a valutare adeguatamente le nuove tecnologie per il prestigio personale che ne otterrei								
4. Ogni volta che propongo una nuova tecnologia, mi sforzo di valutare gli impatti che essa produce								
5. **NON** ho forti motivazioni a dedicare del tempo alla valutazione dell'introduzione di nuove tecnologie								
6. Cercherò di valutare l'introduzione di nuove tecnologie in maniera efficace								
7. I vantaggi che l'**azienda ICP** otterrebbe da una valutazione corretta delle nuove tecnologie sono per me un forte stimolo								
8. I vantaggi che il **Presidio** otterrebbe da una valutazione corretta delle nuove tecnologie sono per me un forte stimolo								
9. I vantaggi che la mia **Unità Operativa** otterrebbe da una valutazione corretta delle nuove tecnologie sono per me un forte stimolo								
10. I vantaggi che il **paziente** otterrebbe da una valutazione corretta delle nuove tecnologie sono per me un forte stimolo								

	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Il mio carico di lavoro **NON** mi permette di valutare efficacemente le nuove tecnologie								
2. Durante l'orario di lavoro, ho diversi momenti in cui posso valutare le nuove tecnologie								
3. La **scheda di budget** indica molto precisamente le informazioni utili per la valutazione di una nuova tecnologia								
4. Ritengo di avere sufficiente tempo a disposizione per valutare efficacemente le nuove tecnologie								
5. Le **istruzioni operative** per la compilazione della scheda di budget **NON** mi supportano sufficientemente nella valutazione di una nuova tecnologia								
6. All'interno della **intranet aziendale** trovo una serie di informazioni utili per la valutazione di una nuova tecnologia								
7. La modalità di attivazione del Comitato di HTA è facilmente accessibile tramite intranet aziendale								

	In completo Disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Ritengo di essere capace di effettuare la valutazione per l'introduzione di una nuova tecnologia								
2. Spesso trovo **DIFFICOLTOSO** stimare gli impatti che una nuova tecnologia avrà sulla mia Unità Operativa								
3. Mi fido molto delle mie capacità di utilizzare la **intranet** aziendale per la valutazione dell'introduzione di una nuova tecnologia								
4. Mi fido molto delle mie capacità di utilizzare la **scheda di budget** per la valutazione dell'introduzione di una nuova tecnologia								
5. Ritengo che sia relativamente facile stimare gli impatti che la nuova tecnologia avrà sui pazienti								
6. Sono in grado di svolgere la valutazione dell'introduzione di una nuova tecnologia in piena autonomia								
7. Spesso la bocciatura di una mia proposta è dipesa da miei errori nella valutazione della nuova tecnologia								
8. Sono capace di spiegare ai **colleghi medici** il perché voglio introdurre una nuova tecnologia								
9. Sono capace di spiegare al **Comitato di HTA** il perché voglio introdurre una nuova tecnologia								
10. Sono capace di spiegare alla **Direzione Sanitaria** il perché voglio introdurre una nuova tecnologia								
11. Sono capace di spiegare all'**Ingegneria Clinica** il perché voglio introdurre una nuova tecnologia								
12. Sono capace di spiegare al **Controllo di Gestione** il perché voglio introdurre una nuova tecnologia								

	In completo Disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Ottengo spesso le informazioni utili a valutare le nuove tecnologie da esperti del settore								
2. Scambio costantemente opinioni sulle nuove tecnologie con il personale della mia Unità Operativa								
3. Mi confronto con un numero elevato di colleghi per informarmi delle nuove tecnologie che intendo proporre								
4. Interagisco regolarmente con colleghi di altri ospedali per ottenere le informazioni sulle nuove tecnologie								
5. Ho spesso uno scambio di idee con la **Direzione Sanitaria** sulle nuove tecnologie da adottare								
6. Ho spesso uno scambio di idee con l'**Ingegneria Clinica** sulle nuove tecnologie da adottare								
7. Ho spesso uno scambio di idee con il **Controllo di Gestione** sulle nuove tecnologie da adottare								
8. Frequento numerose conferenze e seminari che mi forniscono le informazioni necessarie per la valutazione delle nuove tecnologie								

	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Penso che l'eventuale bocciatura di una mia proposta di acquisto di una nuova tecnologia rappresenti una sconfitta personale								
2. Ritengo che l'eventuale bocciatura di una mia proposta possa pregiudicare l'esito delle future proposte che farò								
3.Temo che l'eventuale bocciatura di una mia proposta possa danneggiare la mia reputazione di fronte ai colleghi								
4. Ritengo che l'eventuale bocciatura di una mia proposta mi possa portare a perdere prestigio di fronte alla Direzione								

	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Il Comitato di HTA è attento a ciò che è importante per me								
2. Sono convinto che il Comitato di HTA **NON** mi danneggerebbe intenzionalmente								
3. Ritengo che il Comitato di HTA prenda decisioni in maniera troppo discrezionale								
4. Le decisioni del Comitato di HTA sono prese in assoluta trasparenza								
5. Penso che il Comitato di HTA **NON** abbia le competenze necessarie a valutare pienamente le mie proposte								

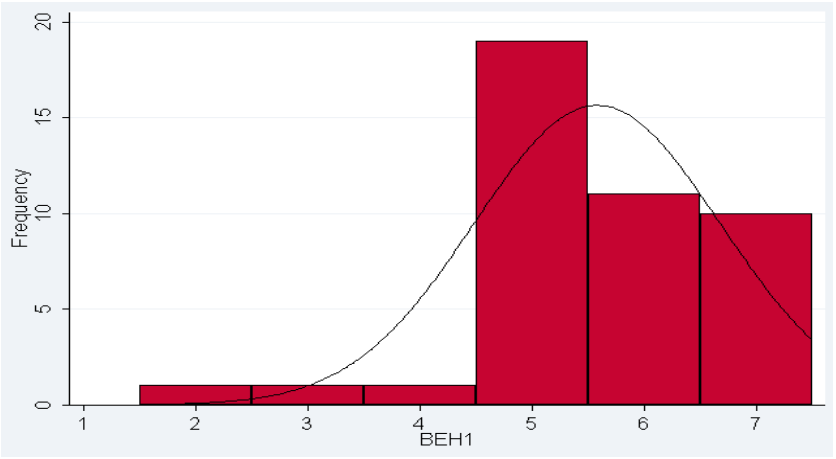
	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Tra i valori condivisi dall'azienda ICP la valutazione delle nuove tecnologie è tra i più importanti								
2. L'azienda ICP valorizza lo scambio di informazioni utili alla valutazione delle nuove tecnologie								
3.L'azienda ICP mi supporta nello sviluppare le competenze utili alla valutazione delle tecnologie								
4.L'azienda ICP **NON** riconosce adeguatamente lo sforzo che impiego nel valutare una tecnologia								

	In completo disaccordo 1	2	3	4	5	6	*In completo accordo* 7	Non so
1. Fornisco stime esaurienti delle implicazioni organizzative (es. spazi, mansioni, carichi di lavoro) della nuova tecnologia che propongo								
2. Mi impegno molto nella stima dei costi connessi alla nuova tecnologia che propongo								
3. Quando propongo l'adozione di una nuova tecnologia, fornisco informazioni esaurienti sui benefici per il paziente								
4. Quando propongo l'adozione di una nuova tecnologia, fornisco informazioni esaurienti sulle eventuali modifiche del percorso paziente								
5.Ogni volta che valuto una nuova tecnologia, dedico molta attenzione a stimare il transitorio (es. tempi a regime, curve di apprendimento)								

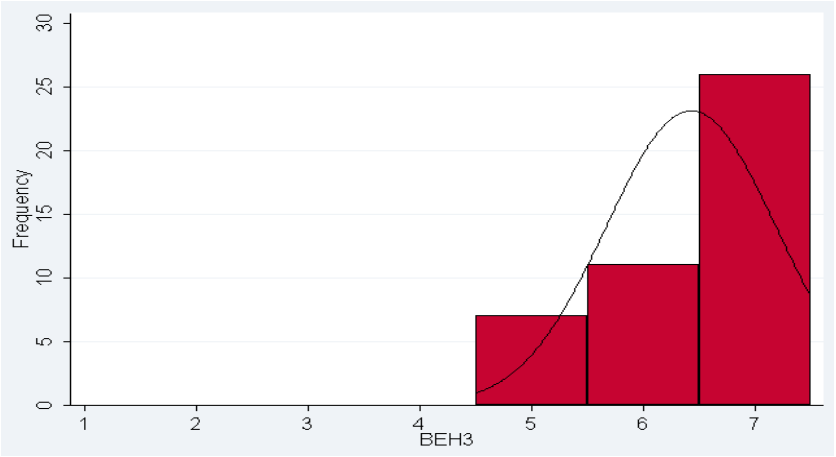
SEZIONE 2

1. Sesso	M ☐ F ☐
2. Età anagrafica	35-45 ☐ 46-55 ☐ 56-65 ☐ 66-75 ☐ >75 ☐
3. Esperienza lavorativa dall'abilitazione professionale (si indichi il numero di anni)	10-20 ☐ 21-30 ☐ 31-40 ☐ >40 ☐
4. Fatto 100 il valore monetario delle nuove tecnologie da Lei richieste negli ultimi tre anni, che percentuale fa riferimento a …	• tecnologie per sostituire tecnologie similari obsolete …% • tecnologie similari a tecnologie già presenti al fine di ampliare i volumi di attività …% • tecnologie nuove non ancora presenti presso gli ICP …% • tecnologie nuove non ancora diffuse in Lombardia o in Italia …%
5. Fatto 100 l'impatto delle tecnologie da Lei richieste negli ultimi tre anni, che percentuale fa riferimento a ...	• impatti economico/finanziari … % • impatti organizzativi …%
6. Nel rispondere a questo questionario, con "nuova tecnologia" ha fatto riferimento a … (è possibile dare più risposte)	☐ apparecchiature ☐ dispositivi ☐ procedure organizzative ☐ farmaci ☐ prestazioni

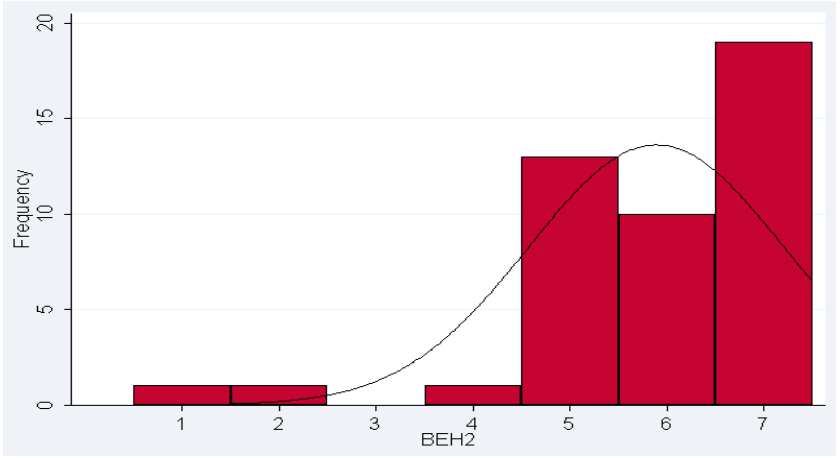
C. Descriptive Analysis of Results



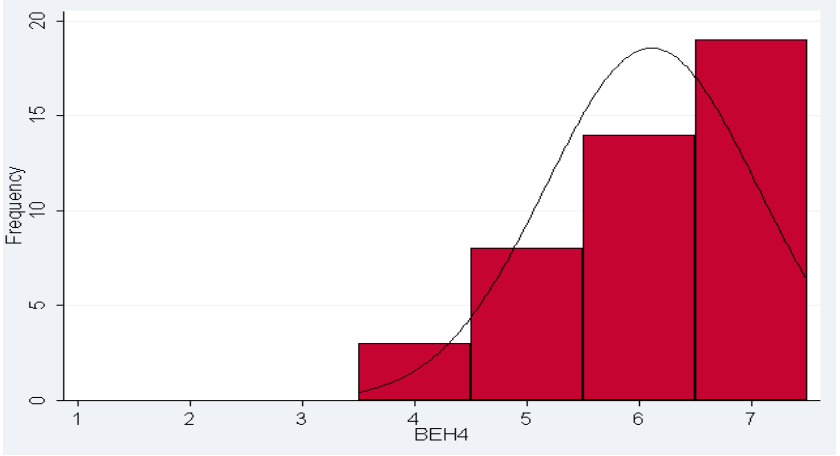
BEH1: I provide comprehensive estimates of the organizational implications (e.g.: spaces, tasks, workloads) of the new technology that I propose



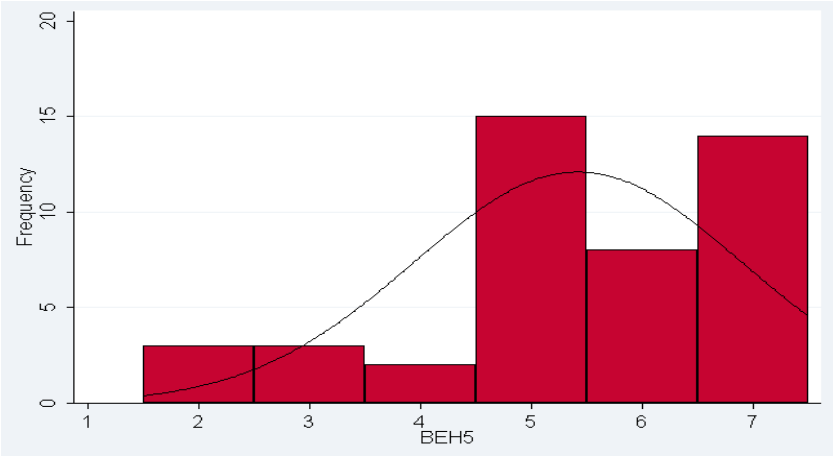
BEH3: When I propose the adoption of a new technology, I provide comprehensive information on the benefits to the patient



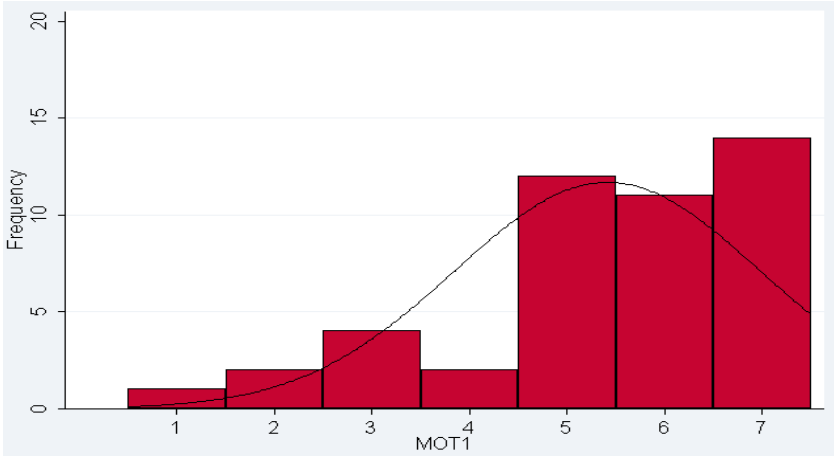
BEH2: I am very committed in estimating the costs associated with new technology that I propose



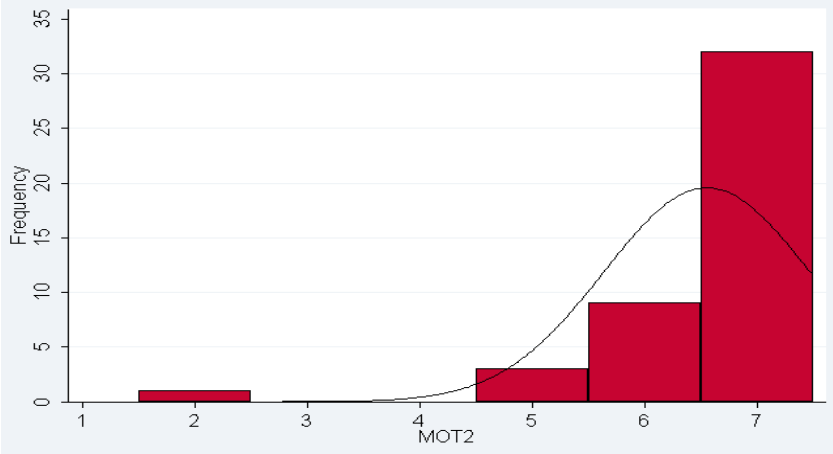
BEH4: When I propose the adoption of a new technology, I provide comprehensive information on any changes in the patient's path



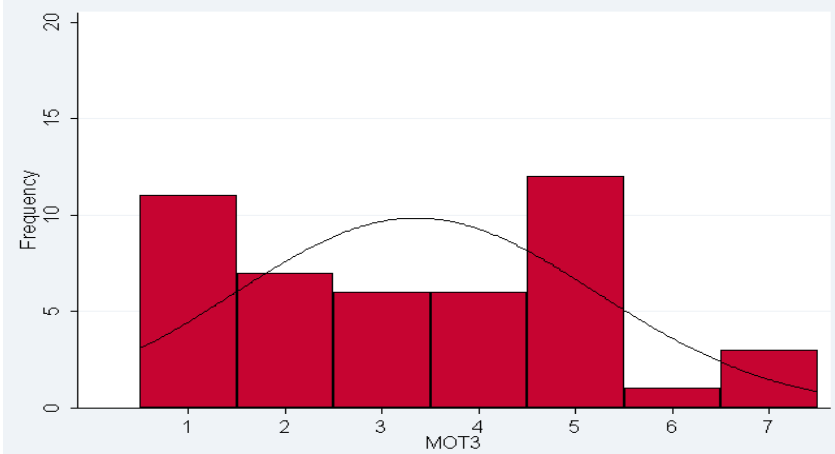
BEH5: Whenever I assess a new technology, I spend much attention to estimating the transitory (e.g.: time to speed, learning curves)



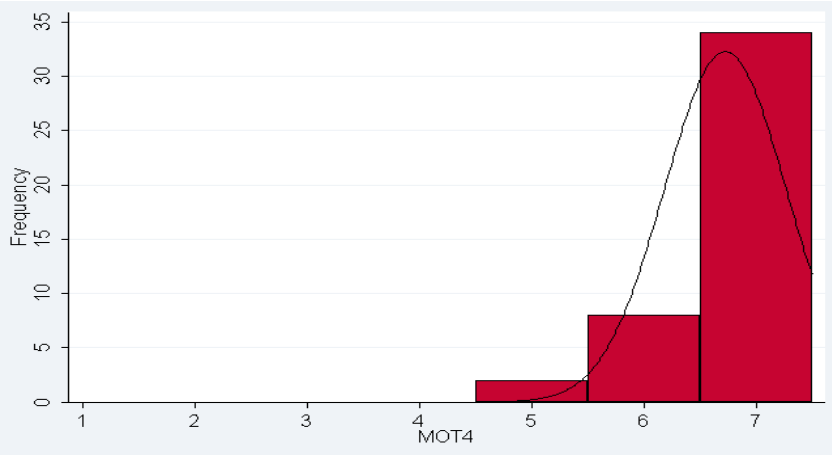
MOT1: I think that if I assess properly the new technologies, the chances that my purchase request is accepted increase



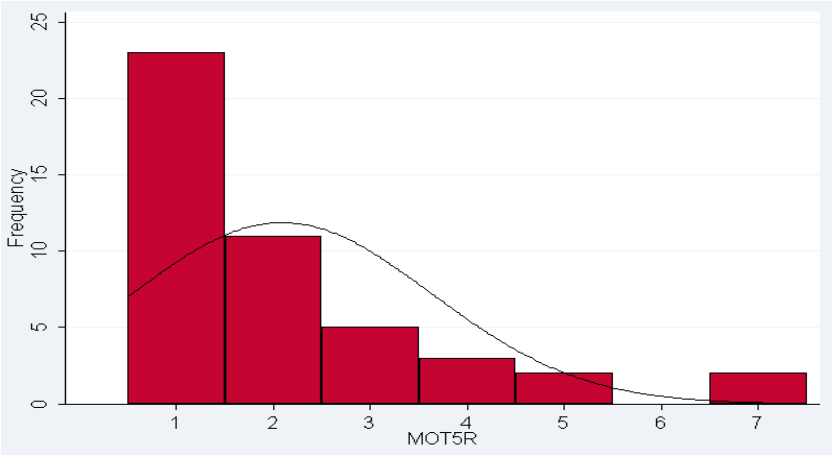
MOT2: I am very willing to assess new technologies that I intend to propose for the purchase



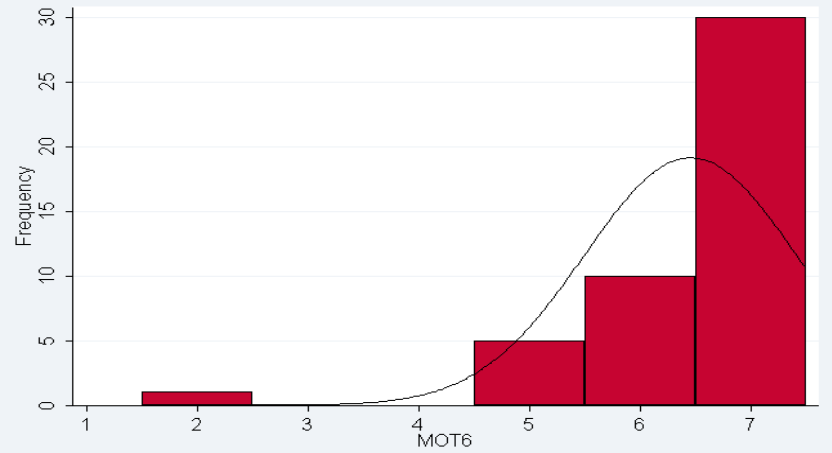
MOT3: I am motivated to properly assess new technology for the personal prestige that he would get



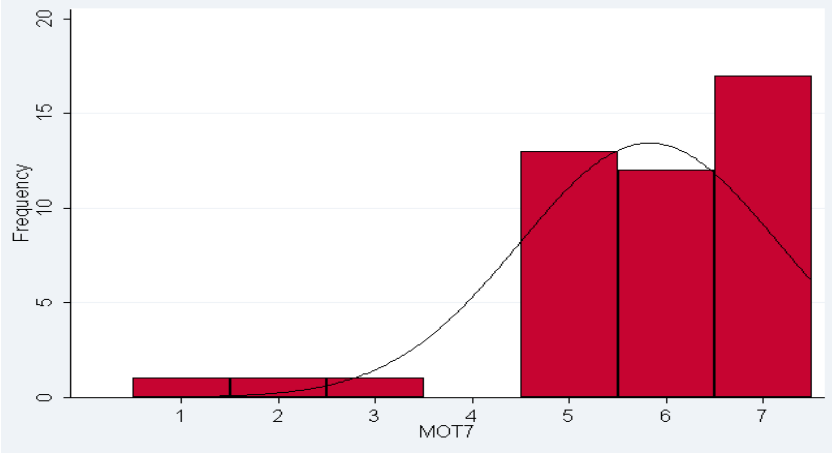
MOT4: Whenever I propose a new technology, I try to assess the impacts that it produces



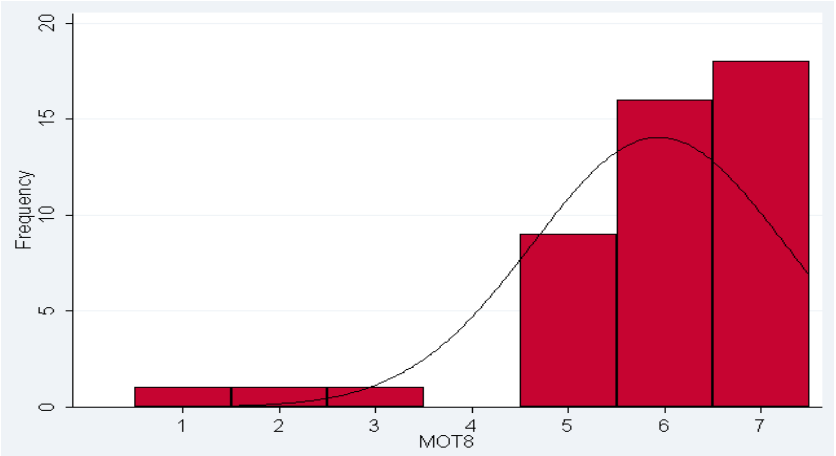
MOT5R: I have NO strong motivation to spend my time to the assessment of the introduction of new technologies



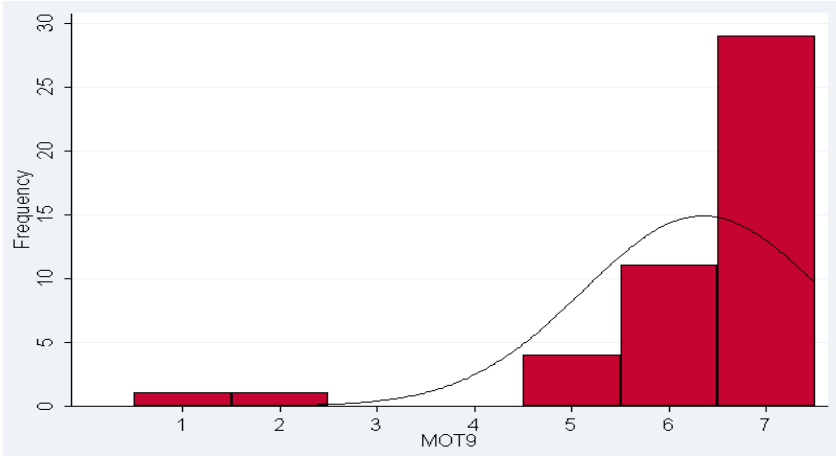
MOT6: I will try to consider the introduction of new technologies in an effectively way



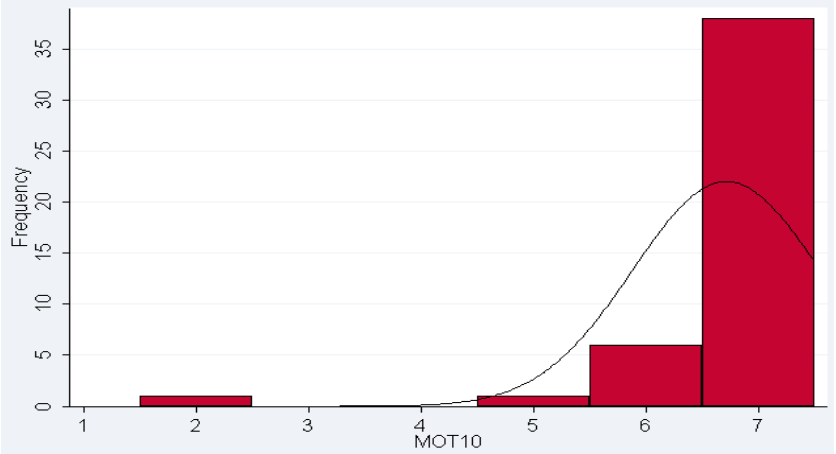
MOT7: The advantages that the *company ICP* would obtain by a fair assessment of new technologies are a strong incentive for me



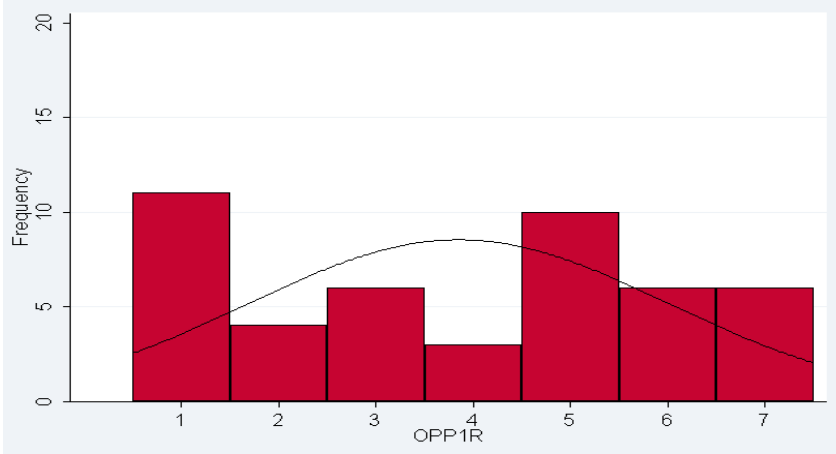
MOT8: The advantages that the *hospital* would obtain by a fair assessment of new technologies are a strong incentive for me



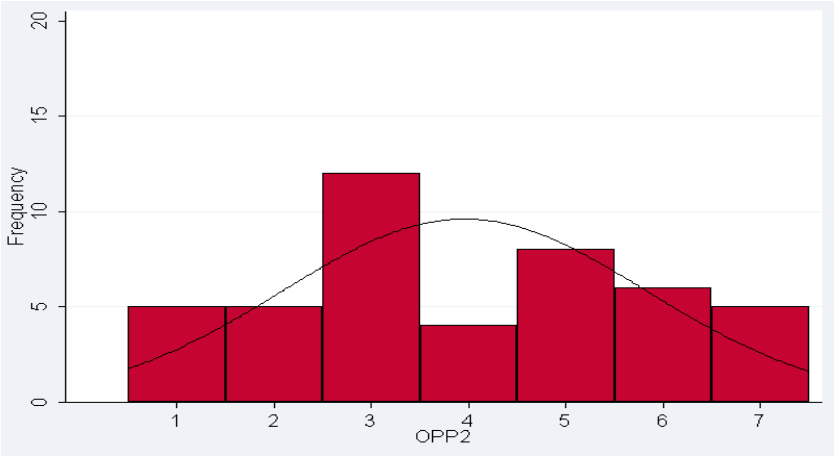
MOT9: The advantages that the *my unit* would obtain by a fair assessment of new technologies are a strong incentive for me



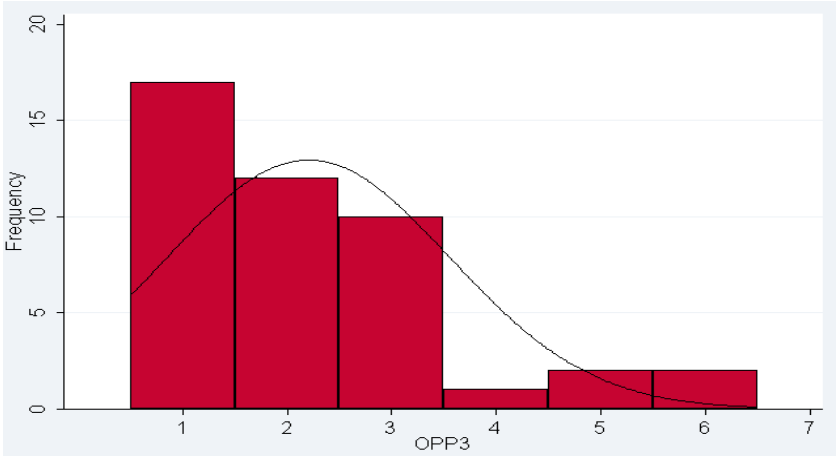
MOT10: The advantages that the *patient* would obtain by a fair assessment of new technologies are a strong incentive for me



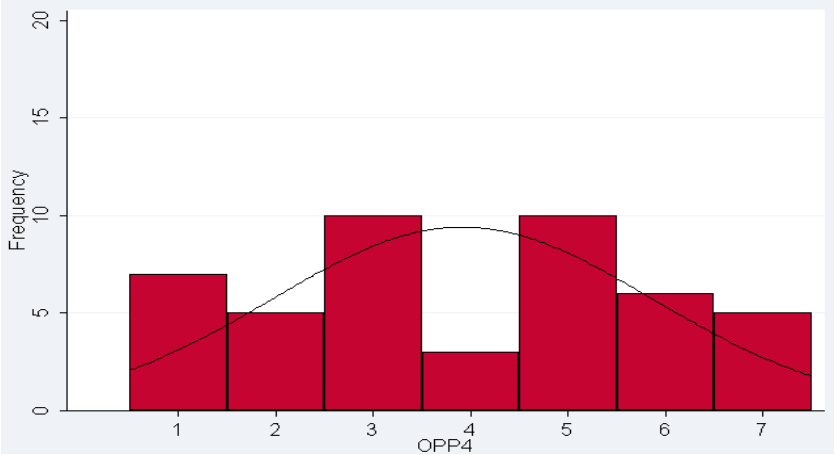
OPP1R: My workload does not allow me to effectively evaluate new technologies



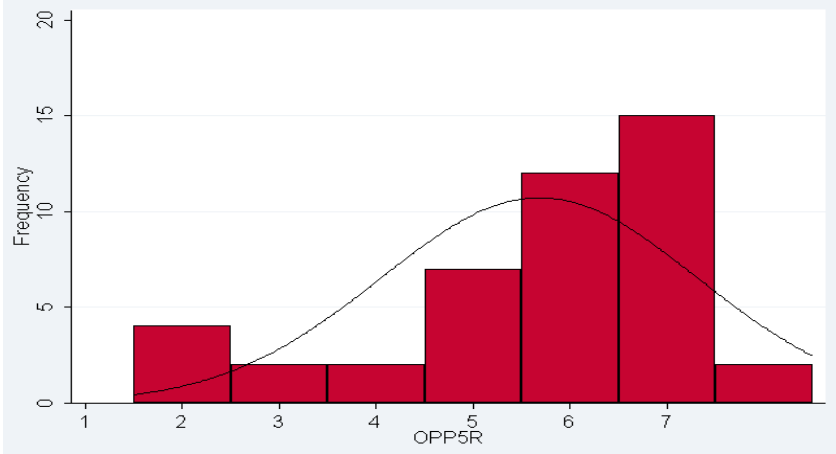
OPP2: During working hours, I have several times in which I can evaluate new technologies



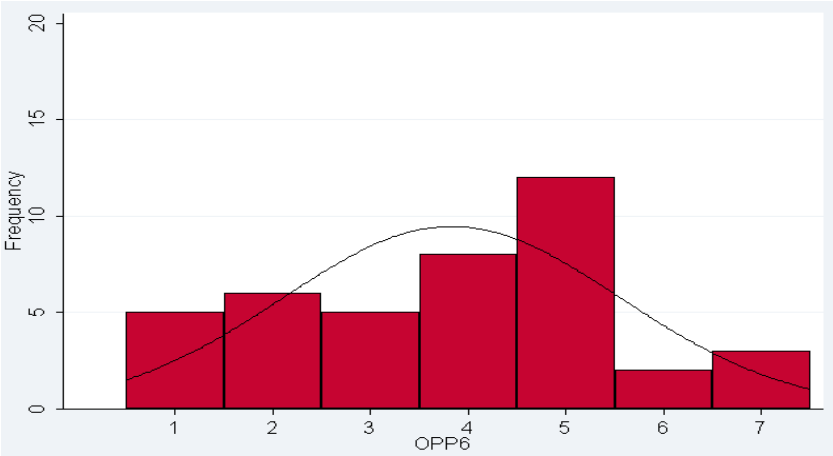
OPP3: The budget form shows very precisely the information needed to assess a new technology



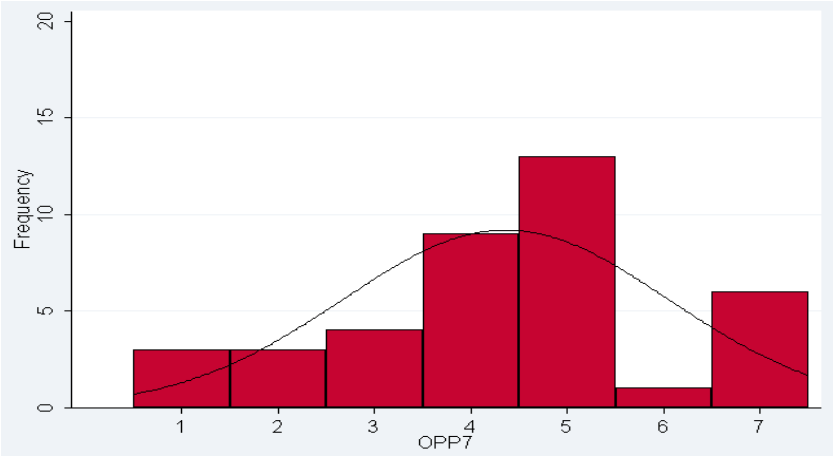
OPP4: I believe to have enough time to effectively assess new technologies



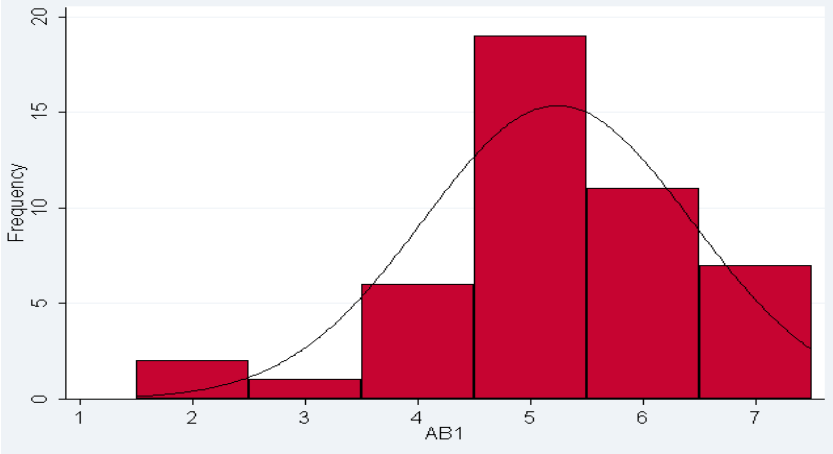
OPP5R: The operating instructions for completing the budget form do NOT support me sufficiently in the assess of a new technology



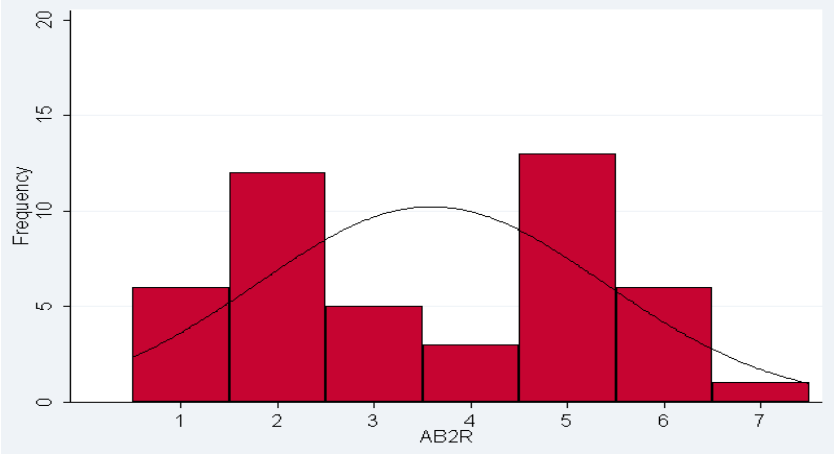
OPP6: Inside the corporate intranet I find a set of information useful for the assess of a new technology



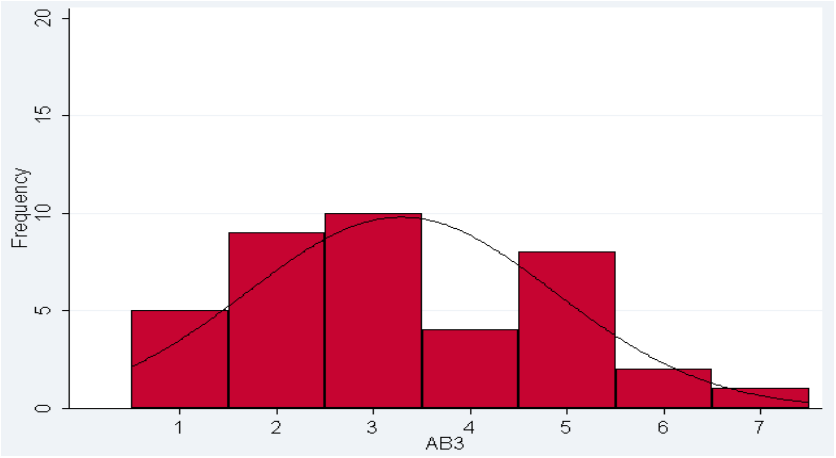
OPP7: The mode of activation of the HTA Committee is easily accessible through corporate intranet



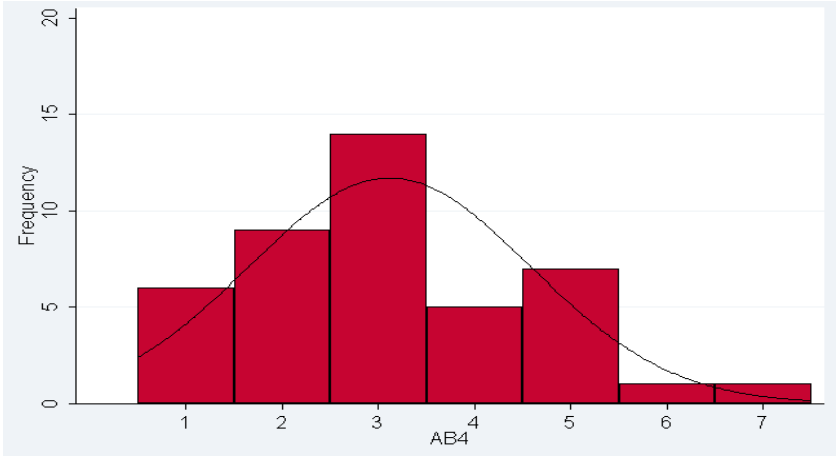
AB1: I think to be able to perform the assess for the introduction of a new technology



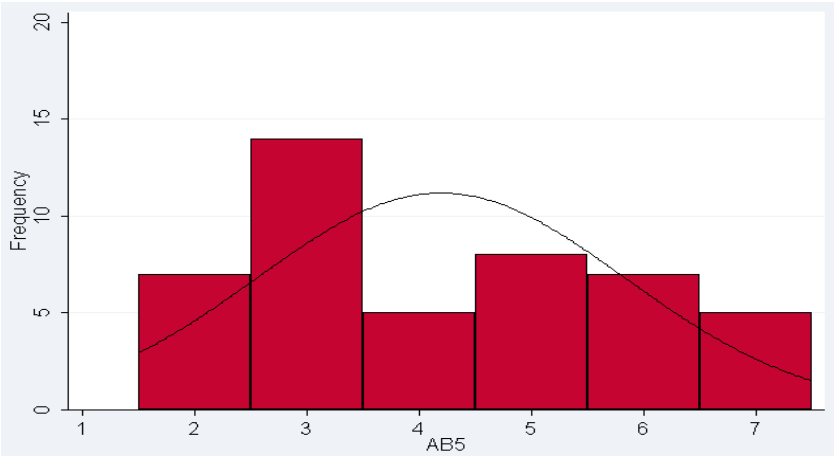
AB2R: I often find the impacts that new technology will have on my unit difficult to estimate



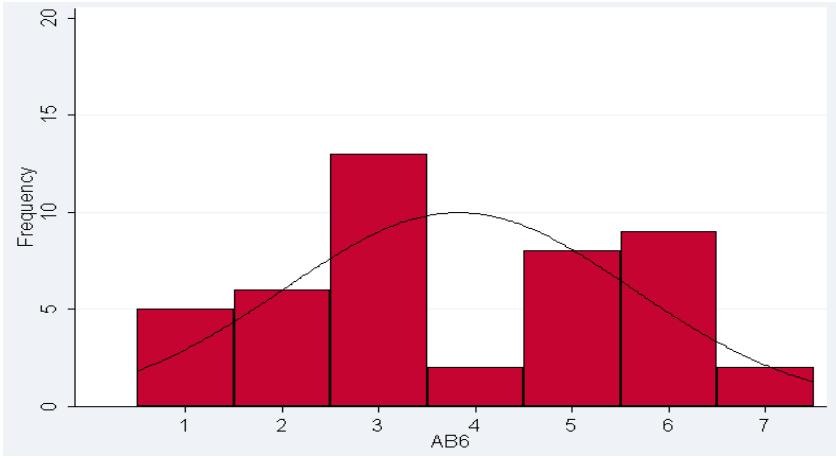
AB3: I trust a lot of my ability to use the corporate intranet for the assessment of the introduction of a new technology



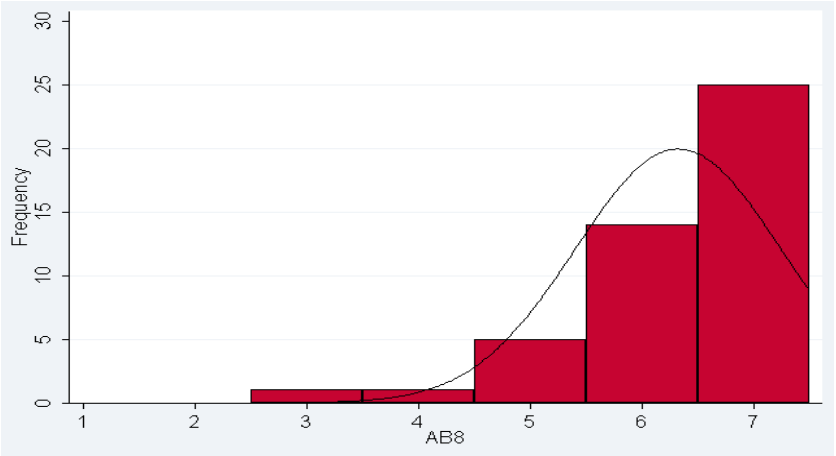
AB4: I trust a lot of my ability to use the budget form for the assessment of the introduction of a new technology



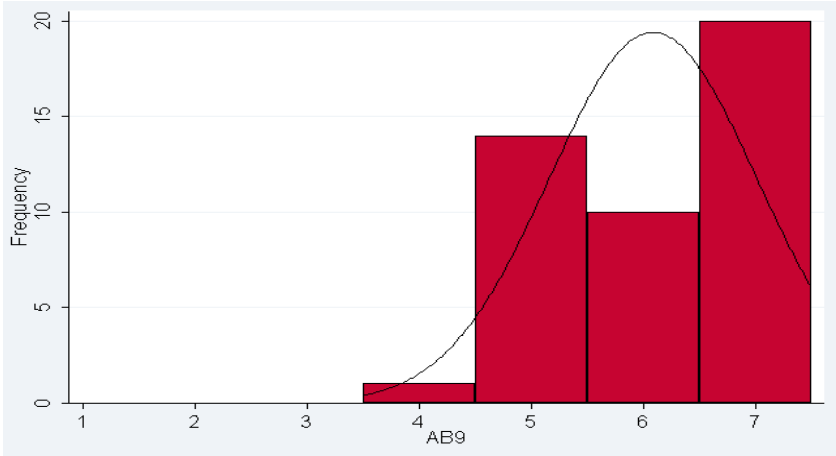
AB5: I believe that estimating the impact that new technology will have on patients is relatively easy



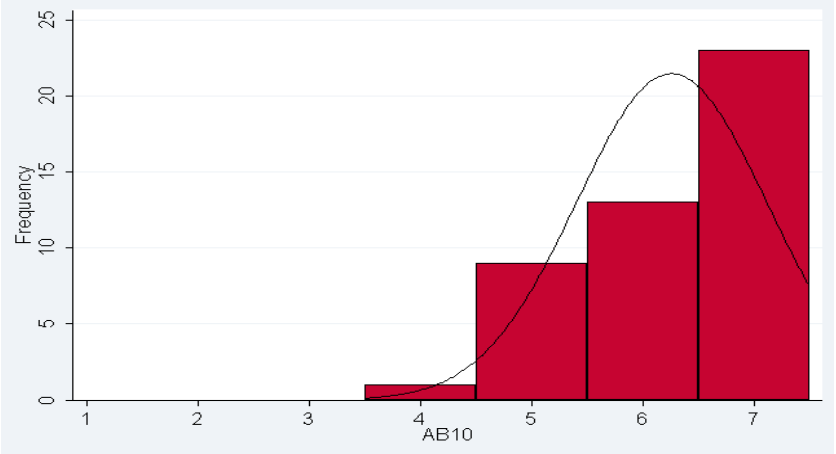
AB6: I am capable to perform independently the assess of the introduction of a new technology



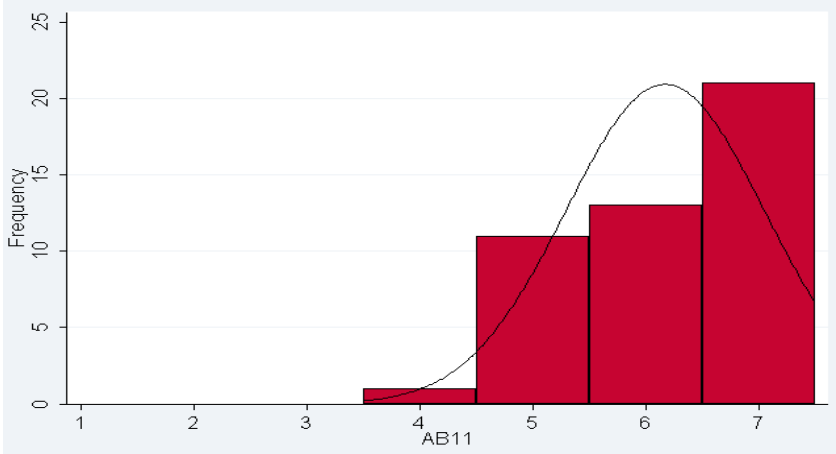
AB8: I am capable to explain to my *colleagues* why I want to introduce a new technology



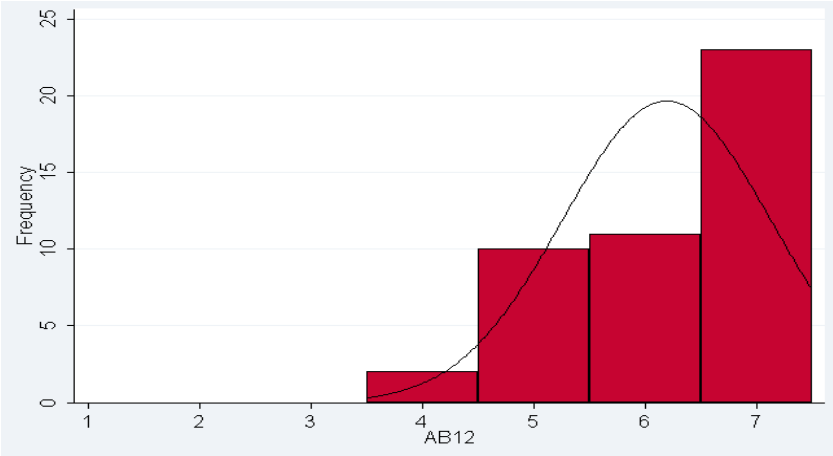
AB9: I am capable to explain to the *HTA committee* why I want to introduce a new technology



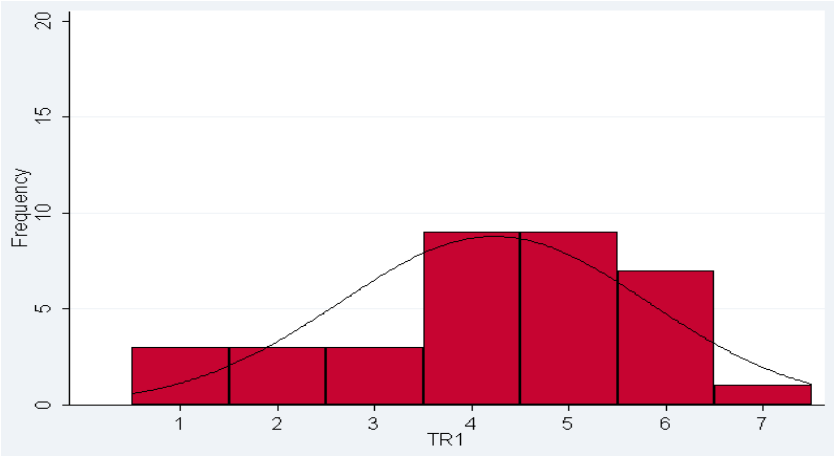
AB10: I am capable to explain to the *Health Direction* why I want to introduce a new technology



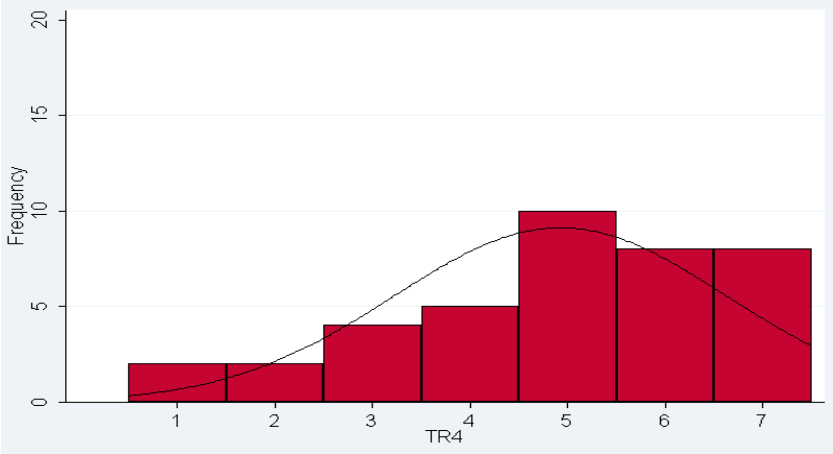
AB11: I am capable to explain to *Clinical Engineering* why I want to introduce a new technology



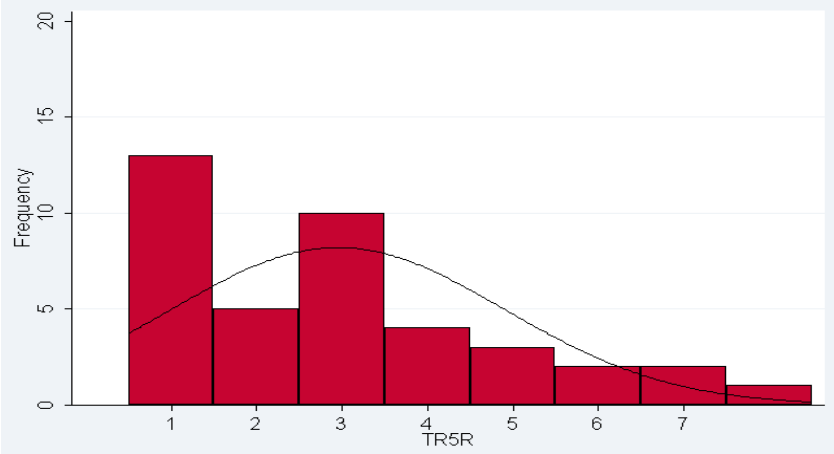
AB12: I am capable to explain to Control *Management* why I want to introduce a new technology



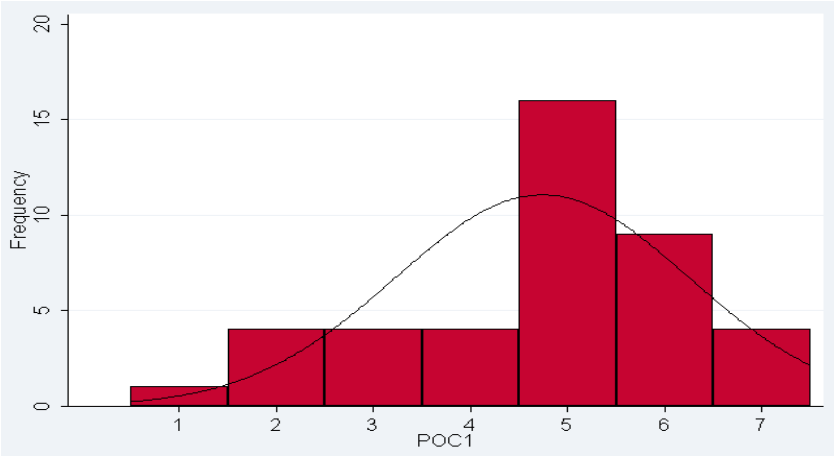
TR1: The HTA Committee is careful to what is important to me



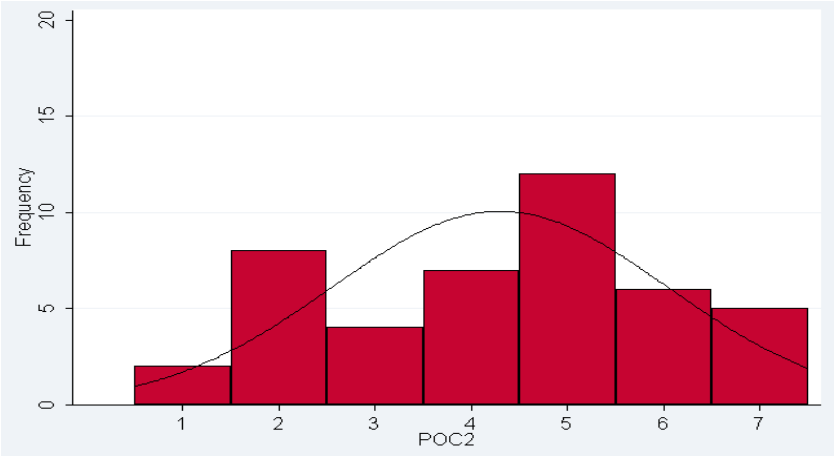
TR4: The decisions of the HTA Committee are taken in full transparency



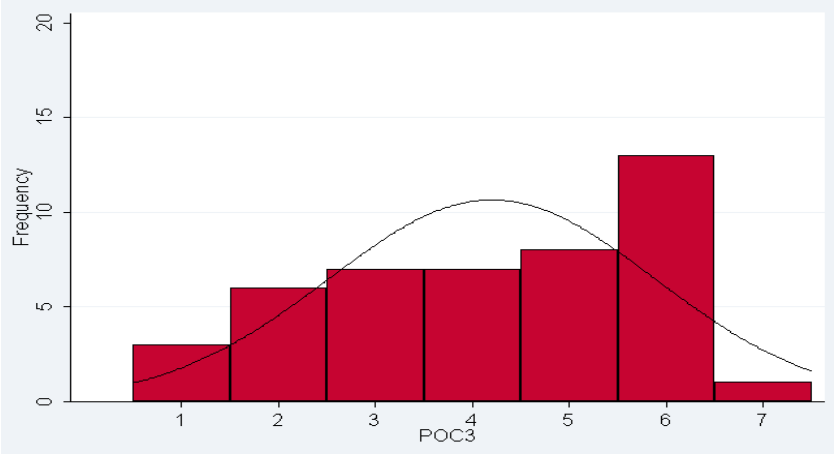
TR5R: I think the HTA Committee does NOT have the skills necessary to fully assess my proposals



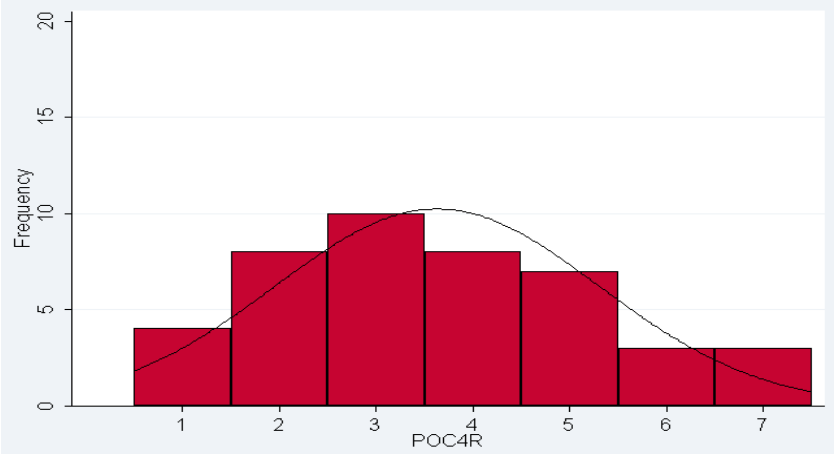
POC1: I believe that the set of shared values existents in the ICP gives much importance to the evaluation of new technologies



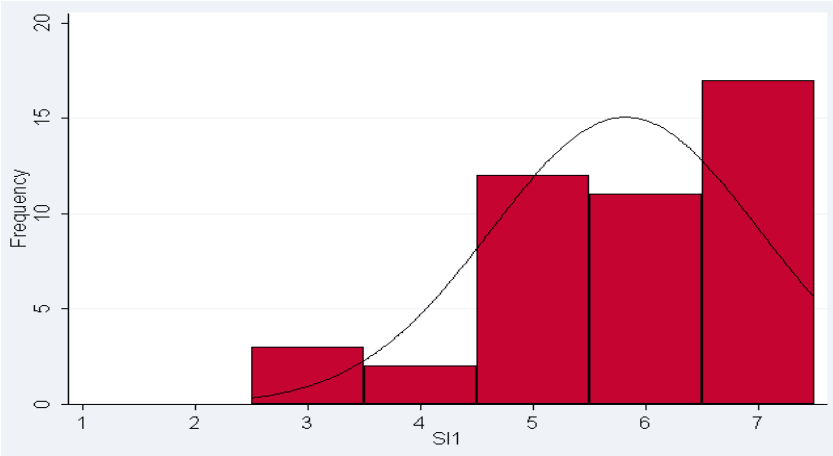
POC2: The company ICP promotes the exchange of information relevant to the evaluation of new technologies



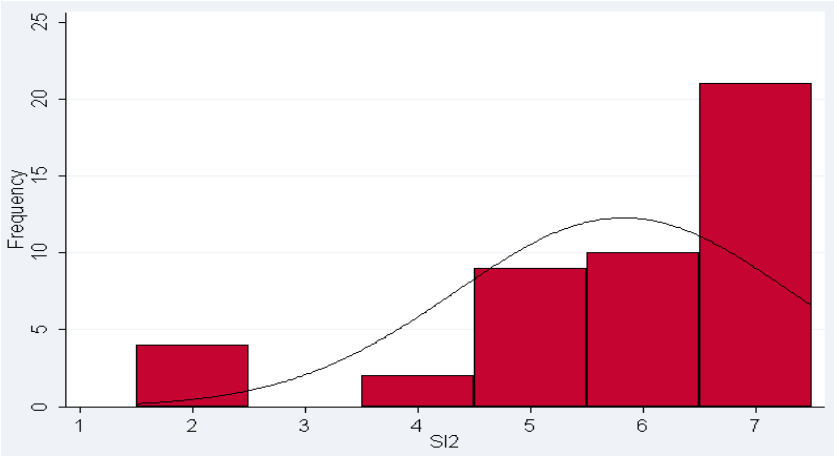
POC3: The company ICP supports me in developing the skills necessary for assessing



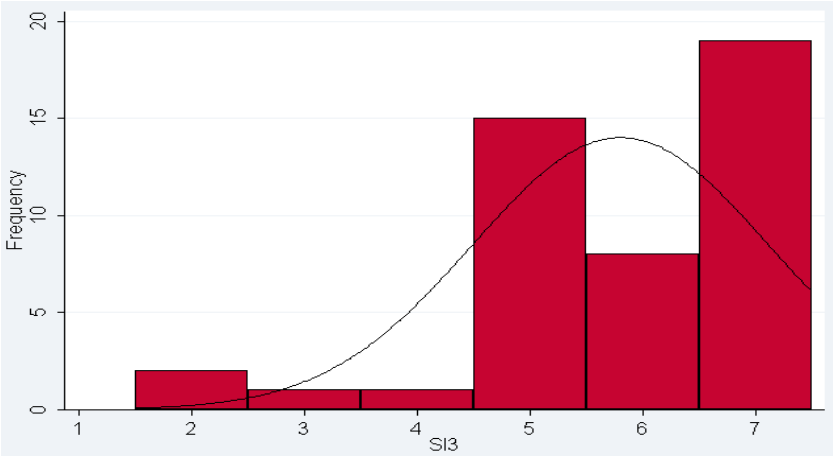
POC4R: The company ICP does NOT recognize properly the effort I invest in assessing a technology



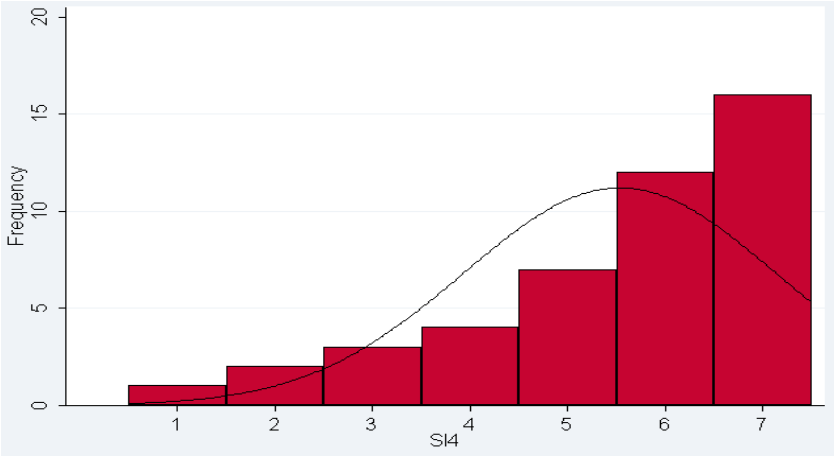
SI1: I often get useful information to assess new technologies by industry experts



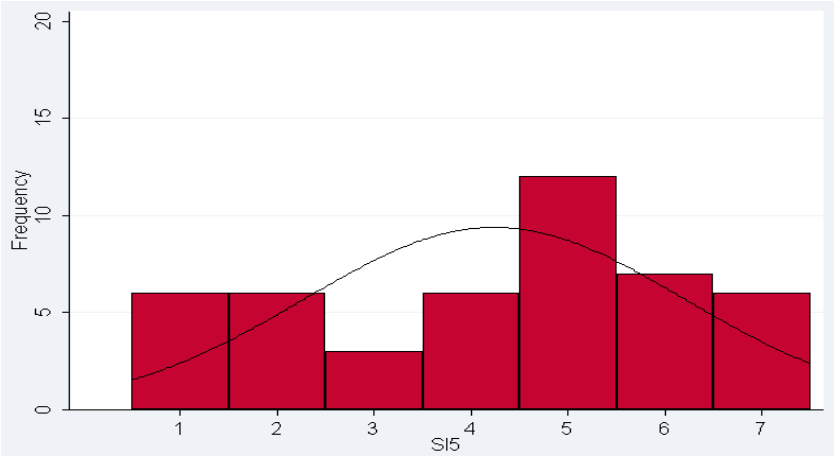
SI2: I constantly exchange opinions on new technologies with the staff of my Unit



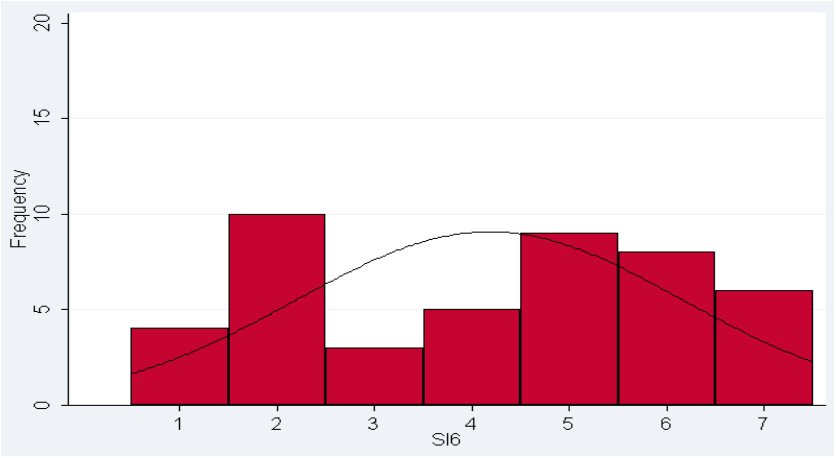
SI3: I confront me with a large number of colleagues to inform myself of new technologies that I intend to propose



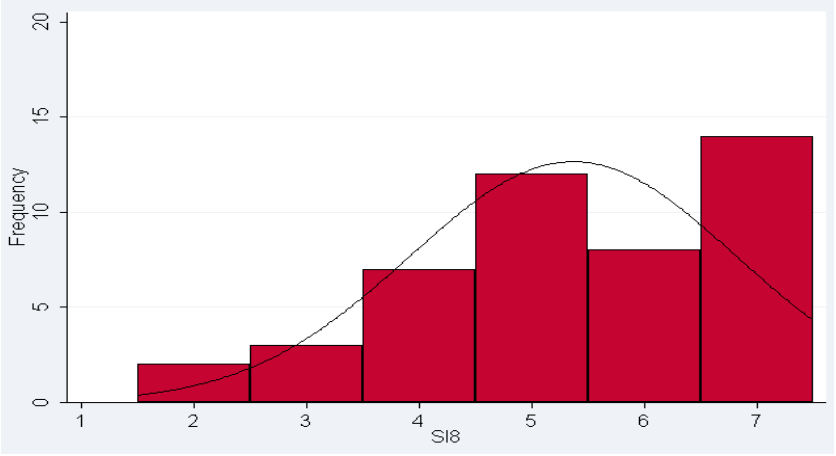
SI4: I interact regularly with colleagues from other hospitals to obtain information on new technologies



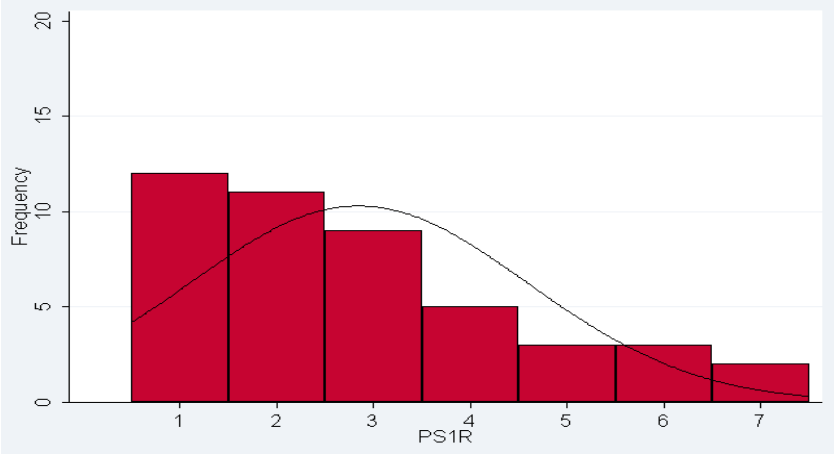
SI5: I have often exchanged ideas with the Health Department on new technologies to adopt



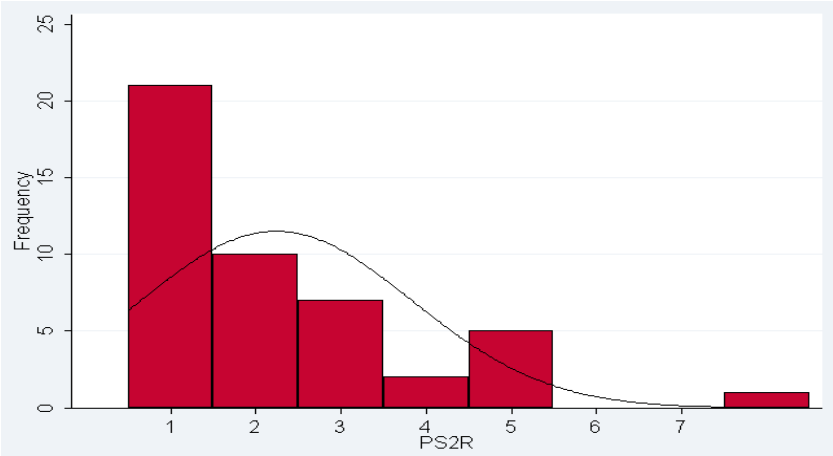
SI6: I have often exchanged ideas with the Clinical Engineering on new technologies to adopt



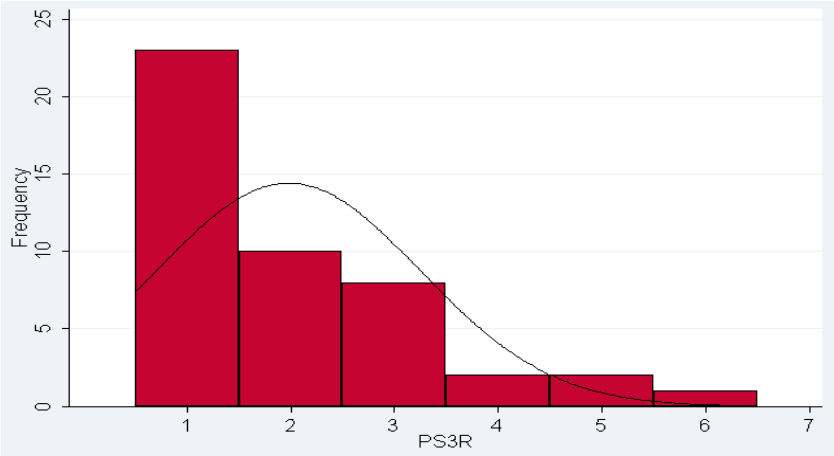
SI8: I attend many conferences and seminars that give me the information necessary for the assess of new technologies



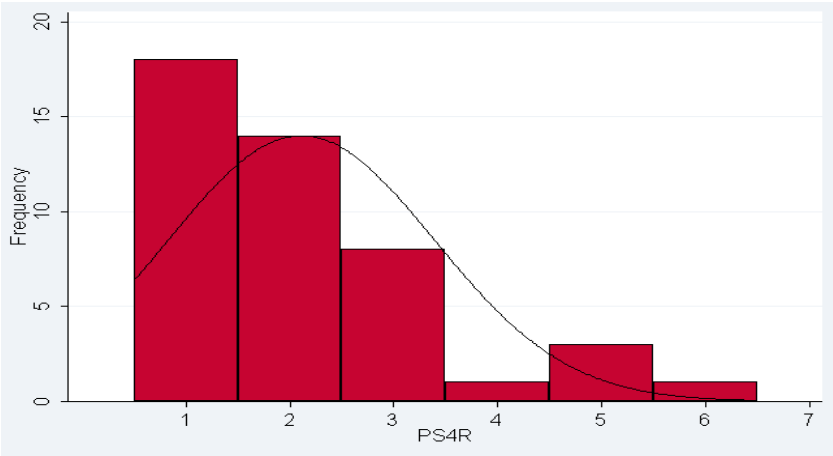
PS1R: I think that the possible rejection of my purchase proposal of a new technology represents a personal defeat



PS2R: I believe that the possible rejection of my proposal might affect the outcome of future proposals that I will



PS3R: I fear that the possible rejection of my proposal could damage my reputation in front of colleagues



PS4R: I believe that the possible rejection of my proposal would lead me to lose prestige in front of the Direction