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PREFACIO

Nuevas Tecnologías y Gestión Hospitalaria

En España, los años de crisis económica han conducido a las autoridades sanitarias hacia una reforma del sector sanitario, introduciendo una serie de medidas con el objetivo mejorar la eficiencia, y asegurar la sostenibilidad del sistema sanitario público de la nación. Más en concreto, y en cuanto a "medidas de eficiencia", resulta destacable el interés por expandir y optimizar el uso de las nuevas tecnologías mediante la implantación de herramientas en el campo de la e-salud (tarjeta sanitaria, receta electrónica e historia clínica digital).

La demanda sanitaria del sector público español está exigiendo una evolución progresiva de los servicios sanitarios, de modo que éstos no solo estén orientados hacia el tratamiento y cura de enfermos sino también hacia la prevención y promoción de la salud, así como, hacia la mayor actividad de los procedimientos de hospital de día y de los cuidados del paciente.

Los hospitales se ven expuestos a realizar cambios en su estrategia de actuación, ya que precisan transformar su estructura tecnológica con vistas a tratar a los pacientes de forma más personalizada, y orientar su actividad a las vicisitudes inherentes a un mercado competitivo.

El nuevo hospital debe ser una organización descentralizada, autónoma y coordinada con un objeto común: ofrecer un servicio de calidad sin aumentar el gasto sanitario. En este proceso de cambio, las nuevas tecnologías desarrollan un papel fundamental dada la necesidad de mejorar e integrar los flujos de información. En definitiva, los cambios de regulación en el sector están demandando la presencia de Tecnologías de la Información (TI) en los hospitales.

Asimismo, los hospitales, considerados como empresas de servicios, deben ser gestionados de forma eficaz y eficiente, como cualquier otra empresa. Más aún, si el sistema de financiación ha pasado de ser retrospectivo, basado en el reembolso del gasto real, a prospectivo, basado, o bien en la asignación de recursos por actividad pactada a precios establecidos de antemano (AECA 2014), o bien en el modelo capitativo.

El desarrollo de la sociedad de la información y de la comunicación que ha tenido lugar en las últimas décadas ha otorgado un importante papel a las TI en las organizaciones. De tal modo, que las aplicaciones de negocios se han orientado a la automatización de determinadas tareas realizadas

manualmente por el usuario, mientras que otras herramientas se han orientado a mejorar los flujos de información de la organización.

Los hospitales no han permanecido ajenos a este fenómeno de modernización tecnológica y han ido incorporando paulatinamente nuevas tecnologías y aplicaciones, que se pueden enmarcar en dos líneas de desarrollo: tecnologías orientadas a mejorar la prestación y gestión sanitaria, y tecnologías orientadas a mejorar la gestión hospitalaria.

La tecnología para la prestación y gestión sanitaria comprende tecnologías para el diagnóstico y tratamiento, potenciando el valor de las TI para mejorar la calidad de la prestación sanitaria, aumentar la seguridad del paciente y disminuir los costes. La concurrencia de aplicaciones tecnológicas orientadas a la prestación sanitaria configura el HIS del hospital, *Health Information Systems* (HIS) o *Health Information Technologies* (HIT).

Por otro lado, las tecnologías de la información para la gestión hospitalaria se ocupan de desarrollar soluciones orientadas a aumentar la eficiencia de los procesos productivos. La corriente actual en el sector sanitario es implantar estrategias de gestión enfocadas a mejorar la eficiencia en los hospitales (Van Merode et al. 2004).

Las explicaciones acerca de las variaciones en el consumo de los recursos hacen imprescindible utilizar otros datos y variables no cuantificables

desde el punto de vista económico. En este sentido destaca la aportación de las herramientas de integración de la información.

El trabajo en equipo permite alcanzar economías de escala que facilitan la reducción de costes, y de inversiones en grandes infraestructuras, más o menos similares entre diferentes departamentos de la organización, evitando las compras de equipamiento duplicadas, en ocasiones, en los diferentes servicios o unidades del hospital (Bloom 1991).

Los hospitales, orientados hacia la satisfacción de las necesidades sanitarias de la población, se organizan de modo que son capaces de ofrecer un sistema integrado de atención sanitaria para sus pacientes. La orientación hacia el paciente conlleva la implicación en cadena de todos los miembros de la organización.

La percepción de los pacientes de un hospital respecto a la calidad en el servicio prestado se valora por la continuidad en la prestación de cuidados asistenciales. La continuidad en los cuidados de un paciente, de carácter múltiple y coordinado, involucra a todos los miembros de la organización, con independencia del estatus de cada individuo que la compone.

El enfoque hacia la integración de los cuidados al paciente implica la creación de equipos de trabajo multidisciplinares, que mejoran la coordinación y la cooperación entre diferentes especialidades médicas, y

también entre el resto de personal involucrado, que no se circunscribe únicamente al personal sanitario.

La segregación entre personal sanitario y personal no sanitario coexistente en las organizaciones hospitalarias ya se manifestaba en la aportación realizada por Bloom (1991), en la que se defendía la obligación, por parte de los gestores de los hospitales, de facilitar la cooperación y la comunicación entre los distintos estamentos de la organización, evitando cualquier tipo de segregación entre su personal.

El hospital, por ser una institución compleja y multifuncional, requiere una sofisticada integración clínica y de gestión. Van Merode et al. (2004) defiende el potencial de *Enterprise Resource Planning* (ERP) como el sistema de información más idóneo para dar soporte a las organizaciones sanitarias. Una de las características esenciales de un sistema ERP es su aportación como herramienta de coordinación de los procesos de la organización.

Los sistemas ERP se caracterizan porque, mediante la integración de las funciones transaccionales de una organización, se dispone de un sistema unificado de datos, más que de un grupo de aplicaciones separadas que ofrecen datos fragmentados.

La mayor parte de la literatura acerca de sistemas ERP (Alshawi et al. 2004, Klaus et al. 2000, Muscatello et al. 2003, y Kansal 2006, entre otros)

coinciden al señalar que este tipo de sistemas de información facilitan la integración entre todas las áreas dentro de una empresa y también entre sus socios o aliados en el sector.

Desde el punto de vista de la gestión, disponer de un sistema de información integrado incrementa la eficiencia de la organización ya que se eliminan las actividades duplicadas, al tiempo que se facilita la sincronización de los diferentes sistemas existentes en la organización, reduciendo así los costes operativos (Alshawi et al. 2004). En opinión de Kansal (2006) algunos procesos de negocios de una compañía pueden estar afectados de falta de operatividad, por no disponer de la información adecuada en el momento preciso. La duplicidad de las actividades y la multiplicidad de la recogida de los mismos datos, una y otra vez, implican un enorme retraso en la obtención de información para la toma de decisiones. El tiempo requerido para recoger datos y convertirlos en información útil puede llegar a ser excesivo e impedir prestar la atención adecuada al análisis y la toma de decisiones.

En resumen, un sistema ERP ofrece un producto integrado capaz de gestionar la mayoría de las aplicaciones en una compañía al mismo tiempo que también es capaz de ofrecer información a tiempo real.

Sistemas ERP en hospitales

Los sistemas ERP están diseñados para ofrecer una solución al problema de la fragmentación de la información o "islas de información" en las organizaciones (Muscatello et al. 2003).

Las funciones que soporta un sistema ERP, y los datos involucrados en este tipo de sistemas, se sustentan en una base de datos integrada que almacena datos maestros y transaccionales de un modo consistente y sin duplicidades (Alshawi et al. 2004, Muscatello et al. 2003).

Una perspectiva común en la literatura relacionada con sistemas ERP, es el interés, por parte de la comunidad científica, en el desarrollo del concepto de "solución total de integración de los negocios en la empresa".

El sistema ERP ofrece un paquete de soluciones de *software* que busca la integración completa de los procesos de negocios y de las funciones de una organización (Davenport et al. 2004), acelera el flujo de información, e impulsa la colaboración interna en una organización, al mismo tiempo que facilita el análisis mediante los indicadores de actividad, indicador de carácter no estrictamente financiero (Granlund y Malmi 2002).

A pesar de la contribución de los sistemas ERP al problema de la integración de procesos y funciones en una entidad, hay que tener en cuenta que, en orden a conseguir dicha integración, el fenómeno ERP

debe ser delimitado desde el punto de vista de los sistemas de información a los productos de *software* que la solución adquirida por la entidad aporte en cada caso (Klaus et al. 2000).

La implantación de un sistema ERP permite reemplazar los procesos de trabajos y la disparidad de aplicaciones existentes en una entidad por aplicaciones sincronizadas para el conjunto de la organización. A su vez, el sistema ERP obliga a los miembros de la organización a respetar una lógica, con normas muy estrictas, al tiempo que ofrece nuevas posibilidades a los usuarios del sistema.

Un sistema ERP se caracteriza por ofrecer una solución para los problemas de integración, consolidada a todos los niveles de la organización. La principal aportación de un sistema ERP es conseguir integrar las aplicaciones individuales, dispersas en la organización, creando una unidad de información a partir del conjunto de los sistemas de información existentes.

La implantación de un sistema integrado de información obliga a las entidades que lo implantan a evolucionar hacia una cultura organizativa nueva impregnada de una visión de trabajo interrelacionado, en la que se comparten tareas y se establecen objetivos en común. La nueva cultura permite a la organización alcanzar cotas más elevadas de calidad en la prestación de los servicios asistenciales a la población (Escobar et al. 2010).

La aportación de un sistema ERP es expuesta detalladamente por Berchet y Habchi (2005), quien enumera que las principales ventajas de un sistema ERP son las siguientes:

- Unificación y coherencia en los datos
- Enfoque de procesos
- Mayor eficiencia en los procesos financieros, en el proceso de toma de decisiones y en procesos corporativos de la entidad
- Disponibilidad de la información a tiempo real
- Facilidad y rapidez en el acceso a la información
- Rigurosidad en la gestión
- Visión actualizada, y consolidada de la estructura del negocio, permitiendo un análisis integral del mismo

Si bien la solución de integración de ERP ha surgido en los últimos años, la trayectoria de ERP, como paquete de aplicaciones de *software,* comenzó en los años 70 y se ha ido extendiendo hasta nuestros días. Las organizaciones sanitarias vienen usando las nuevas tecnologías para automatizar y mejorar sus procesos clínicos y de negocios. Así, en los últimos años, se ha acentuado el interés, por parte de los órganos de

gestión de los hospitales, en la inversión en nuevas tecnologías (Van Merode et al. 2004).

En opinión de Khoumbati et al. (2006), esta tendencia se materializa en estrategias de innovación en las que se priorizan como más urgentes la integración de los procesos clínicos, organizativos y gerenciales, confiando mayoritariamente en el soporte ofrecido por los sistemas ERP. Los beneficios de ERP en las organizaciones sanitarias se sitúan a nivel estratégico ya que están asociados con una reducción sustancial de los errores médicos (Khoumbati et al. 2006).

Las infraestructuras de los sistemas de información en los hospitales se caracterizan por estar construidas sobre aplicaciones y sistemas heterogéneos y autónomos. La naturaleza de la "no integración" de los sistemas de información en los hospitales se asocia con una reducción de la calidad en los cuidados así como en el aumento de los errores médicos (Khoumbati et al. 2006).

En opinión de Bloom (1991), Van Merode et al. (2004), Kallinikos (2004), Berchet y Habchi (2005), Boudreau (2004), Escobar et al. (2010), Granlund y Malmi (2002), Stefanou y Revanoglou (2006), y Watson et al. (2003), entre otros, los sistemas ERP están diseñados para facilitar el concepto de "integración", facilitando la introducción en la organización de paquetes

de tecnología de la información a gran escala, de los que resultan importantes implicaciones en los procedimientos (Kallinikos 2004).

Con respecto a la aportación que supone la implantación de un sistema ERP en un hospital, la integración de la información permite disponer de información exhaustiva para la toma de decisiones en el ámbito de la organización sanitaria (Stefanou y Revanoglou 2006). Consecuentemente, la implantación de un sistema ERP aporta a la organización la herramienta para realizar las operaciones diarias, minimizando el comportamiento humano imprevisible y consiguiendo una gestión organizativa más transparente (Stefanou y Revanoglou 2006).

La integración de los servicios, productos y técnicas diversas en un hospital tiene un impacto directo sobre los pacientes, el personal de enfermería, y facultativos, el personal de servicios y el personal financiero, e incluso, influye en las relaciones con agentes externos a la organización como entidades e instituciones financiadoras, proveedores y otras autoridades sanitarias.

Hay que destacar, sin embargo, las limitaciones existentes a la hora de conseguir la integración de las distintas funciones en una organización sanitaria. A pesar de que en el entorno del sector hospitalario un sistema ERP aporta conectividad entre las funciones de admisión, farmacia, laboratorio, facturación, nominas, compras, mantenimiento, servicios,

finanzas etc., puede afirmarse, que en el caso del sector hospitalario, generalmente, los niveles de innovación tecnológica están condicionados a la influencia social de todos y cada uno de los empleados que forman parte de la plantilla del hospital, es decir a las relaciones ínter organizativas que conviven en el hospital y en su entorno (Mc Ginnis et al. 2004, Soh y Sia 2004).

En este sentido, en el marco del estudio realizado en tres hospitales que implantaron el mismo paquete de *software* ERP, Soh y Sia (2004) presentan la adopción de diferentes soluciones de implantación para cada uno de los casos, en función del grado de alineación de las diferentes unidades de una organización. La resolución del conflicto en cada caso está condicionada a la presión que los *stakeholders* de la organización sean capaces de interponer en la implantación de la estrategia.

Adicionalmente a la influencia social de los integrantes de la organización, se identifican una serie de aspectos que pueden impulsar o impedir la introducción de nuevas tecnologías en la organización. Aspectos, tales como la capacidad de innovación tecnológica de un hospital, la composición del equipo de dirección y el liderazgo de la plantilla médica (Mc Ginnis et al. 2004).

En general, se puede hablar de dos principales enfoques para integrar la información en los hospitales: integración completa e integración parcial (Stefanou y Revanoglou 2006).

El enfoque de integración completa se fundamenta en un programa integrado que abarca los módulos de información clínica, recursos humanos, finanzas, mantenimiento, etc. en una plataforma única para toda la organización.

Los responsables de la gestión consideran que este enfoque de integración completa es eficiente y su coste es compensado por los beneficios que aporta a la organización (Stefanou 2001), ya que los factores conductores de valor añadido de ERP son la integración, la optimización y la información (Davenport et al. 2004).

Sin embargo, Soh et al. (2000) argumentan que el enfoque de integración completa no es válido para el caso hospitalario, ya que en las organizaciones sanitarias la integración de las funciones administrativas y clínicas es mínima (Mc Ginnis et al., 2004). En esta última corriente de pensamiento se está considerando el factor de rechazo del personal hacia la integración de sistemas, ya que éste puede llegar a ser problemático puesto que la plantilla no siempre está dispuesta a incorporar cambios en sus rutinas de trabajo, al tiempo que tiene que asumir una supervision más cercana (Anderson 1997).

Por su parte, la integración parcial implica utilizar los modulos de ERP administrativos y financieros, conectándolos via interfaz con las aplicaciones clínicas tales como farmacia, radiología, laboratorio, etc. El enfoque de integración parcial resulta más acorde con la realidad existente en los hospitales en cuanto a implantación de los sistemas ERP, ya que cada unidad o servicio dentro de la organización utiliza sistemas y tecnologías diferentes (Imra et al. 2000, Khoumbati et al. 2006).

Si bien los sistemas ERP se han empleado para facilitar la integración entre todas las áreas dentro de una empresa (Muscatello et al. 2003, Klaus et al. 2000, Alshawi et al. 2004, Kansal 2006), en el caso particular de los hospitales los sistemas ERP ofrecen una solución parcial al problema de la fragmentación de la información (Muscatello et al. 2003).

En el entorno sanitario se están utilizando integraciones parciales para conseguir al menos la integración dentro del área económico-financiera. De acuerdo con las restricciones existentes en los hospitales para conseguir la integración de las distintas funciones, junto con la mencionada escasez de presupuesto en tecnologías de la información, característica del sector hospitalario, se puede concluir, que el porcentaje de implantación de nuevas tecnologías en los hospitales se mantiene por debajo de las implantaciones que se vienen efectuando en el sector industrial (Khoumbati et al. 2006).

Objetivos y estructura

En opinión de Mathieson (1991) los sistemas de información tienen el potencial de mejorar la actuación organizativa, pero únicamente si estos sistemas se utilizan realmente.

A pesar de las ventajas técnicas que una determinada herramienta tecnológica pueda ofrecer, su impacto en la organización dependerá en cualquier caso del grado de utilización que los individuos que componen la organización hagan de ella.

Es evidente que los sistemas de información, si no se utilizan, no pueden mejorar la actuación organizativa. El comportamiento de los usuarios es determinante a la hora de utilizar o infrautilizar un determinado sistema de información. La conducta de los empleados puede llegar a obstaculizar, en algunos casos, el logro de las expectativas establecidas con la implantación de nuevas tecnologías, e incluso condicionar, a nivel de una organización, la decisión de abordar un determinado proyecto de inversión en tecnologías de la información

La infrautilización de los sistemas de información, y la complejidad que ello implica en cualquier proyecto de implantación y posterior uso de nuevas tecnologías, ha emplazado a la comunidad científica a la búsqueda

e identificación de las variables que intervienen en el proceso de implantación de nuevas tecnologías, y que previsiblemente variarán con cada sistema, con cada individuo y para cada contexto.

Los hospitales públicos españoles representan un amplio sector de la economía y ocupan una posición consolidada e influyente a la hora de introducir nuevos sistemas y llevar a cabo la reingeniería de procesos que ello implica. Las peculiaridades del sector hospitalario público español, en los que la plantilla del personal se adscribe a la administración pública, ponen de manifiesto la necesidad profundizar en el conocimiento de los factores relacionados con la actitud de los usuarios hacia el uso de los sistemas ERP. El estudio de la influencia de estos factores permitirá una mayor concreción acerca de las acciones precisas para impulsar la adopción de esta herramienta por parte de potenciales usuarios en los hospitales.

La complejidad, inherente a la introducción de un sistema ERP en una organización, requiere obtener evidencia adicional acerca de la influencia de los factores culturales en la actitud de uso de las TI.

En general, el esfuerzo de la comunidad científica se ha dirigido principalmente a explorar los factores críticos relacionados con el éxito o fracaso de la implementación de los sistemas ERP (Berchet y Habchi 2005, Bingi et al. 1999, Finney y Corbett 2007, Muscatello et al. 2003, Nah et al.

2001, Santamaría-Sanchez et al. 2010). La mayor parte de los estudios sugieren que el fracaso de una implementación de un sistema ERP está relacionado con la actitud de los usuarios hacia el sistema (Umble at al. 2002), pero apenas consideran un número limitado de factores que influyen en la actitud hacia el uso y la aceptación de un sistema ERP (Sternad et al. 2011).

Conseguir que un sistema ERP funcione va más allá de la cuestión o experiencia tecnológica de los implantadores. Se trata de una interacción dinámica entre el sistema ERP y los diferentes grupos de la organización, tales como vendedores, consultores, y *stakeholders,* entre otros (Newman y Westrup 2005).

Resulta apropiado estudiar cuales son los factores críticos que explican tanto el fracaso inicial como el éxito final en la implementación de un sistema ERP (Akkermans y Helden 2002). El objetivo general de este trabajo es analizar aspectos relacionados con la actitud hacia el uso de sistemas ERP en hospitales públicos.

Este objetivo general se puede concretar en los siguientes objetivos específicos:

- Identificar cómo influyen las características personales de los usuarios y el apoyo organizativo en la actitud hacia el uso de sistemas ERP en hospitales públicos.

- Identificar cómo influyen los factores culturales en la actitud hacia el uso de sistemas ERP en hospitales públicos.

- Llevar a cabo una evaluación sistemática de una experiencia de integración de información en una organización sanitaria.

Para alcanzar estos objetivos, esta Tesis se estructura en cuatro capítulos. En el Capítulo 1, se lleva a cabo un análisis de la actitud que el personal sanitario mantiene hacia el uso de los sistemas ERP en un hospital público español, junto con la identificación de los factores que influyen sobre el uso de este tipo de sistemas en el entorno hospitalario. La investigación está basada en un análisis de regresión de las variables latentes, y utiliza la técnica de optimización de *Partial Least Squares*, al tiempo que aplica el modelo TAM de aceptación de tecnología, y propone un modelo de investigación basado en las relaciones entre los diferentes constructos. Los resultados del trabajo muestran que las características personales de los usuarios potenciales de un sistema de información determinado son críticas a la hora de explicar la actitud hacia el uso de los sistemas ERP en los hospitales públicos españoles.

En el Capítulo 2 se analiza el impacto de los factores culturales sobre la actitud de los usuarios hacia el uso del ERP en un hospital público, identificando aquellos aspectos críticos que influyen para que los usuarios utilicen el ERP. El marco teórico de este trabajo de investigación se fundamenta en el modelo TAM de aceptación de tecnologías. El modelo propuesto tiene seis constructos y nueve hipótesis que han sido generadas a partir de las conexiones entre los seis constructos. Los resultados, obtenidos mediante la técnica de optimización de mínimos cuadrados parciales, muestran que la resistencia al cambio puede ser un factor crucial en la implementación de los sistemas ERP en los hospitales. Además, la reticencia a ser controlado, la resistencia al cambio y los riesgos percibidos por parte de personal sanitario, deben ser gestionados de forma correcta para mejorar su actitud hacia estos sistemas.

El Capítulo 3 aborda la evaluación sistemática de una experiencia de integración de información en una organización sanitaria, atendiendo a las implicaciones que la misma conlleva. La investigación se ha desarrollado mediante un estudio longitudinal. La implantación del nuevo sistema en la organización sanitaria del sector público ha permitido automatizar y mejorar sus procesos, abriendo el paso hacia la integración de los procesos clínicos, organizativos y gerenciales.

Por último, el Capítulo 4 sintetiza las principales conclusiones obtenidas y sugiere posibles extensiones de esta investigación.

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CAPÍTULO 1

The role of users' personal characteristics and of organizational support in the attitude towards using ERP systems, based on an implementation in a Spanish public hospital

Abstract

ERP systems enable central and integrative control over all processes throughout an organization by ensuring one data entry point and the use of a common database. This paper analyses the attitude of healthcare personnel towards using an ERP system in a Spanish public hospital, identifying influencing factors. This research is based on a regression analysis of latent variables using the optimization technique of Partial Least Squares. We propose a research model including possible relationships among different constructs using the Technology Acceptance Model. Our results show that the personal characteristics of potential users are key factors in explaining the attitude towards using ERP systems.

Key words: ERP; TAM; innovation; acceptance processes; hospitals

Introduction

The worldwide economic recession is associated with budgetary reductions for healthcare organizations (Willard et al. 2012). The lack of public funds demands new action to maintain the quantity and quality of public healthcare services. A hospital manager should get the greatest output for the least input of effort, balancing all factors of care delivery better, to achieve the most with an optimal level of quality (Eastaugh 2010). In this context, Information Technologies (IT) play a very important role because of their ability to reduce costs and increase efficiency.

Although public health lags behind general healthcare and other industries in the adoption and implementation of IT (Burke & Evans 2003), public healthcare organizations are increasingly adopting new IT innovations that require coordinated use by many members of the organization (Helfrich et al. 2007). IT innovation is usually defined as the adoption of a new technology by individuals or organizations in relation to their technological environment (Becker & Whisler 1967). However, it has also been defined as the adoption of IT that is new to the organization adopting it (Aiken & Hage 1971). Therefore, the IT can have been previously used by other organizations as long as the idea has not previously been used by the adopting organization.

Advances in IT have significantly changed the way computerized information systems can be used in hospitals (Li & Collier 2000). Traditionally, IT aims to enhance both the quality and the efficiency of healthcare management (Chaudhry et al. 2006). However, IT can also enhance the dynamic capabilities of healthcare organizations (Leung 2012). For instance, Singh et al. (2011) specifically showed that IT enhances the ability of healthcare organizations to handle unexpected external events.

Hospitals are complex and multi-functional institutions which require sophisticated systems to integrate clinical and management functions. Some IT innovations in Spanish public hospitals focus on integrating data within the hospital environment by using Enterprise Resources Planning (ERP) systems. ERP systems enable central and integrative control over all processes throughout an organization by ensuring one data entry point and the use of a common database (Davenport 1998). In ERP systems, all the main business functions, such as finance and accounting, human resources, supply chain, sales and customer services, manufacturing and logistics, are combined into a single, integrated software platform, which runs over a shared database (Newman & Westrup 2005).

Two main approaches for integrating information in the hospital setting can be identified (Stefanou & Revanoglou 2006): the complete approach

and the partial approach (Figure 1). The complete approach is based on a single integrated modular programme encompassing clinical, administrative and financial data, such as patient admission and discharge information, the location of first aid kits, invoicing and pharmacy data, etc, using different applications. This approach gives a multi-functional perspective encompassing all areas of the business. Due to the integrated nature of the system, the same information is shared by different areas. This represents the re-engineering of processes, resulting in big organizational changes which affect both the way work is done and the way centralized information is controlled. Anderson (1997) considers that personnel reject these integrated systems, as they are normally reluctant to change their work routines, and feel that closer supervision might be problematical. Soh, Sia and Tay-Yap (2000) argued that this 'complete integration approach' to implementing ERPs is not entirely appropriate for hospitals because their research findings demonstrated significant misalignment between software functionality and organizational requirements due to particular characteristics of healthcare organisations. *Partial integration*using different modules, which are connected to each other so that data can be transferred between them. The ERP's administrative and financial modules are connected to other modules via a series of separate applications (e.g.radiology, laboratory).

Partial integration involves using different modules which are connected to each other so that data can be transferred between them. The ERP's administrative and financial modules are connected to other modules via a series of separate applications (radiology, laboratory, etc).

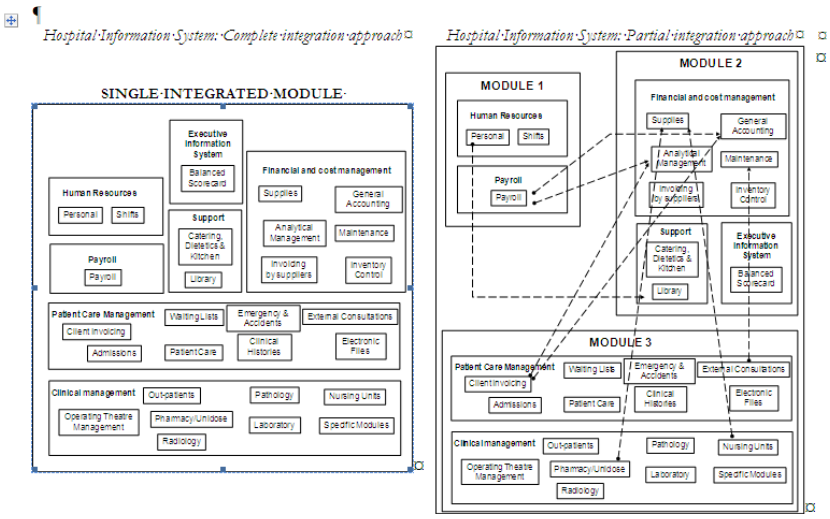

Figure 1. Complete and partial integration approaches

The current trend in the healthcare sector is to implement IT innovations which are focused on improving efficiency in hospitals. It has been argued that ERP is the most suitable type of information system for supporting the management of organizations like hospitals (Van Merode et al. 2004). This is related to the current trend in the healthcare sector of

implementing management strategies focused on improving efficiency in hospitals. Initially, processes of 'partial integration' were carried out, using the administrative and financial modules of ERP, and keeping specific applications for other areas. As a general rule, ERP systems have been employed to facilitate the integration of all functional areas within a company organization (Kansal 2006). In the case of hospitals, they are being used to achieve, as a minimum, the integration of planning within the financial area. ERP systems have been developed in response to the need to manage across global businesses, a difficult task that is even more difficult in organizations such as hospitals, where each business unit uses different systems and technologies (Imra et al. 2000).

ERP is an important software system in operations management, but ERP implementation affects technologies and people (Yusuf et al. 2006). IT cannot by itself influence the productivity of a company. The main efficiency factor lies in the way people use the technologies (Botta-Genoulaz et al. 2005). User attitude can be defined as a predisposition to respond favourably or unfavourably to a computer system or application (Melone 1990). Users may form attitudes towards using a system, which in turn influence their productivity through the quality or quantity of system usage and other important traits, such as job satisfaction and loyalty towards the organization (Nah et al. 2004). Therefore user attitude towards ERP systems is critical to the effectiveness and sustainability of

these innovations in hospitals (Ochieng & Hosoi 2006; Weiner et al. 2009).

User attitude towards ERP systems could depend on different factors, such as organizational support or users' personal characteristics. To improve the efficiency and effectiveness of ERP systems in hospitals, healthcare managers need to research the factors that affect users' attitude towards using these systems. In this field, the Technology Acceptance Model (TAM) is widely used for explaining IT users' affective and behavioural responses (Youngberg et al. 2009). Even though TAM can be applied to a variety of technologies, the constructs of TAM need to be extended by customizing factors for specific IT and sectors (Calisir et al. 2009). This research analyses the attitude of healthcare personnel in a Spanish public hospital towards using an ERP system, identifying influencing factors. Understanding these factors provides an opportunity to explore which actions might be carried out to boost adoption by potential users.

The remainder of the article proceeds as follows. The next section provides the theoretical background and posits the hypotheses. Research methods are provided next, followed by the reports of our findings and a discussion. Finally, the last section provides theoretical contributions and

managerial implications along with a discussion of some of the limitations of the findings.

Conceptual framework and hypotheses

Background

The aim of previous research has focused on exploring critical factors related to the success and failure of an ERP implementation process (Berchet & Habchi 2005; Bingi et al. 1999; Finney & Corbett 2007; Muscatello et al. 2003; Nah et al. 2001; Santamaría-Sánchez et al. 2010). These critical factors include top management support, user training and education, change management, business process re-engineering and effective communication (Bradford & Florin 2003; Finney & Corbett 2007; Gargeya & Brady 2005; Ngai et al. 2007; Ragothaman 2012).

These critical success factors are helpful and appropriate in explaining both an initial failure and an eventual success of the implementation (Akkermans & van Helden 2002). However, making an ERP system work is more than an issue of technical expertise or social accommodation: it is an ongoing, dynamic interaction between the ERP system, different groups in the organization, and external groups, such as vendors, management consultants and shareholders (Newman & Westrup 2005). ERP systems might be implemented successfully from a technical

perspective, but success depends on the attitudes of the ERP users towards using the system (Kwahk & Kim 2007; Kwahk & Lee 2008).

Therefore, a number of studies have been carried out to identify factors related to ERP system acceptance. Ramayah and Lo (2007) examined the impact of shared beliefs concerning the benefits of an ERP system. Their findings support the view that the perceived ease of use partially mediates the effects of shared beliefs concerning the usefulness of the ERP. Amoako-Gyampah and Salam (2004) found that both training and project communication influence the shared beliefs that users form about the benefits of ERP systems, and that the shared beliefs influence the perceived usefulness and ease of use of this technology. Bueno and Salmerón (2008) analysed the influence of top management support, communication, co-operation, training and technological complexity in ERP system acceptance.

Other factors related to the predisposition of users to new technology have been considered. For instance, Shivers and Charles (2006) found that readiness for change is a significant predictor of attitude towards using the ERP system. Lee et al. (2010) examined the impact of organizational support on behavioural intention regarding ERP implementation. Recently, Sternad et al. (2011) examined a wide range of external factors that could influence the intention to use an ERP system. Technological

innovativeness, computer anxiety, computer self-efficacy, computer experience, data quality, system performance, user manual helpfulness, ERP functionality and business processes fit, social influence, ERP support, ERP communication and ERP training were factors included in this study, and the authors found some influences of these factors on the attitude towards using an ERP system.

In the healthcare sector, healthcare managers during recent decades have been trying to maximize the efficiency of hospitals without reducing the quality of the healthcare services provided to patients (Pizzini 2006). This imperative has been reinforced in recent years, as a consequence of the lack of available public resources for meeting the ever-increasing demand for healthcare services, by using information systems such as ERP systems.

Hospital information systems are usually heterogeneous and autonomous (Khoumbati et al. 2006). Therefore, integrated management systems could be applied to improve the efficiency of the hospital sector. These integrated systems would help to improve hospitals' processes and reduce operating costs (Alshawi et al. 2004; Berchet & Habchi 2005; Kansal 2006; Van Merode et al. 2004). In particular, such systems are becoming an essential part of modern healthcare systems, and they are considered as a

type of enterprise information system or ERP system which addresses the needs of the healthcare sector (Duan et al. 2011).

It is not easy to deal with this integration process in hospitals because of their organizational issues. The major problems that arise in most ERP adoptions do so because of organizational issues, for example social and cultural barriers, and user resistance, rather than technical issues (Pan et al. 2007). Furthermore, the business processes of a company are often substituted for the business processes implemented in the ERP (Portougal 2005). In hospitals, ERP systems are welcomed by personnel as long as they provide direct benefit to their work and ease their work practices (Nicolau 2004). Nevertheless, previous literature yields little about the attitude of ERP users in hospitals that contributes to a wider understanding of ERP in this context.

TAM and hypotheses

TAM (Davis et al. 1989) is a highly economical, predictive and robust theoretical framework to explain the intention to use IT (Liu & Ma 2006), and it is commonly applied in IT research (Lee et al. 2010). TAM proposes two important determinants for analysing what causes people to accept or reject IT: perceived usefulness and perceived ease of use. Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance.

On the other hand, perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort.

-TAM has been tested primarily on the adoption of technologies that are relatively simple to use in environments in which adoption was voluntary (Brown et al 2002). ERP systems, however, are implemented in organizational settings and are very complex to use (Nah et al. 2004). Further review of the literature revealed that recent research has expanded on the acceptance of technology, especially in an organizational context in which the technology is mandatory such as public hospitals. Several researchers have recommended that TAM be revised to address user attitude, intent and behaviour when applied to complex IT in organizational settings where usage is generally considered mandatory (Nah et al. 2004). Because ERP users have an impact on other people, they cannot choose to avoid the system, regardless of their attitude towards the ERP system (Sternad et al. 2011). Therefore, following Nah et al. (2004), we analyse users' attitudes towards using an ERP system by looking at their voluntary mental acceptance of the system in a Spanish public hospital (Figure 2).

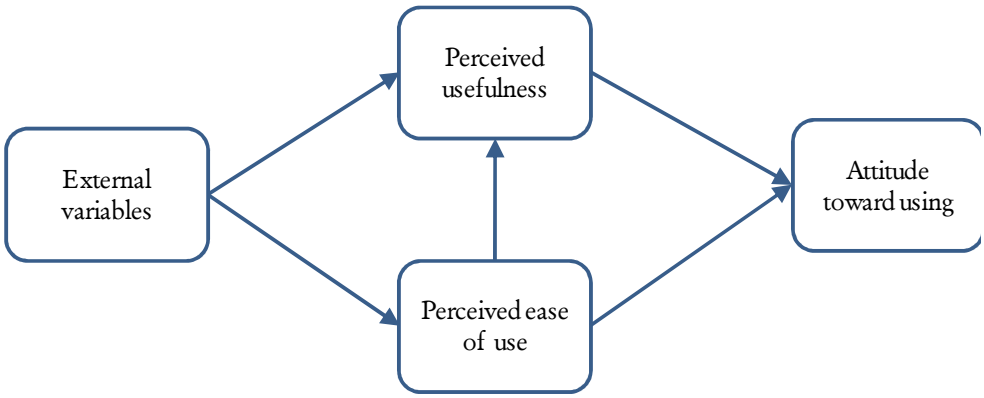

Figure 2. Technology Acceptance Model (Davis et al. 1989).

According to Davis et al. (1989), perceived ease of use and perceived usefulness exert their influence on individuals' attitudes towards using a system as follows: if individuals perceive a system to be useful for their jobs or to be easy to use, if they see the system performing its tasks well, and if the results are discernible and match the individuals' goals, then the individuals tend to have a more positive attitude towards using the system. Consequently, our model hypothesizes the following:

H1. Perceived ease of use has a significant effect on the perceived usefulness of ERP systems.

H2. Perceived ease of use has a significant effect on the attitude towards using ERP systems.

H3. Perceived usefulness has a significant effect on the attitude towards using ERP systems.

This study includes a number of external factors to help to examine the attitude toward using ERP systems in a Spanish public hospital. We placed these external factors into two groups: one representing users' personal characteristics and the other representing organizational support.

External factors in the first group include two constructs: the user's prior experience of IT and the user's age. Previous studies have demonstrated that experience with computers and age influence a user's attitude towards using computers (Shoham & Gonen 2008).

The experience level of potential users could be a key factor influencing the attitude towards using the IT. Messineo & DeOllos (2005) found that experience level is key to the success of the IT. Jiang et al. (2003) found evidence that experience needs to be incorporated into the model in order to realize the relationship of experience to the success of the system. Therefore, experience with computers seems to be an important factor for the acceptance of the technology in this Spanish public hospital (Calisir et al. 2009; Venkatesh & Bala 2008). The next hypotheses can be stated:

H4. The level of experience in the use of computers has a significant effect on the perceived usefulness of ERP systems.

H5. The level of experience in the use of computers has a significant effect on the perceived ease of use of ERP systems.

An ERP system is a disruptive technology that may be shunned by potential users (Quattrone & Hopper 2005). The alignment of the standard ERP processes with the company's business processes has, for a long time, been considered to be a critical step in the implementation process (Botta-Genoulaz et al. 2005). This is because process re-engineering is frequently linked with ERP implementations (Wenrich & Ahmad 2009). Potential users are faced with acquiring new IT skills on a steep learning curve (Thuemmler et al. 2009), which is not always in line with the way they usually work. Sometimes, some older users do not perceive the technology to be useful if it does not fit with the way they like to work. On the other hand, younger users tend to find it easy to use new IT because they have a high IT learning rate and, sometimes, they find the change in IT change gives them an opportunity to be promoted. We can state these two hypotheses:

H6. Younger users perceive the usefulness of ERP systems to be higher.

H7. Younger users perceive the ease of use of ERP systems to be higher.

The second group of external factors deals with organizational support. It includes ERP training and ERP support. ERP training is defined as the degree to which users think that they have had enough formal and informal training during and after ERP implementation. The effective

implementation of IT innovation often requires hefty investments of time and money in technology start-up, training, and user support (Katherine & Knight 2005). Training provided to potential users can have a significant influence on the perceived ease of use and perceived usefulness of the ERP system (Bradley & Lee 2007). Training can facilitate learning processes and illustrate the relative advantages of the technology, in order to improve attitudes towards using it in hospitals (Robinson et al. 2005). Consequently, we state the following two hypotheses:

H8. ERP training has a significant effect on the perceived usefulness of ERP systems.

H9. ERP training has a significant effect on the perceived ease of use of ERP systems.

The availability of various types of support services should lead to a greater understanding of a particular technology's potential, and may enhance the users' expectations of the usefulness of the technology (Carr et al. 2010). ERP support means that there is an adequate support service for ERP users (Lee et al. 2010), and it could affect the perceived usefulness and ease of use of the system in this Spanish public hospital. Thus, the last group of hypotheses is:

H10. ERP support has a significant effect on the perceived usefulness of ERP systems.

H11. ERP support has a significant effect on the perceived ease of use of ERP systems.

Figure 3 shows the proposed model including possible relationships among different constructs.

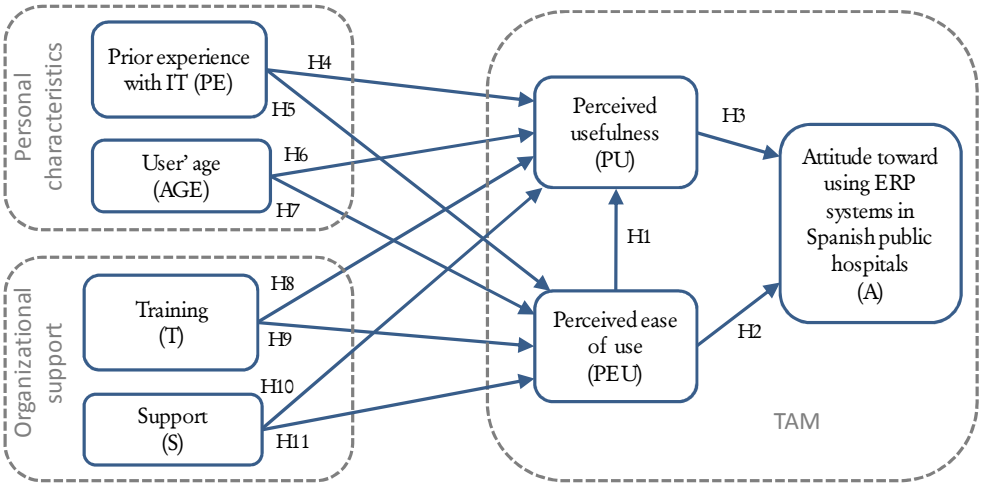

Figure 3. The research model

Method

A field survey was employed to test our research model. The study was carried out in a Spanish Hospital Foundation (hereinafter FHM) located in Madrid. Its Hospital Information System (HIS) is a set of procedures and functions directed towards the collection, production, assessment, storage, recovery, and distribution of items of information within the

organization, and is oriented towards promoting the flow of these items from the points where they are generated to the final intended recipients. The HIS comprises 3 modules with the following functions:

- Module 1: Human Resources (Personnel Management and Management of Shifts) and Payroll.
- Module 2: Financial & Cost Management (Supplies, General Accounting, Analytical Management and Management of Costs, Payment of Suppliers' Invoices, Inventory Management and Maintenance), Supporting Services (Catering, Dietetics and Kitchen) and Executive Information System.
- Module 3: Patient Care Management (Admission of in-patients, Waiting lists, Emergencies and Emergency Boxes, External Consultations, Electronic Clinical History, Invoicing to the Customer), and Clinical Management (Management of Operating Theatres, Radiology, Out-patients, Ward Control Points, Control Infrastructure, Generation of Medical Reports, Pharmacy, Pathology and Nursing Units, Document Manager, Medical Protocols, Laboratory).

Partial integration involves the ERP's administrative and financial modules (Module 2), connecting them via a series of specific applications (Figure 1). The ERP software that had been chosen for Module 2 was SAP

R/3. SAP R/3 is an immensely powerful but notoriously complex system. The selection of SAP R/3 for Module 2 was well documented, and its implementation has generally been portrayed as successful. In this paper, we seek to explore the attitude in this Spanish public hospital towards using SAP R/3, and to determine in more depth the impact of the personal characteristics of the users and the organizational support.

The study took place among all SAP R/3 users in FHM. Data were collected in September 2011. Almost all ERP users participated in this research. The response rate was over 80%, with a total of 59 valid replies collected. The questionnaire had several items related to each of the constructs included in the model. The survey items were measured using a seven-point Likert scale. All items ranged from 1 (strongly disagree) to 7 (strongly agree). Theoretical constructs were operationalized using validated items from prior research. Perceived ease of use, perceived usefulness and attitude toward using SAP R/3 in FHM were measured using items adapted from Davis (1989, 1993), Davis et al. (1989) and Mathieson (1991). The measures for the "Training" and "Support" items drew their inspiration from Bramble et al. (2010) and Carr et al. (2010).

This research is based on a regression analysis of latent variables using the optimization technique of Partial Least Squares (PLS) to develop a model that represents the relationships between the seven proposed constructs

measured by many items. The PLS is a multivariate technique to test structural models (Wold 1985), and it offers the advantage of allowing the entire research model to be tested at once. The PLS method estimates the model parameters which minimize the residual variance of the whole model dependent variables (Hsu et al. 2006), does not require any parametric conditions (Chin 1998) and is recommended for small samples with non-normal data (Hulland 1999).

These PLS characteristics are different from those of the Structural Equations Models based on covariance analysis, which require big samples due to the sensitiveness of the Chi-square test. Basically, the objective of the PLS modelling is to predict dependent variables, latent and manifest, maximizing the explained variance of the dependent variables and minimizing the residual variance of the endogenous variables (Lévy et al. 2009). The PLS method is oriented more to the predictability of the model (Chin & Frye 2003) and the stability of the estimates will be measured by the Student T statistic, issued from a bootstrapping made over random samples (Efron & Gong 1983).

Data analysis and Results

Data analysis was conducted by using VisualPLS v.1.04 and carried out in accordance with a two-stage methodology where the measurement model is developed and evaluated first, separately from the full structural

equation model (Gerbing & Anderson 1988). Accordingly, the first step was to establish the convergent and discriminant validity of the constructs. The convergent validity of each construct is acceptable if the

Construct	Indicator	*Strongly disagree* 1	2	3	*Neither agree/ disagree* 4	5	6	*Strongly agree* 7	Loading
Prior experience with IT (PE)	What is your previous professional experience related with information technologies? (years) (1) None, (2) <5, (3) 6-9, (4) 10-14, (5) 15-19, (6) 20-24, (7) >25.	8.47	45.76	27.12	16.95	0.00	0.00%	1.69%	1.000
Users' age (AGE)	How old are you? (years) (1) <25, (2) 25-34, (3) 35-44, (4) 45-54, (5) 55-59, (6) 60-64, (7) >65.	15.25	28.81	20.34	10.17	15.25	10.17	0.00	1.000
Training (T)	The kind of training provided to me about the ERP system was complete.	6.78	3.39	10.17	27.12	27.12	22.03	0.00	0.967
	My level of understanding about the ERP system was substantially improved after going through the training program.	6.78	3.39	10.17	27.12	28.81	20.34	0.00	0.962
	The training gave me confidence in the ERP system.	8.47	3.39	11.86	20.34	30.51	23.73	0.00	0.849
Support (S)	It is important to have on-site support from my ERP supplier.	3.39	6.78	3.39	6.78	30.51	25.42	23.73	0.972
	It is important to have on-line support from my ERP supplier.	3.39	6.78	3.39	10.17	27.12	28.81	20.34	0.971
	It is important to have support manuals and reference materials for users of ERP systems.	1.69	8.47	3.39	11.86	20.34	30.51	23.73	0.841
Perceived usefulness (PU)	Using ERPs improve my job performance.	5.08	11.86	5.08	11.86	37.29	22.03	6.78	0.911
	ERPs support critical aspect of my job.	0.00	20.34	1.69	10.17	32.20	28.81	6.78	0.928
	Using ERPs allows me to accomplish more work than would otherwise be possible.	5.08	11.86	5.08	6.78	28.81	35.59	6.78	0.938
Perceived ease of use (PEU)	I do not become confused when I use ERPs.	20.34	5.08	0.00	11.86	27.12	20.34	15.25	0.927
	I do not make errors when using ERPs.	15.25	10.17	0.00	10.17	15.25	22.03	27.12	0.939
	Interacting with ERPs is easy.	16.95	5.08	3.39	8.47	11.86	38.98	15.25	0.952
Attitude toward using (A)	Using ERPs is a good idea.	1.69	8.47	3.39	6.78	18.64	27.12	33.90	0.899
	Using ERPs is pleasant.	3.39	8.47	1.69	10.17	25.42	27.12	23.73	0.886
	Using ERPs is beneficial.	1.69	8.47	3.39	11.86	20.34	33.90	20.34	0.906

Table 1. Items percentages per categories and loading

loading is higher than 0.505 (Falk & Miller 1992). Table 1 shows that all variables comply with the established conditions, and it presents the percentages per category.

Reliability makes it possible to measure the internal coherence of all the indicators in relation to the constructs. To verify the reliability of each

indicator, the Cronbach alpha coefficient (Cronbach 1970) and the composite reliabilities coefficient (Werts et al. 1974) were utilized, each ranging from 0 (no homogeneity) to 1 (maximum homogeneity). Both parameters are taken into account, as the first considers the contribution made by each indicator to the construct, while the second takes the loading of each item into account. Table 2 indicates the values of each coefficient. Composite reliabilities are over the minimum acceptable limit of 0.70 (Gefen et al. 2000; Nunnally 1978). The Cronbach alpha coefficient levels are also shown in Table 2. They were all above 0.70, which is recommended for confirmatory research (Churchill 1979). The constructs "PE" and "AGE" do not need to fulfil this last condition: we do not need to measure their internal coherence because they have only one item. Table 3 describes the correlation of latent variables.

Construct	Composite Reliability	AVE	Cronbach Alpha
PE	1.000	1.000	-
AGE	1.000	1.000	-
T	0.948	0.860	0.917
S	0.950	0.865	0.920
PUE	0.947	0.857	0.916
PEU	0.958	0.882	0.933
A	0.925	0.804	0.878

Table 2. Composite reliability, AVE and Cronbach alpha coefficient

	PE	AGE	T	S	PUE	PEU
AGE	0.007	-	-	-	-	-
T	0.007	-0.383	-	-	-	-
S	0.002	-0.373	0.496	-	-	-
PUE	0.289	-0.631	0.593	0.591	-	-
PEU	0.257	-0.338	0.301	0.608	0.448	-
A	0.053	-0.418	0.458	0.450	0.320	0.300

Table 3. Correlation of latent variables

After individual item reliability and convergent and discriminate construct validity have been established, the structural model is examined. To test hypotheses H1 to H11, a PLS analysis was performed. Regression coefficients are based on a bootstrapping of 100 samples (Efron & Gong 1983) and not on a samples estimator. This permits the generalization of the results and the computation of the t-value for each hypothesis (Lévy et al. 2009). The results are presented in Figure 4 and Table 4 summarizes the relationships between the different constructs. The predictive capability of the model is satisfactory because all R-Squares are higher than 0.10 (Falk & Miller 1992).

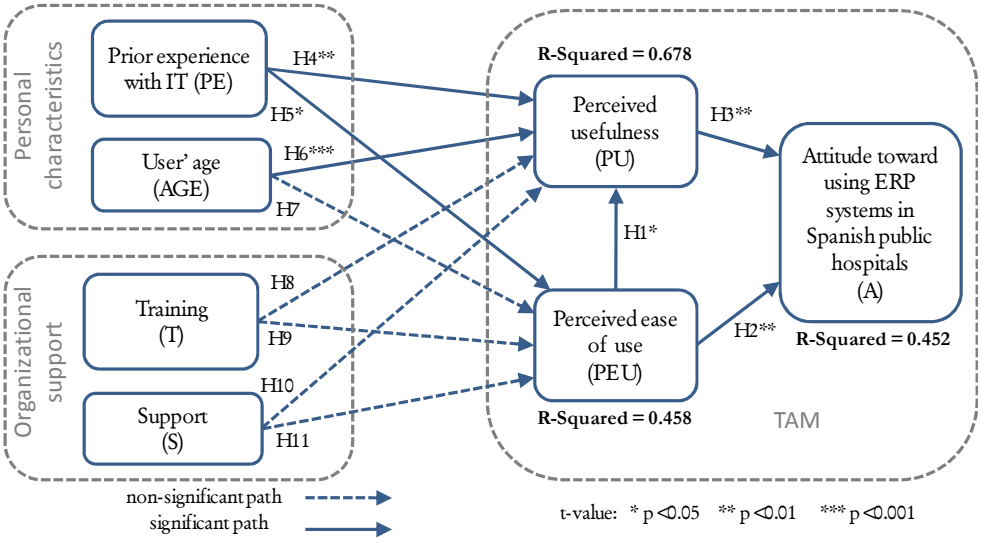

Figure 4. Results of the testing model

Hypothesis	Path	Standardized path coefficient	t-value	Supported?	Construct	R-Squared
H1	PEU→PU	0.292	2.1834	Yes (*)	Perceived usefulness	0.678
H4	PE→PU	0.217	2.7554	Yes (**)		
H6	AGE→PU	-0.442	-3.6888	Yes (***)		
H8	T→PU	-0.061	-0.0945	No		
H10	S→PU	0.309	0.4525	No		
H5	PE→PEU	0.262	2.2085	Yes (*)	Perceived ease of use	0.458
H7	AGE→PEU	-0.144	-1.2335	No		
H9	T→PEU	-0.963	-0.9403	No		
H11	S→PEU	1.513	1.3065	No		
H2	PEU→A	0.341	2.7026	Yes (**)	Attitude toward using	0.452
H3	PU→A	0.399	3.2235	Yes (***)		

Table 4. Summary of test results for the structural model

(* p<0.05; ** p<0.01; *** p<0.001)

Discussion and conclusion

TAM has been extended in this study, through the addition of users' personal characteristics and organizational support, in the context of the attitude towards using ERP systems in this Spanish public hospital. The findings above suggest that TAM is a valid model which can be used to predict the attitude of healthcare personnel towards using these systems.

This study confirms the three hypotheses in the proposed model based on three basic relationships set up in TAM. TAM suggests that there is a significant positive relationship between perceived ease of use and perceived usefulness. Based on our research model, this hypothesis (H1) is supported. Our results also support the relationship between perceived ease of use and attitude towards using ERP systems (H2). In similar results to those found in the literature, our results indicate that perceived usefulness has a positive and significant relationship with attitude towards using ERP systems (H3). Therefore, this paper validates in this healthcare organization the existing research results involving ERP systems.

Personal characteristics of ERP users seem to be really important for explaining users' attitude towards using ERP systems. We noted a significant relationship between prior experience with IT and perceived usefulness (H4). A significant relationship between prior experience with IT and perceived ease of use was also found (H5). Thus, this is the most relevant variable for explaining users' attitude.

Technological experience proved to be key in explaining the attitude towards using the ERP in this Spanish hospital. When people have experience in using specific IT, they will tend to know its functions and how to use it, therefore becoming more familiar with it. It has been suggested that knowledge acquired from past behaviour will help to shape attitudes towards using new IT. More importantly, there may be differences between experienced and inexperienced users in their attitude and intention to use ERP systems in FHM.

From a practical point of view, these two significant relationships highlight the role of previous experience with IT in attitude towards using IT, and they should be noted by healthcare technology developers. During the development and implementation process, technology developers and implementation teams might consider this variable as a key factor influencing the acceptance of ERP systems by healthcare personnel.

The age of users has been identified as another relevant external variable influencing the attitude towards using ERP systems. We found that age influences the perception of the usefulness (H6) of ERP systems. This relationship shows that younger users in this Spanish public hospital are more likely to perceive ERP systems to be useful. This is a significant result. As older workers may begin to feel inferior in their respective work environments for a multitude of reasons (including technological obsolescence), these feelings may translate into work habits and patterns which are difficult to change. However, the relationship between age and perceived ease of use (H7) is not supported.

Contrary to other research papers (Carr et al. 2010), we have not found any significant relationship between organizational support variables and perceived usefulness/ease of use. The relationships between these variables (H8, H9, H10, and H11) are not supported. Therefore, the training and support programmes did not modify the attitude toward using ERP systems in this hospital. The main reason could be that training and support programmes were not as good as they should have been.

An ERP system is not easy to use. It requires training prior to use, as it is rigid and not user-friendly, in contrast to other healthcare IT systems which are fairly simple to use or are familiar to healthcare personnel. The company setting up the SAP R/3 originally committed to providing some training courses to familiarize staff with the use of the new system. The courses were broken down into modules, and were given to people in intermediate positions who could train their subordinates. Some ERP users received courses in just one day! Although for those personnel with a limited numbers of simple tasks one day may be sufficient, these people do not have an idea of what an ERP really is and how important the data they are providing to the system are for the whole organization. The personnel lack an overall vision of the information system, and this might be due to a lack of training about the true implications of an ERP system in FHM. Therefore, the lack of training in this case did not improve the attitude towards using the ERP system.

Some training courses which had been envisaged did not take place as expected, and the opportunity to get a better acceptance of this IT was lost. Support programmes had similar problems. If this core process of training and support programmes is under-performing, it is highly likely that the attitudes of many healthcare personnel will also not be ideal.

In addition to the theoretical contribution, the research model suggests important practical implications for improving the attitude towards using ERP systems, and develops an understanding about the acceptance process for this IT in hospitals. This research can be used to direct hospitals towards successful paths for supporting the implementation of ERP systems. In this regard, based on our findings, the following recommendations to hospitals could be pointed out. During the development and implementation process of ERP systems, technology developers and implementation teams might consider the personal characteristics of potential users. This is one key factor for improving the attitude towards using them. Training and support programmes should be properly designed and put into action. These programmes could cost a lot of money, but they will be ineffective if they are not focused on enhancing the perceived usefulness and ease of use of the ERP system.

Further research might investigate the importance of influences such as national differences and the role of technology in hospitals as predictors

of perceived ease of use and usefulness. It would also be interesting to analyse this problem in the light of other theories such as social exchange theory or social network theory. A social relationship refers to a relationship between different members of an organization. These social theories could better explain the social changes that happen in a hospital during an ERP implementation process, as well as the attitude and behaviour of ERP users as part of an organization. Furthermore, the same variables could be measured over time to capture the dynamic nature of the research model.

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CAPÍTULO 2

THE INFLUENCE OF CULTURAL FACTORS ON ATTITUDE TOWARD USING ERP SYSTEMS IN PUBLIC HOSPITALS

Abstract

The major problems arise in most ERP adoptions because of organizational rather than technical issues, for example social and cultural barriers, and user resistance. This paper analyzes the impact of cultural factors on the users' attitudes toward ERP use in public hospitals identifying influencing factors. The theoretical grounding for this research is the TAM. The proposed model has six constructs ("resistance to be controlled", "resistance to change", "perceived risks", "perceived usefulness", "perceived ease of use", and "attitude toward using") and nine hypotheses have been generated from the connections between these six constructs. Results suggest important practical implications for attitude toward using ERP and develop an understanding about how to improve this attitude in hospitals.

Resumen

La mayor parte de los problemas que surgen en la implantación de sistemas ERP tienen su origen en causas de tipo organizativo más que en causas técnicas, como por ejemplo, las barreras sociales o culturales y la resistencia por parte de los usuarios. Este trabajo analiza el impacto de factores culturales sobre la actitud hacia el uso de sistemas ERP en un hospital público. El marco teórico empleado es el modelo de aceptación tecnológica (TAM). El modelo propuesto consta de seis constructos

("resistencia a ser controlado", "resistencia al cambio", "riesgo percibido", "facilidad de uso percibida", "rendimiento percibido", y "actitud hacia el uso") y nueve hipótesis, que han sido generadas a partir de las conexiones entre los constructos. Los resultados sugieren importantes implicaciones prácticas respecto a la actitud hacia el uso de sistemas ERP y cómo mejorar esta actitud en los hospitales.

Keywords

Information and Communication Technology; Technological Change; Technological Innovation; Employee Participation; Health.

Palabras clave

Tecnologías de la información y comunicación; Cambio tecnológico; Innovación tecnológica; Participación de los empleados; Servicios sanitarios.

1. Introduction

During the last decades health care managers try to maximize hospitals' efficiency, without reducing the quality of health care services provided to the patients (Calzado et al. 1998; Escobar et al., 2014; Herwartz and Strumann, 2014; Pizzini, 2006). This imperative has been reinforced in recent years as a consequence of the lack of available public resources for meeting the ever-increasing demand for health care services.

Hospital information systems are usually heterogeneous and autonomous (Khoumbati et al., 2006). However, to improve the efficiency of the hospital sector, it has been proposed that integrated management systems should be applied in these health care organizations. These integrated systems would help to improve hospital' processes and reduce operating costs (AECA, 2014, Alshawi et al., 2004; Berchet and Habchi, 2005; Kansal, 2006, Van Merode et al., 2004).

The behaviour of health care personnel in relation to the management of information is directly related to their status as primarily clinical rather than administrative personnel. The clinical personnel constitute a power group that, informally, exerts considerable influence in the management decisions taken within the hospital (Bloom, 1991; Soh and Sia, 2004). As a consequence of the power structure existing in hospitals, information is usually fragmented between clinical and non-clinical topics or areas,

which can make the use of integrated management systems difficult or impossible.

The control of information is sometimes used to legitimize and maintain the structures of power existing in an organization (Escobar et al., 2010). To prevent this phenomenon, information systems can be employed to redistribute power among the different members of the organization (Abernethy and Vanoni, 2004). The implementation of new information systems in a hospital represents a possible vehicle for the transformation of a "de facto" power structure into a different, more formal kind of power structure, by involving all the personnel, clinical and non-clinical, in the functions of management and supervision of the diverse activities of the hospital (Ribeiro and Scapens, 2006; Scapens and Jazayeri, 2003).

However, it must be recognised that the introduction of new information systems in a hospital has a direct impact on the behaviour of the clinical personnel in relation to the acceptance of information technologies (Khoumbati et al., 2006, Mc Ginnis et al., 2004; Pizzini, 2006). In this context, Soh and Sia (2004) emphasized the influence that power groups exert over the implementation of information systems. Thus, on occasions even non-compatible software packages are adopted in function of the specific context of each hospital (Escobar et al., 2010).

There are two main approaches for integrating information in hospitals: complete and partial (Stefanou and Revanoglou, 2006). The complete approach is based on a single integrated module program encompassing clinical, administration, and financial data using different applications, such as patient sign-in and discharge information, the locations of first aid kits, invoicing and pharmacy data, etc. Anderson (1997) considers that personnel reject these integration systems, as they are normally reluctant to change their work routines, and feel that closer supervision might be problematical. Organizational routines that reflect institutionalized practices are slow to change and such changes often face resistance (Granlund and Malmi, 2002). Soh and Sia (2004) argues that this approach to implementing ERPs is not valid for hospitals. Conversely, management consider this integration approach to be efficient, and that its cost is offset by its benefits (Stefanou, 2001). Partial integration involves using the ERP's administrative and financial modules, connecting them via a series of specific applications (radiology, laboratory, etc.).

The current trend in the health care sector is to implement management strategies focused on improving efficiency in hospitals. It has been argued that ERP is the most suitable type of information system for supporting the management of organizations like hospitals (Escobar et al., 2010; Van Merode et al., 2004). Initially, processes of "partial integration" are being carried out, using the administrative and financial modules of ERP, and

keeping specific applications for other areas. As a general rule, ERPs have been employed to facilitate integration among all functional areas within a company organization (Muscatello et al., 2003; Klaus et al., 2000; Alshawi et al., 2004; Davenport, 1998, Kansal, 2006). In the case of hospitals, they are being used to achieve, as a minimum, the integration of planning within the financial area. ERPs have been developed in response to the need to manage across global businesses, a difficult task made more so in organizations such as hospitals, where each unit business is using different systems and technologies (Imra et al., 2000).

It is not easy to deal with this integration process in hospitals because of their organizational issues. The major problems arise in most ERP adoptions because of organizational rather than technical issues, for example social and cultural barriers, and user resistance (Pan et al., 2007). In hospitals, ERP systems are welcomed as long as they provided direct benefit to their work and eased their work practices (Escobar et al., 2010, Nicolau, 2004). At the same time, hostile reactions toward the ERP system were evident since it implied control mechanisms of their work and introduced new work tasks previously performed by others (Jensen and Aanestad, 2007). These hostile reactions could be strong in Spanish public hospitals. In Spanish public hospitals, health care personnel are public servants with permanent contracts, so it is very important to

analyze their attitude toward using new technologies because they are in a very strong position to hinder new systems and process re-engineering.

The aim of previous research has focused on exploring critical factors related to success and failure of the ERP implementation process (Berchet and Habchi, 2005; Bingi et al., 1999; Finney and Corbett, 2007; Muscatello et al., 2003, Nah et al., 2001, Santamaría-Sánchez et al., 2010). However, a deeper knowledge of factors related with attitude toward using ERP systems in hospitals is required. The main objective of this paper is to analyze the impact of cultural factors on the attitude toward using ERP systems in public hospitals identifying influencing factors. Cultural factors that have been included in this paper refer to organizational culture. Organizational culture can be defined as the general pattern of mindsets, beliefs and values that members of the organization share in common, and which shape the behaviours, practices and other artifacts of the organization which are easily observable (Prajogo and McDermott, 2005; Sathe, 1985; Schein, 1985). Understanding these factors provides the opportunity to explore which actions might be carried out to boost adoption by potential users.

Technology Acceptance Model (TAM) (Davis, 1989, 1993) is generally used to analyze individuals' acceptance of new technologies (Cornell et al., 2011; Dasgupta et al., 2002) and has become established as a robust,

powerful and parsimonious model for predicting attitude toward using (Hu et al., 1999, Venkatesh and Davis, 2000). Apart from the aforementioned aims, our analysis will validate TAM in the context of Spanish public hospitals while also identifying new external variables which affect the constructs of perceived usefulness, perceived ease of use, and attitude toward using.

The remainder of the paper proceeds as follows. In the next section, we provide a theoretical background and posit the hypotheses. We then describe our research methodology and present data analysis and results. We then conclude, discussing implications for future research.

2. Background

2.1. Technology Acceptance Model

TAM specifies the causal relationships between systems design features, perceived usefulness, perceived ease of use and attitude toward using (Davis, 1993). The basic premise of this model is that the more accepting users are of new systems, the more they are willing to make changes in their practices and use their time and effort to actually start using the system (Jones et al., 2010).

TAM proposes two important determinants to analyze what causes people to accept or reject information technology (IT): perceived usefulness and perceived ease of use. Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance. On the other hand, perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort (Davis et al., 1989) (figure 1).

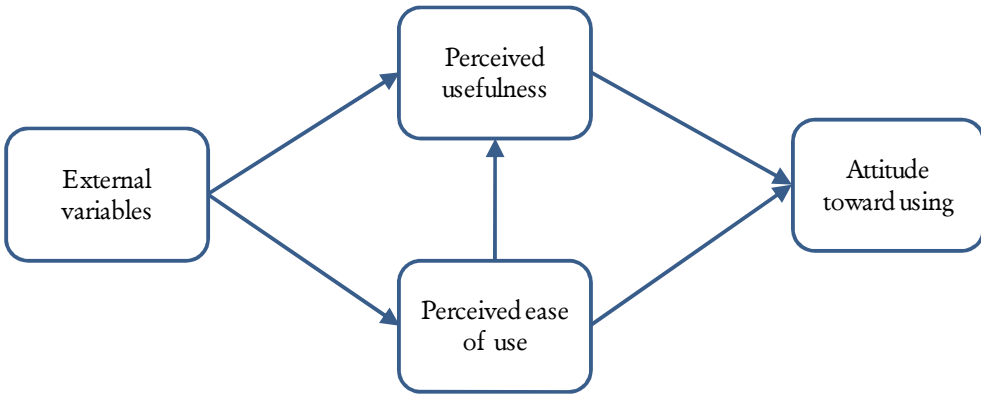

Figure 1. Technology Acceptance Model

TAM addresses the issue of how users accept and use a technology (Teo and Noyes, 2011). Several papers have demonstrated the usefulness of TAM for analyzing user behaviour as well as intention of use of a wide range of IT (Chin and Gopal, 1995; Igbaria et al., 1996; Gefen and Straub, 1997; Hu et al., 1999; Chau and Hu, 2002).

Significant progress has been made over the last decades in explaining and predicting user acceptance of IT. In particular, substantial theoretical and empirical support has accumulated in favour of the TAM and this model compares favourably with alternative models such as the Theory of Reasoned Action and the Theory of Planned Behaviour (Venkatesh, 1999; Venkatesh and Davis, 2000).

During the last two decades TAM has been used to predict user acceptance of a technology. This model has been used to explain intention

of use by different types of users, including an analysis of the conditions in which technology is used (Venkatesh, 2000), gender aspects (Gefen and Straub, 1997; Venkatesh and Morris, 2000), and cultural factors (Teo et al., 2008).

A number of studies have been carried out in the context of ERP using TAM, often with significant results. Ramayah and Lo (2007) examined the impact of shared beliefs concerning the benefits of ERP. Their findings support that perceived ease of use mediate partially the effects of shared beliefs concerning the usefulness of the ERP. Amoako-Gyampah and Salam (2004) found that both training and project communication influence the shared beliefs that users form about the benefits of ERPs and that the shared beliefs influence the perceived usefulness and ease of use of this technology.

Bueno and Salmerón (2008) analyzed the influence of top management support, communication, cooperation, training and technological complexity in ERPs acceptance. Other factors related with user predisposition to new technology have been considered. For instance, Shivers and Charles (2006) found that readiness for change is a significant predictor of attitude toward usage of the ERP.

Lee et al. (2010) examined the impact of organizational support on behavioural intention regarding ERP implementation based on TAM.

They found that this is an important factor for perceived usefulness and perceived ease of use. Recently, Sternad et al. (2011) examined a wide range of external factors that could influence the intention to use an ERP. The factors technological innovativeness, computer anxiety, computer self-efficacy, computer experience, data quality, system performance, user manual helpfulness, ERP functionality business processes fit, social influence, ERP support, ERP communication and ERP training were included in this study using TAM, finding some influences on the attitude toward using ERP.

These critical success factors are helpful and appropriate in explaining both the initial failure and the eventual success of the implementation (Akkermans and van Helden, 2002). However, making an ERP system work is more than an issue of technical expertise or social accommodation: it is an ongoing, dynamic interaction between the ERP system, different groups in an organisation and external groups, such as vendors, management consultants and shareholders (Newman and Westrup, 2005). Therefore, additional evidence is required about the influence of cultural factors on the attitude toward using.

In general, the literature on ERPs focuses on implementation and other technical issues such as efficiency, effectiveness, and business performance; there is a relative lack of attention given to the social context, that is, user

acceptance (Grabski et al., 2011). Furthermore, it has been tested primarily on technologies that are relatively simple and voluntary (e.g. e-mail, word processors). Several researchers have recommended that TAM be revised to address user attitude, intent and behaviour when applied to complex IT in organizational settings where usage is generally considered mandatory (Nah et al., 2004). Because ERP users impact others, they do not have the choice to avoid the system, regardless of their attitudes about ERP systems (Sternad et al., 2011). Therefore, following to Nah et al. (2004), we analyze users' attitudes toward ERP, which refers to users' voluntary mental acceptance of the system. Therefore, TAM can be considered valuable and useful for explaining or predicting attitude toward using ERP systems in public hospitals.

ERP systems might be implemented successfully from a technical perspective, but success depends on ERP users' attitudes toward the system (Kwahk and Lee, 2008). Several studies suggest that ERP failure is related to user attitudes toward ERP systems (Umble et al., 2002). Moreover, most of these studies consider a limited number of factors which influence the attitude toward using and acceptance of ERPs (Sternad et al., 2011). Nevertheless, previous literature yields little in the way of users's attitude in hospitals that contributes to a wider understanding of ERP acceptance in this context.

Apart from the inherent complexity of the service they provide, hospitals are an example of organizations with differing cultural functional areas; there are different groups able to exert pressure during the set-up of an ERP system. Should the organizational culture influence the attitude toward using ERP systems (Palanisamy , 2008), it is worth carrying out going deeper into the study of organizations with different coexisting cultures, while paying special attention to how and which variables influence the attitude toward using (Cavalluzzo and Ittner, 2004). In spite of the documented empirical applicability of TAM, additional efforts are needed to validate existing research results, particularly those involving different technologies, users, and/or organizational contexts, in order to extend the model's theoretical validity and empirical applicability.

The aim of this paper is to extend the number of observed factors which influence attitude toward using in public hospitals. We try to understand the relationships between hospitals organizational culture and users' attitude. Apart from the above mentioned aims, this analysis will validate the TAM in the context of ERP in public hospitals while also identifying new external variables which affect the constructs of perceived usefulness and ease of use.

2.2. Hypotheses

The first three hypotheses in the proposed model are based on three basic relationships set up in TAM (Davis, 1989; Davis et al., 1989). TAM arises from the theory that a technology viewed by people to be easier to use and/or to have higher usefulness is more likely to be accepted. Therefore, TAM establishes that "perceived ease of use" and "perceived usefulness" affect the "attitude toward using". Moreover, TAM assumes that "perceived ease of use" of a technology has an effect on the "perceived usefulness". Several studies have confirmed this relationship (Liaw and Huang, 2003; Shang et al., 2005), others have rejected it (Agarwall and Prasad, 1999; Venkatesh and Morris, 2000), while others do not take it into account (Gefen and Straub, 1997; Liu and Wei, 2003). The intensity or direction of this relationship is not always the same, depending on the degree of innovation of the technology (Peffers and Dos Santos, 1996). Therefore, the first set of hypotheses for this study is stated as follows:

H1. Perceived ease of use has a significant effect on the perceived usefulness of ERP in public hospitals.

H2. Perceived ease of use has a significant effect on the attitude toward using ERP in public hospitals.

H3. Perceived usefulness has a significant effect on the attitude toward using ERP in public hospitals.

Perceived ease of use and perceived usefulness have traditionally been used as determinants of individual technology adoption (Szajna, 1994; Koufaris, 2002). However, these two variables do not fully reflect users' motivation to adopt ERP in public hospitals. To complete the proposed model, we include three external variables related to cultural factors which might be relevant for health care personnel to adopt ERP. These external variables might influence the attitude toward a behaviour indirectly by influencing the salient beliefs about the consequences of performing the behaviour (Fishbein and Ajzen, 1975).

Resistance to change (RC)

The alignment of the standard ERP processes with the company's business processes is for a long time considered as a critical step of the implementation process (Botta-Genoulaz et al., 2005). That is because process reengineering is frequently linked with ERP implementations (Wenrich and Ahmad 2009).

ERP implementations almost always require business process reengineering, because of the need to adapt the organizational processes to match the capabilities of the software (Amoako-Gyampah and Salam,

2004). There are several reasons that cause individuals in a hospital to have a low readiness for change; the purpose is not made clear, participants are not involved in planning, the habit patterns of the individuals are ignored, excessive work pressure is involved, and/or the current condition seems satisfactory (Battilana and Casciaro, 2013; Carlstrom and Ekman, 2012; Schiavone, 2012).

Venugopal and Suryaprakasa (2011) suggest that the existing structures embodied in the well entrenched legacy system will offer greater resistance to the work flows dictated by the ERP system. Therefore, this process reengineering could cause some resistances to change by potential users and affect the attitude toward using ERP in hospitals. Sometimes, health care personnel are unwilling upgrade to a new technology because ERPs are not flexible enough to adapt to the processes of the hospital. We can state these two hypotheses:

H4: Resistance to change has a significant effect on perceived usefulness of ERP in public hospitals.

H5: Resistance to change has a significant effect on perceived ease of use of ERP in public hospitals.

Perceived risks (PR)

A health care system failure can have serious consequences. The perception of possible risks related to ERP could affect users' attitude. Health care personnel make continuous efforts to reduce risks due to the serious repercussions involved. Legal and economic factors, as well as public trust in the health care system, have also been affected by these risks. Therefore, perceived risk could have a significant impact on the attitude toward using new technologies (Cho, 2004).

Many patients' processes in hospitals differ substantially in their degree of variability and stochasticity. As a result the logistic processes supporting the patients' processes may differ to the same degree (Van Merode et al., 2004).

ERP have significant advantages. All information is centralized in a single relational database accessible by all modules, eliminating the need for multiple entries of the same data (Muscatello et al., 2003). However, ERP requires that processes be described very precisely. Often the formal information is not complete, and the implementers do not know where the different types of process knowledge reside in the organization (Van Stijn and Wensley, 2001). Therefore, health care personnel could think that implementing ERP would be risky because it would either lead to

missing functions or to suboptimizing parts of the organization. The next hypotheses can be stated:

H6: Perceived risks have a significant effect on perceived usefulness of ERP in public hospitals.

H7: Perceived risks have a significant effect on perceived ease of use of ERP in public hospitals.

Resistance to be controlled (RBC)

By centralizing operational information in one place where it can be shared by all the company's key functional systems and standardizing business processes across functions, an ERP indeed offers the promise of integration (Davenport et al., 2004). Integration and standardization of data and processes that usually accompanies it allow improving organizational control systems. Therefore, ERP configurations can dramatically affect controls and how actions are made visible (Quattrone and Hopper, 2005).

ERPs involve the centralization of control over information. This is a quality consistent with hierarchical, command and control organizations with uniform cultures (Davenport, 1998). However, public hospitals have not got these characteristics. Therefore, hostile reactions toward the ERP

should be evident since it implied new control mechanisms (Jensen and Aanestad, 2007). Consequently, the final group of hypotheses is:

H8: Resistance to be controlled has a significant effect on perceived usefulness of ERP in public hospitals.

H9: Resistance to be controlled has a significant effect on the attitude toward using ERP in public hospitals.

The proposed model has six constructs and nine hypotheses have been generated from the relations of these six constructs (figure 2).

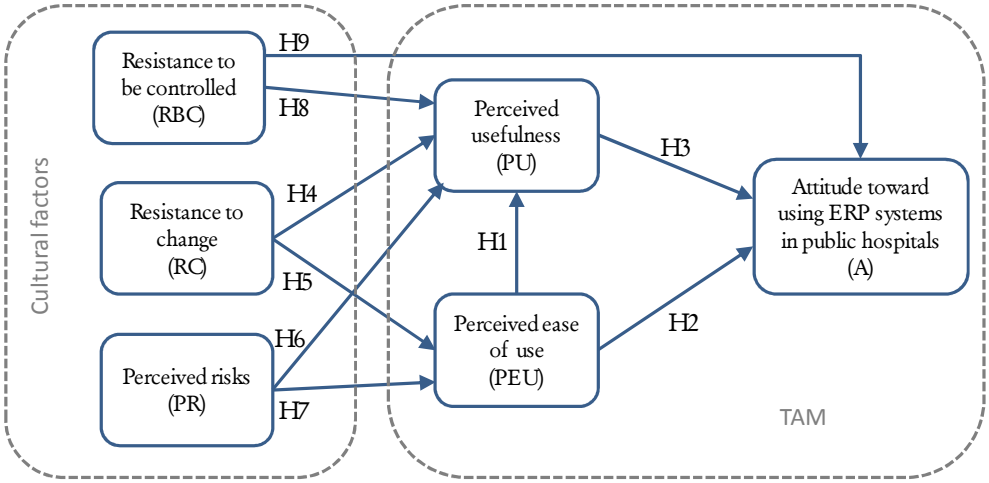

Figure 2. Research model, relations and hypotheses of different constructs

3. Methodology

A field survey was employed to test our research model. The study was carried out in a medium Spanish public hospital (Alcorcón Hospital) located in Madrid. Its Hospital Information Systems (HIS) is a set of procedures and functions directed towards the collection, production, assessment, storage, recovery, and distribution of items of information within the organization, oriented to promoting the flow of these items from the points where they are generated to the final intended recipients. It was implemented at the beginning of the last decade and comprises of 3

modules and 11 applications (figure 3).

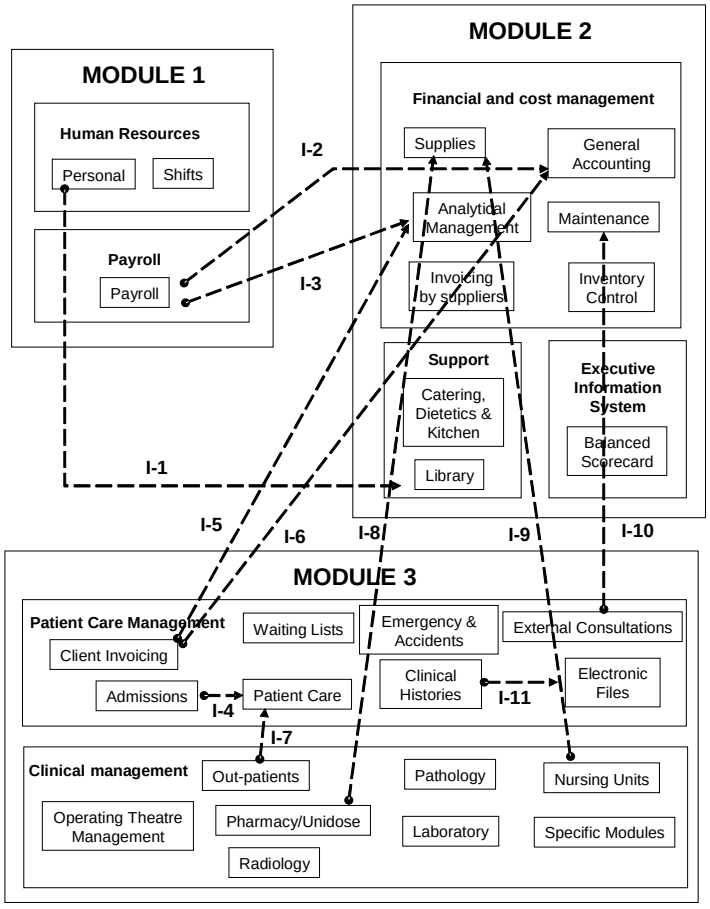

Figure 3. Diagram of the HIS modules

As we can see, the HIS is not a single integrated module program encompassing clinical, administration, and financial data. Instead, three different modules were implemented connected by eleven interfaces.

Therefore, the HIS consists of three "big systems", one system for each module.

The functions included in each module and the eleven interfaces are the following:

- Module 1: Human Resources (Personnel Management and Management of Shifts) and Payroll.
- Module 2: Financial & Cost Management (Supplies, General Accounting, Analytical Management and Management of Costs, Payment of Suppliers' Invoices, Inventory Management and Maintenance), Supporting Services (Catering, Dietetics and Kitchen) and Executive Information System.
- Module 3: Patient Care Management (Admission of in-patients, Waiting lists, Emergencies and Emergency Boxes, External Consultations, Electronic Clinical History, Invoicing to the Customer), and Clinical Management (Management of Operating Theatres, Radiology, Out-patients, Ward Control Points, Control Infrastructure, Generation of Medical Reports, Pharmacy, Pathology and Nursing Units, Document Manager, Medical Protocols, Laboratory).

- Applications: Laboratory, Dietetics, DOCtor, Gacela, Carevue, GPC, Invoicing, Library, Balanced Scorecard, Pharmacy and Pathology.

In the standard version of each module there is a set of interfaces for the exchange of information between them. However, this is not the case with the different applications acquired; for this reason it was necessary to incorporate up to 11 interfaces, which are described below:

- Interface I-1: It conects the Personnel and the Library Management Modules. Its objective is to load onto the database of the Library the data of the hospital personnel that are considered necessary for managing borrowings of publications.
- Interface I-2: It exchanges data between the Payroll Module and the Financial Accounting Module, with the object of recording the accounting details necessary for each Payroll payment.
- Interface I-3: This is similar to the previously described interface; its purpose is to exchange data between the Payroll Module and the Analytical Accounting Module, assigning the costs of each payroll item to its corresponding cost centre.
- Interfaces I-4 and I-7: The Patient Care Module is generated in function of the data obtained when the patient is admitted to

hospital. Therefore, it is necessary to transfer information corresponding to each patient.

- Interface I-5: From the data of the invoices, which reflect the cost of all the services and products that each patient has consumed during their hospitalization, the total costs of each hospitalization are determined and these costs are assigned to the corresponding units.
- Interface I-6: In the same way as in the previous interface, the costs of each period of hospitalization are assigned the corresponding units; the interface of Invoicing with Financial Accounting allows the invoicing to be assigned to the account of each unit.
- Interfaces I-8 and I-9: Among their functions, the Nursing and Pharmacy Modules support the control of the ward sub-stores and orders for supplies placed on the central warehouse; therefore interfaces are created that enable both the completion of orders placed automatically in function of the level of stock of certain materials, and the generation and shipment of orders placed manually to the Supplies Module.
- Interface I-10: It allows to make modifications to the planned capacity of the External Consultations, in function of the periods of time that the equipment of each Service is not available due to maintenance or repair work.

- Interface I-11: This interface allows the localization of the electronic file of documents associated with each medical history from the application that manages the Clinical Records.

Partial integration involves using the ERP's administrative and financial modules (Module 2), connecting them via a series of specific applications (radiology, laboratory, etc.). ERP software that had been chosen for the Module 2 by the hospital was SAP R/3. SAP R/3 was seen as an immensely powerful but notoriously complex system. The selection of SAP R/3 as Module 2 was well documented and its implementation has generally been portrayed as successful. In this paper, we seek to explore the acceptance of SAP R/3 in public hospitals and to determine in more depth the impact of cultural factors on its acceptance by health care personnel.

The study took place among all SAP R/3 users in this public hospital. Data were collected in September of 2011. Almost all ERP users participated in this research. The response rate was over 80%, with a total of 59 valid replies collected. The questionnaire has several items related to each of the constructs included in the model. The survey items were measured using a seven-point Likert scale. All items ranged from 1 (strongly disagree) to 7 (strongly agree). Theoretical constructs were operationalized using validated items from prior research. "Perceived ease

of use", "perceived usefulness" and "attitude toward using" SAP R/3 were measured using items adapted from Davis (1989, 1993), Davis et al. (1989) and Mathieson (1991). The measurement of "Resistance to change" was adapted from Dasgupta et al. (1999) and Moore and Benbasat (1991). "Perceived risks" items' measures drew their inspiration from Carr et al. (2010). Items for "Resistance to be controlled" were developed for this research.

This research is based on a regression analysis of latent variables using the optimization technique of the Partial Least Squares (PLS) to develop a model that represents the relationships among the six proposed constructs measured by many items. The PLS is a multivariate technique to test structural models (Wold, 1985). The PLS method estimates the model parameters which minimize the residual variance of the whole model dependent variables (Hsu et al., 2006), does not require any parametric conditions (Chin, 1998) and is recommended for small samples with non-normal data (Hulland, 1999).

These PLS characteristics are different from those of the Structural Ecuations Models based on covariance analysis, which requires a high sample due to the sensitiveness of the Chi-square test Basically, the objective of the PLS modeling is predicting dependent variables, latent and manifest, maximizing the explained variance of the dependent

variables and minimizing the residual variance of endogen variables (Lévy et al, 2009). PLS method is more oriented to the model predictability (Chin and Frye, 2003) and the estimates' stability will be measured by the Student T statistic, issued from a bootstrapping made over random samples.

4. Data analysis and results

Data analysis takes place via a two-stage methodology, in which the measurement model first is developed and evaluated separately from the full structural equation model (Gerbing and Anderson, 1988). The first step involves establishing individual reliability for each item, followed by determining the convergent and discriminate validity of the constructs.

Individual item reliability is determined via loadings or correlations between the item and the construct. The convergent validity of each construct is acceptable for a loading higher than 0.505 (Falk and Miler, 1992). Table 1 indicates the loading for each item. All variables comply with established conditions.

Construct	Indicador	Mean	Standard deviation	Loading
Resistence to be controlled (RBC)	RBC1. ERPs enable managers improve quality of control activities.	3.271186	1.627676	0.8329
	RBC2. Implementation of an ERP reduces the time related to control the individual behavior.	2.745763	1.677367	0.9154
	RBC3. ERPs with their databases and data analysis capacities can facilitate management control.	2.694915	1.793227	0.9508
Resistance to change (RC)	RC1. Using ERPs is not compatible with aspects of my work.	4.406780	2.035196	0.9329
	RC2. I think that using ERPs do not fit well with the way I like to work.	3.949153	1.601979	0.9192
	RC3. Using ERPs do not fit into my work style.	3.813559	1.644998	0.9316
Perceived risks (PR)	PR1. There is a significant potential for loss data with ERPs.	3.457627	2.119873	0.9412
	PR2. There is a significant risk of potential failure to using ERPs.	3.254237	1.996490	0.9480

	PR3. Using ERPs is not completely sure.	4.016949	1.645176	0.8958
Perceived usefulness (PU)	PUE1. Using ERPs improve my job performance.	4.576271	1.599605	0.9123
	PUE2. ERPs support critical aspect of my job.	4.677966	1.580492	0.9283
	PUE3. Using ERPs allows me to accomplish more work than would otherwise be possible.	4.762712	1.664425	0.9364
Perceived ease of use (PEU)	PEU1. I do not become confused when I use ERPs.	4.423729	2.094355	0.9278
	PEU2. I do not make errors when using ERPs.	4.745763	2.186110	0.9394
	PEU3. Interacting with ERPs is easy.	4.711864	2.093099	0.9516
Attitude toward using (A)	A1. Using ERPs is a good idea	5.491525	1.633411	0.9034
	A2. Using ERPs is pleasant	5.220339	1.640729	0.8814
	A3. Using ERPs is beneficial	5.237288	1.557396	0.9057

Table 1. Items descriptive and loading

Reliability makes it possible to measure internal coherence of all the indicatiors in relationship to constructs. To verify the realibility of each indicator, the Cronbach coefficient alpha (Cronbach, 1970) and the composite reliabilities coefficient (Werts et al., 1974) were utilized, each ranging from 0 (no homogeneity) to 1 (maximun homogeneity). Both parameters are taken into account, as the first considers the contribution made by each indicator to the construct, while the second takes the respective item's loading into account. Table 2 indicates the values of each coefficient. Composite reliabilities are over the minimun acceptable limit of 0.70 (Gefen et al., 2000; Nunnally, 1978). The Cronbach coefficient alpha levels are also shown in Table 2. They were all above 0.70, which is recommended for confirmatory research (Churchill, 1979).

Construct	Composite Reliability	AVE	Cronbach Alpha
Resistence to be controlled (RBC)	0.928071	0.811838	0.884200
Resistance to change(RC)	0.948958	0.861062	0.913416
Perceived risks (PR)	0.949444	0.862334	0.916416
Perceived usefulness (PU)	0.947275	0.856928	0.916488
Perceived ease of use (PEU)	0.957671	0.882934	0.933439
Attitude toward using (A)	0.925039	0.804459	0.877930

Table 2. Composite reliability, AVE and Cronbach coefficient alpha

Discriminant validity was assessed by examining whether each item loaded higher on the construct it measured than on any other construct. The factor structure matrix of loadings and cross-loadings (Table 3) indicates that the measurement exhibited reasonable discriminant validity. Items measuring the same construct indicate distinctly higher factor loadings on a single construct than on other constructs. This is also an indication of the convergent validity of the measurement.

Scale Items	RBC	RC	PR	PU	PEU	A
RBC 1	**0.8330**	0.4926	0.3278	-0.4079	-0.4846	-0.5646
RBC 2	**0.9154**	0.1715	0.4038	-0.3695	-0.5738	-0.6582
RBC 3	**0.9508**	0.2964	0.5166	-0.4986	-0.6939	-0.7882
RC 1	0.2766	**0.9329**	0.3053	-0.3681	-0.4286	-0.1807
RC 2	0.3644	**0.9192**	0.3905	-0.4042	-0.4220	-0.3720
RC 3	0.3235	**0.9316**	0.2848	-0.4017	-0.3969	-0.3122
PR 1	0.5099	0.2364	**0.9412**	-0.3874	-0.7087	-0.4789
PR 2	0.4408	0.3012	**0.9480**	-0.4084	-0.6330	-0.4190
PR 3	0.3479	0.4663	**0.8958**	-0.4007	-0.5569	-0.2653
PU1	-0.4084	-0.4160	-0.3875	**0.9123**	0.5811	0.5202

PU2	-0.4801	-0.3547	-0.5016	**0.9283**	0.6652	0.5897
PU3	-0.4311	-0.4045	-0.2961	**0.9364**	0.5515	0.6072
PEU1	-0.5947	-0.4323	-0.6670	0.6360	**0.9278**	0.5448
PEU2	-0.6255	-0.3983	-0.6668	0.5571	**0.9394**	0.5907
PEU3	-0.6326	-0.4326	-0.5963	0.6346	**0.9516**	0.5514
A1	-0.6961	-0.2324	-0.4405	0.5708	0.5069	**0.9034**
A2	-0.7101	-0.3520	-0.3474	0.5853	0.6007	**0.8814**
A3	-0.6106	-0.2488	-0.3474	0.5028	0.4953	**0.9057**

Table 3. Factor structure matrix of loadings and cross-loadings

After individual item reliability and convergent and discriminate construct validity have been established, the structural model is examined. To test H1 through H9, a PLS analysis was performed. Regression coefficients are based on bootstrapping samples and not on samples estimator. It permits the generalization of the results and the computation of the t-value for each hypothesis (Lévy et al., 2009). The results are presented in Figure 3, and Table 4 summarizes the relationships between the different constructs. The predictive capability of the model is satisfactory because all R-Squares are higher than 0.10 (Falk and Miller, 1992).

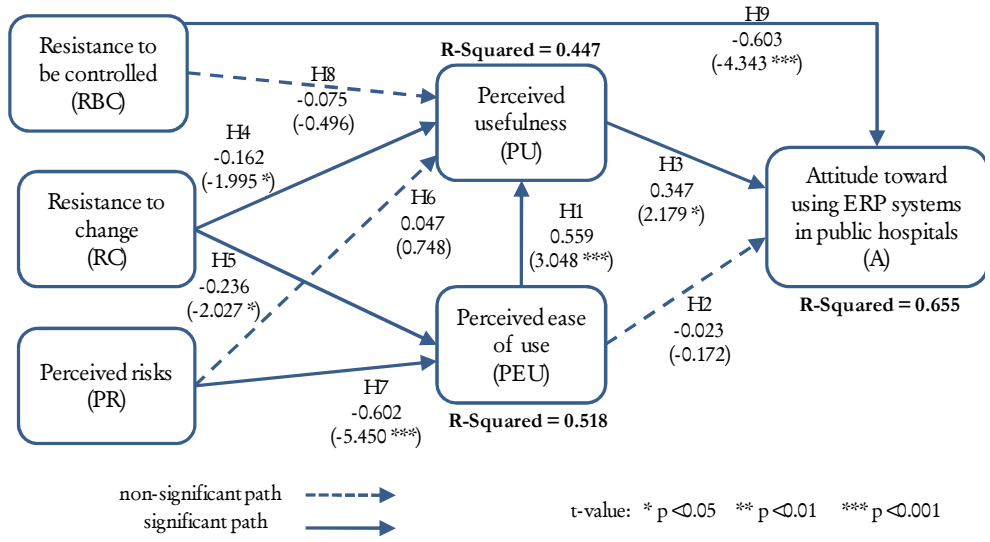

Figure 4. Results of testing model

Hypothesis	Path	Standardized path coefficient	t-value	Supported?	Construct	R-Squared
H1	PEU→PU	0.559	3.048	Yes, p < 0.001	Perceived usefulness	0.447
H4	RC→PU	-0.162	-1.995	Yes, p < 0.05		
H6	PR→PU	0.047	0.748	No		
H8	RBC→PU	-0.075	-0.496	No		
H5	RC→PEU	-0.236	-2.077	Yes, p < 0.05	Perceived easy of use	0.518
H7	PR→PEU	-0.602	-5.450	Yes, p < 0.001		
H2	PEU→A	-0.023	-0.172	No	Attitude toward using	0.655
H3	PU→A	0.347	2.179	Yes, p < 0.05		
H9	RBC→A	-0.603	-4.343	Yes, p < 0.001		

Table 4. Summary of test results for the structural model

5. Discussion

TAM theory suggests that there is a significant positive relationship between perceived ease of use, perceived usefulness and attitude toward using ERP in public hospitals (H1, H2, H3). These paths have been supported in the research model except for the path between perceived ease of use and attitude toward using (H2). Therefore, it should be noted that perceived ease of use does not necessarily lead to attitude toward using.

These results are according to other studies that have not found support for this hypothesis. For instance, Szajna (1996) posits that perceived usefulness has a direct influence on intention to use, whereas the perceived ease of use has only an indirect effect on intention to use through perceived usefulness.

This is also congruent with the findings of Chen et al. (2003), who found that perceived usefulness appears to be the only construct that has a significant direct influence on intention. In general, the findings support the notion that when a technology is perceived by users to be easy to use

or learn, such users will also project the system as being useful (Ignatius and Ramayah, 2005).

The findings indicate that resistance to change is negatively related to perceived usefulness and perceived ease of use of ERP in public hospitals, giving support for H4 and H5. The higher the "resistance to change", the lower the "perceived usefulness" and "perceived ease of use". Therefore, despite the potential benefits of ERPs, resistance to change must be taken into account in order to achieve the desired results.

Insufficient attention has been paid to the problem of fundamental differences between the structures embedded in the organization (as reflected by its procedures, rules and norms) and those embedded in the package. Ideally, organizations should be able to assess, prior to implementation, the extent of the misalignment, so that they may better manage the process of bringing the organization and package into alignment (Soh and Sia, 2004).

This is a common challenge faced during ITs implementation (Jones, 2003; Lippert and Davis 2006). The use of new technologies normally implies changes in the way tasks are carried out, sometimes generating reticence in those involved. Health care personnel are faced with acquiring new skills on a steep learning curve (Thuemmler et al. 2009), which is not always in line with the way they usually work. This can be

frustrating for health care managers; after they have invested in new technologies, they may find these technologies rejected by reticent heath care personnel.

The test results clearly suggest that perceived risk has a significant relationship with perceived ease of use (H7). Users who perceive high risks for losing data or system failures do not find them easy to use. Contrary to other cases (Carr et al., 2010), the relationship between perceived risks and perceived usefulness (H6) is not supported by the test results summarized in Table 5. Sometimes, perceived risks could imply that users do not perceive the usefulness of technology if there is a significant risk of potential failure. However, this relationship is not significant in this research.

One of the contributions of this research is to incorporate the construct "resistance to be controlled" to explain the attitude toward using ERP in public hospitals. While H8 is not supported, the results show that health care personnel who find that ERP enable managers improve quality of control activities and facilitate management control are more reluctant to use them (H9). This is a very important finding to explain attitude toward using IT in public hospitals by health care personnel due to its social and cultural barriers.

6. Concluding remarks

Hospitals are undergoing significant changes, mainly due to ITs within the health care process. Within this framework, the use of ERP have significant advantages. All information is centralized in a single relational database accessible by all modules, eliminating the need for multiple entries of the same data. Therefore, ERP could help to improve quality of service while increasing efficiency.

This research integrates the appropriate information systems literature in order to enhance the knowledge of attitude toward using ERP from the heatl care personnel's perspective. A further theoretical contribution is the development and validation of survey measures for the constructs examined in this study, particularly for the constructs "resistance to be controlled", "resistance to change", and "perceived risks". In a situation where theory is advanced, it is essential to involve the creation and validation of new measures, and such efforts are considered an important contribution to scientific practice in the information systems field (Straub et al, 2004). These measures can be utilized to examine other emerging technologies within the health care context.

In addition to the theoretical contribution, the research model suggests important practical implications for attitude toward using ERP and develops an understanding about how to improve this attitude in hospitals. Reducing the resistance to be controlled, the resistance to change and the perceived risks of using this technology by health care personnel is a central issue to get a better attitude toward using ERP in public hospitals.

The success in the implementation of an ERP system could depend on the interaction of these three factors and its impact on users' "attitude toward using". These three factors should be managed during the implementation process to influence the attitude of users toward the use of ERP systems in the right way and, therefore, to increase the success probabilities.

Results support that health care personnel resistance to change may be a serious cause for concern in implementing ERP in public hospitals because it affects the perceived ease of use and usefulness of this IT. To reduce personnel's "resistance to change", managers must be prepared to talk candidly about the needs for change, otherwise fear and uncertainty will remain a prevailing element that can damage morale and prevent successful implementation of the ERP at all levels of the organization (Bateh et al., 2013). These significant relationships are notable for health care technology developers. During the development and implementaion

process of ERP, technology developers and implementation teams might adapt systems to the new work environment, in order to ensure a good fit. If health care personnel perceive incompatibility between the tasks to be performed and the new system, they might find it difficult to use and/or useless. Implementation teams should create strong ties to potentially influential organization members who are ambivalent about the ERP system to provide the change agent with an affective basis in order to get an more intensive and positive coorperation (Battilana and Casciaro, 2013).

On the other hand, training processes might not only explain system use but also illustrate the ability of the ERP to enhance job performance. Training processes should also be fucussed to reduce the resistance to be controlled and the perceived risks by health care personnel.

The training process is one main vehicle for the dissemination of the organizational culture and should be directed toward reducing "resistance to change", "resistance to be controlled", and "perceived risks" in healthcare organizations. The training process should not only be focused to explain how the system works, but also to show the ability of information systems to facilitate daily operations, so that they are centered on spreading cultural factors in the organization. By using this strategy, the training process can be oriented to reduce resistance to be

controlled and minimize the risks perceived to the use of these technologies.

Further research might investigate the importance of influences such as individual differences, prior experience, level of educations, and the role of technology in organizations in the context of ERP aceptance in public hospitals.

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CAPÍTULO 3

INTEGRATION OF HEALTHCARE AND FINANCIAL INFORMATION. EVALUATION IN PUBLIC HOSPITALS USING A CASE STUDY.

ABSTRACT

Public Health Care organizations are moving toward the use of new technologies to automate and improve internal processes in order to increase the effective and efficient use of their resources. The aim of this research work is to tackle the systematic evaluation of an experience of integrating information in a healthcare organization, paying attention to the implications that this entails. The results show that the integration of the information in the hospital brings about higher levels of quality. The study contributes a vision of interrelated work, in which tasks are shared and aims are jointly established.

Key words: Integration, Information, Efficiency, Hospitals, Processes.

1. INTRODUCTION

The lack of the integration of information systems in hospitals – a consequence of using numerous systems and applications – tends to produce a redundancy of data and overlapping functionalities. This makes the coordination of organizational processes difficult (Shand & Callen, 2003).

In recent years, healthcare organizations have been using new technologies to automate and improve their clinical and business processes. They have increased their interest in investing in tools which prioritize the integrating of clinical, organizational and management processes (Duan et al., 2012).

Health departments increasingly recognize the value of sharing information not only between multiple programs, but also with private sector providers, policy makers and the public (Wild et al., 2004). The integrating of an organization's transactional functions allows it to have a unified data system instead of a group of isolated applications which offer fragmented data, as well as counting on updated information. This accelerates the communication flow and drives the organization's internal collaboration. At the same time, it facilitates the decision-making process.

The literature on management in the hospital sector defends the applying in healthcare organizations of integrated information systems. These

contribute to the improvement of processes and the reduction of operational costs (Van Merode et al., 2004).

According to Nicolau (2004), Enterprise Resource Planning (ERP) systems are well accepted in hospitals insofar as they provide direct benefits in daily work and facilitate tasks. That said, there also tend to be hostile reactions toward ERP because they introduce control mechanisms in the daily work and usually require prominent process reengineering (Jensen & Aanestad, 2007; Osorio & Paredes, 2001).

The limitations for achieving the integration of different functions in a healthcare organization are both technical and organizational (Khoumbati et al., 2006). This is the reason why partial integration processes are frequently carried out. These use financial and administrative models but maintain the specific applications which have been traditionally used in the welfare area.

Hospitals are complex and multifunctional institutions. This is why they require a sophisticated clinical and management integration. There are two major approaches for carrying out the integration of information in hospitals: complete and partial (Stefanou & Revagnolou, 2006). Complete integration means incorporating clinical administrative and financial modules in a single system, with different applications such as the admission and discharge of the patients, wards having first aid kits, pharmacy billing, etc. This kind of integration means a process

reengineering and produces important organizational changes which affect both the way of working and the control that comes from having centralized information. For Anderson (1997), this sort of integration tends to produce a rejection of all the personnel – both carers and non-carers – who are usually reluctant to change their way of working or believe that control by their superiors can cause them problems. For their part, Soh et al. (2004), argue that this way of implementing an ERP may not be valid for the concrete case of hospitals because of the need to use specific tools and carry out process reengineering. However, for hospital management this way of integration means efficacy and efficiency, which compensates for the outlay (Stefanou, 2001).

On the other hand, partial integration consists of using the ERP system's administrative and financial modules and connecting them to a series of specific applications: radiology, laboratory, etc. This means, for example, computerizing the patient's history and thus obtaining the electronic clinical history of each of them. For the medical and nursing staff this integration is an important base for clinical decision-making, as information can be captured in real time and can be had anywhere (in the doctor's office, the operating theatre, the ICU, etc.). Unlike complete integration, there is not a thorough process reengineering and therefore it is not necessary to substantially modify the way of working, although it still means a greater degree of control (Anderson, 1997; Grimson et al.,

2000). This raises the question of if perceiving that centralized information can be used to establish control mechanisms could generate rejection, even though the personnel's work procedures are going to be maintained and improvements in the available information will be achieved.

In this line, systems are being developed in which the health-care information is at least partly integrated with the economic-financial information, as carried out in the Alcorcón Foundation University Hospital (HUFA). However, in parallel to the implementation, evaluation processes are necessary. These allow the identifying of what the new systems are contributing to the organization. The success of health information technologies should be evaluated by developing specific tests of evolutionary fitness (Leung, 2012). This is because most evaluations are done from the point of view of the system's efficiency and evidence is only gathered once this has been implemented. This is why they have various deficiencies, such as, for example, the lack of a comparison between the situation before and after the implementation. That is to say, a "pre-versus-post" implementation evaluation (i.e. Al-Azmi et al., 2009; Cherry et al., 2011; Fareed et al., 2012; Ruxwana et al., 2010).

In this context, and aiming to go more deeply into the evaluation of the ERP systems, this research work tackles the systematic evaluation of an

experience of information integration in a health organization, paying attention to the implications that this entails in HUFA.

2. THE IMPLEMENTATION OF ERP SYSTEMS IN HUFA

Context. The integration of information in HUFA

HUFA, assigned to the Madrid Health Service, was founded under the Law 15/1997 of April25, which deals with new ways of managing the National Health System. It started up in December 1997 and currently has a population area of more than 250,000 inhabitants.

Practically from the beginning, the members of the Foundation were convinced that the hospital needed to have an ERP. Due to this, the Firm Plan was established as one of the main aims to achieve the integration of clinical and economic-financial information via the use of an ERP.

The HUFA Information System currently has three major modules, inter-connected via a series of interfaces (Figure 1).

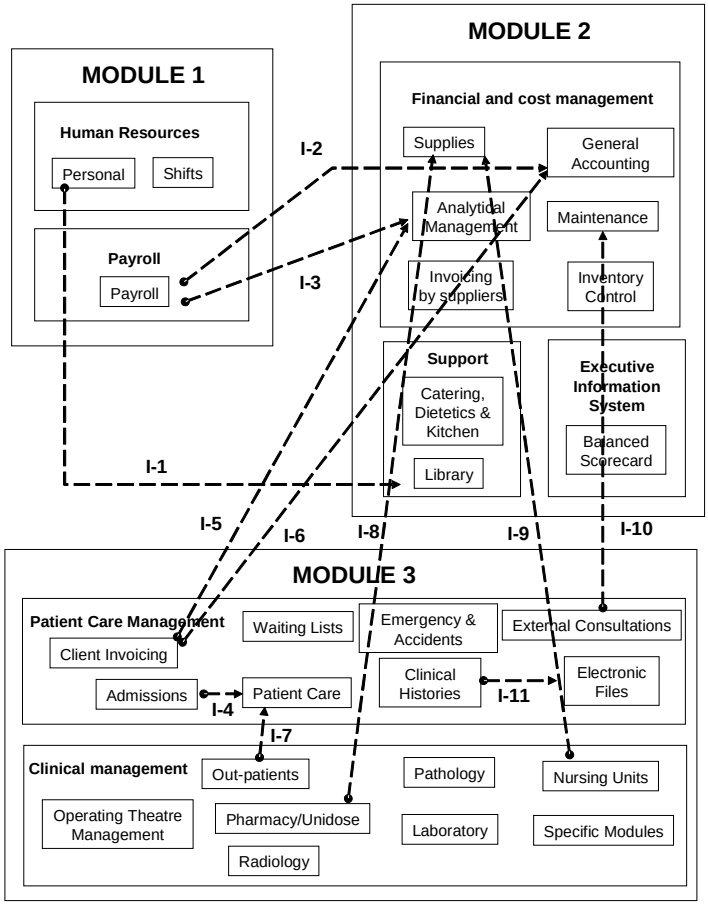

Figura 1. Health Information System at HUFA

To develop its activity, HUFA is financed by the Madrid Health Service, regulated by the Agreement signed by both parts. Additionally, the hospital provides healthcare to third parties who are required to pay, such as collaborating and private entities (mutual companies), private insurance entities (traffic accidents) and individuals. Moreover, to contribute to

carrying out the Foundation's typical activities, HUFA provides services for collaborations which correspond to sums received from sponsors and business collaborators. These are mostly for the clinical trials.

Regarding HUFA's non-healthcare service provision, there is the payment of the assignment of the Foundation's physical spaces for exploitation by third parties of different businesses, such as the restaurant or employees' cafeteria, as well as the incomes from different courses given by the Foundation. To sum up, HUFA's services provisions give rise to different billable elements which can be classified according to the following typology:

1. Patient with patient guarantor
2. Patient with private guarantor
3. Patient with firm guarantor
4. Firm

Implementation of the integrated system in HUFA

The implementation of the healthcare and financial information project in HUFA has allowed the healthcare activity, supported by the Selene application, to be connected to the hospital's SAP R/3 through the hospital's billing tool, called AURORA.

A differentiated file structure has been defined according to the typology of bills in the hospital, and for each one of them. These files are transmitted through the HUFA information system.

The integration process begins when a bill is generated in the AURORA system, as a file is automatically created with the text structure defined and a file with the image of the bill. Once the directory has produced the file, it makes a call via an event to a SAP R/3 job. This validates the file, records the document and attaches the image of the bill to the account document, or else produces a file with the error log. This is notified via a warning in the Outlook of the users assigned.

As a result, to achieve the integration of the healthcare and economic information in the hospital, it is compulsory to establish agreements and restrictions between both systems in order to homogenize the structure of the data coming from the different applications.

From these restrictions and from the records of the healthcare activity corresponding to "Financier" (Private, Social, Muface[1], International Agreements, etc.) and "Area" (Emergencies, Hospitalization, Outpatients, and so on) in the SAP R/3, the economic record of the service provided is

[1] Muface is one of the most important private health insurance firms for civil servants in Spain.

obtained. In this record the cost center or else the project (PEP[2]) assigned is obligatorily reported in each bill.

The center to which the cost is assigned corresponds to the structure approved in HUFA of the Homogeneous Functional Groups (HFGs).

On the other hand, the management of the research projects in HUFA requires obtaining information about collections and payments related to the projects which are carried out in the hospital and that are managed in SAP R/3 via the PEP elements.

In both cases, the master data of the center of the PEP cost or element correspond to a single table which is kept in the SAP R/3. This is updated in real time via another interface between both systems. A second table is used for the billing of non-healthcare activities. This has, according to the kind of "firm" bill issued, the Value Added Tax type, the account and the allocation to the corresponding cost center or PEP element.

3. RESULTS

Evaluation of the integrated system

In order to carry out a systematic evaluation of the integrated system implemented in HUFA, we are going to use the conceptual framework

[2] The PEP elements are objects to which the budget is assigned, having an availability control when recording or committing an expenditure. In this way it can be controlled that more is not spent than what is received for the activity carried out.

proposed by King and Rodríguez (1978). They propose that the comprehensive evaluation of a management information system must take into account two fundamental aspects. The first is to determine how the new system has affected the users' attitude and the value that they perceive in it. The second refers to the usefulness of the information. At the same time, it tries to identify to what extent the new system has improved the quality of the decision-making processes. This is both in the sense of altering the decision process itself because of the managers having better quality information and in the sense of proposing new problems or situations, due to having information that did not exist before the implementation of the new system. In other words, how the new system has improved the managers' use of the information, making it more accessible, reliable and timely.

Users' attitude and perceived value

A field study was done in HUFA to compare the users' attitude and their perceived value of the system.

The study was carried out with all the users of this public hospital's SAP R/3. Two surveys were done at two moments of time to identify how both the users' attitude and the value perceived have evolved. The data of the first survey were gathered in September 2011, before the integration of the economic-financial and healthcare information was done. The

second survey took place in April 2013, once the integration was finished. The users of the ERP system of administration, nursing and information systems took part in this research. On both occasions, the response rate obtained was 80%, with a total of 59 valid responses in each case.

The questionnaire included the items related to a series of constructs which allow the evaluating of the users' attitude and perceived value of the system. This is described in Table 1. The theoretical constructs were designed from the previous research of Davis (1989, 1993), Davis et al. (1989), Mathieson (1991), Dasgupta et al. (1999), Moore and Benbasat (1991) and Carret et al. (2010). The items which make up each of the constructs were quantified via a 7-point Likert scale, in which 1 meant "completely disagree" and 7 "completely agree".

Construct	Item
Resistance to being controlled (RBC)	RBC01. The ERP system allows the management to improve the quality of the control systems.
	RBC02. Implementing an ERP system reduces the time needed to control the behavior of the workers.
	RBC03. As a result of its single database and its analysis capacity, the ERP system facilitates the control tasks.
Resistance to change (RC)	RC01. The use of an ERP system is not completely compatible with my current work.
	RC02. I believe the use of the ERP system does not fit the way I like to work.
	RC03. The use of an ERP system does not fit my way of working.
Perceived usefulness (PU)	PU1. The use of ERP systems improves my performance.
	PU2. The use of ERP systems helps me to improve the most important aspects of my work.
	PU3. The use of ERP systems allows me to do more work than would otherwise be possible.
Perceived ease of use (PEU)	PEU1. The use of ERP systems is frequently confusing.
	PEU2. Mistakes are frequently made when ERP systems are used.
	PEU3. Interacting with ERP systems is frequently frustrating.
Attitude toward use (A)	A1. The use of ERP systems in the hospital is a good idea.
	A2. The use of ERP systems at work is pleasant.
	A3. The use of ERP systems is beneficial, improving both the attention to the patient and the hospital management.

Table1

Once the data were obtained, the results of both surveys were compared using the Student's t-test (Lastovicka & Thamodaran, 1991; Tabachnik & Fidell, 1989). The results obtained are shown in Table2.

	September 2011		April 2013				
Item	Average Before	DT Before	Average After	DT After	t-value	p-value	Significant
RBC01	3.27118644	1.62767561	3.84745763	1.34950258	2.09351263	0.0384822	Yes, $p < 0.05$
RBC02	2.74576271	1.67736678	3.54237288	1.59007736	2.64742557	0.00923837	Yes, $p < 0.01$
RBC03	2.69491525	1.79322708	3.72881356	1.59558127	3.30852505	0.00124958	Yes, $p < 0.01$
RC01	4.40677966	2.03519587	3.6779661	1.79501876	2.06291903	0.04135254	Yes, $p < 0.05$
RC02	3.94915254	1.60197861	3.38983051	1.43859305	1.99536149	0.04834724	Yes, $p < 0.05$
RC03	3.81355932	1.64499844	3.22033898	1.42717223	2.09229434	0.03859313	Yes, $p < 0.05$
PU01	4.57627119	1.59960545	5.25423729	1.29446062	2.53069493	0.01272332	Yes, $p < 0.05$
PU02	4.6779661	1.58049183	5.54237288	1.03926423	3.51012443	0.00063871	Yes, $p < 0.001$
PU03	4.76271186	1.66442475	5.3559322	1.33600939	2.13494574	0.03486945	Yes, $p < 0.05$
PEU01	4.42372881	2.09435522	3.25423729	1.34668457	3.60770762	0.00045706	Yes, $p < 0.001$
PEU02	4.74576271	2.18610992	3.76271186	1.535095	2.82674704	0.00553967	Yes, $p < 0.01$
PEU03	4.71186441	2.09309907	3.6779661	1.71645864	2.93381025	0.00403637	Yes, $p < 0.01$
A01	5.49152542	1.63341066	6.08474576	0.95209634	2.41009025	0.0175201	Yes, $p < 0.05$
A02	5.22033898	1.64072941	5.89830508	0.90391706	2.77996065	0.00634494	Yes, $p < 0.01$
A03	5.23728814	1.55739596	5,88135593	0.93004905	2.72727165	0.00737854	Yes, $p < 0,01$

Table 2

The results (RBC1; $p < 0.05$, RBC2; $p < 0.01$ and RBC3, $p < 0.01$) confirm that resistance to being controlled (RBC) is a significant factor to evaluate the users' attitude and their perceived value of the system. The study shows that RBC varies according to the progress in the project's implementation. After the implementation of the project in the hospital, the average values of each item show an increase with respect to the first consultation, carried out in the tool's pre-implementation phase. The comparison of the results obtained in the two phases confirms that as the implementation of an integrated information system advances, there is progress in the reduction of time spent controlling the workers, the quality of the information improves and the tasks and control systems are facilitated. The users consider the lack of compatibility of the system with their tasks, likes and ways of working to be significant (RC01; $p < 0.05$; RC02, $p < 0.05$ and RC03, $p < 0.05$). The item resistance to change (RC) shows a decrease in its values between the periods compared. The average of the results obtained in September 2011 and April 2013 vary considerably in the samples observed. As the project advances, the users perceive a greater fit of the new system's tools with their needs.

Counting on specific variables related to the users' attitude toward the new system (A) -such as is the case of perceived usefulness (PU) and

perceived ease of use (PEU)- has allowed the users' emotional values to be incorporated into this study.

The results of the users' perceived usefulness show a significant relationship (PU01; $p < 0.05$; PU02, $p < 0.01$ and PU03, $p < 0.05$). Thus, the users' perceived usefulness concerning the new information system is consolidated as an influential factor in the employees' attitude regarding introducing innovations in the hospital's information system.

The study's findings show an average increase of the PU values of the items consulted (PU01, PU02 and PU03) between the periods compared. This result upholds the idea that with the consolidating of the implementation of the project, the users perceive improvements in performance and in the main aspects of their work. This brings about the reduction of their resistance to change, as has been commented on previously

The PEU results adjust to the standard proposed by the model (PEU01; $p < 0.01$; PEU02, $p < 0.01$ and PEU03, $p < 0.01$), while the decrease in the value of the items is broadly noted in the comparative data between the two periods. The users appreciate the improvements incorporated with the new tool, as using the new application has allowed them to reduce errors in their daily work. After the implementation and experiencing the new system, the users feel a greater satisfaction and are clearer about the new system's advantages of use.

Lastly, the results note a significant increase related to the users' attitude. Once the system has been implemented, the users are satisfied with the benefits it brings them in their daily work, as well as with the improvements which it offers the organization as a whole (strategic planning and results obtained by the hospital, work atmosphere, etc.).

The results show that one of the key factors for the implementation process to be satisfactory is the users' attitude and their perceived value of the new system.

The answers on the users' behavior and emotiveness toward the innovations of the information systems are a critical factor to be taken into account in any implementation project. The positive attitude detected in the second period of the project increases the wish to use the tool.

This study has allowed the verification of the hypothesis that, through their behavior, the users' attitude plays an important role during the implementation process of any technological innovation.

Management of the information and Improvement in Decision-Making

The plan to open the hospital counted on the implementation of management strategies focused on improving efficiency. The ERP system was opted for as being the most suitable to give computer support to the organization. It is clear that in the investments carried out by the hospital

since its inauguration there has been a priority for the implementation of new technologies and the development of applications and tools. These allow the integration of processes that are clinical, organizational and related to hospital management.

Currently, HUFA's Accounting and Treasury Department is practically automated and almost all the process are computerized. It has a digital system of bills issued and received, available online.

The solution adopted in HUFA implies using financial and administrative modules but keeps the specific applications that have traditionally been utilized in the healthcare area. In this case, it works with SAP R/3 connected to specific healthcare applications which contain economic information through interfaces. For this reason, it does not have modules unified in a single platform. This is what is known as a partial solution.

There is access to the clinical episodes which are subject to monetary compensation through the integration of the healthcare activity with billing.

The implementation of this innovation is integrated with the hospital's ERP and its main contributions to the information management are detailed below. Thus, the renovation of the receiving, recording and validation processes of the bills received, automating the comparison of the prices of the orders to suppliers with what these suppliers bill, the reconciliations of the units of goods received with the units billed and the

recording (entering) in the bill's data system has contributed the following advantages:

- The managing of the different formats of documents of bills received in accordance with the precise financial, legal and accounting requirements.
- The converting of paper into digital images. The bill's image is exportable and is available throughout the bill's processing. It integrates the bill's digital image with the accounting record in the hospital's ERP.
- It captures the information of any kind of bill at the level of lines of detail, allowing the automatic reconciliation with the order and the delivery note without the user's intervention.

Regarding the bills issued, the implementation of this research project of integrating healthcare and financial information has allowed the hospital to establish a gateway between AURORA, the billing tool of the healthcare activity (SELENE) and the hospital's economic information system, SAP R/3.

Concerning the capturing, recording and exactitude of the information, the main advantages in the implementation of this tool have been:

- An increase in capacity and shorter response-reaction times in the seeking, recording, collection and payment of bills.
- An increase in the efficiency in the handling process of bills that have been issued, the eliminating of bills in paper archives, the

introducing of single data from a single module and the automatic posting of the bills.

- Improvements in the access to information, synchronization and updating of information simultaneously in all the related areas. There is a link from the SAP R/3 system to each posted document.
- Reduction of errors.

With the solution adapted by the hospital - based on the SAP R/3 connection with specific healthcare applications - the information is totally integrated. This accelerates the flow of information and drives internal collaboration. For example, it decreases the response time to solve any problem related to the information transmitted. Furthermore, the personnel is more committed to a real time philosophy, as they have less repetitive work, have digitalized information and do not have to carry out tedious paper searching.

Moreover, the connection of the data between the different functions developed in the hospital facilitates the analysis of the information for decision-making. The integration makes it possible to optimize the process of obtaining information. In the past, this used to be extremely complex and laborious due to the time needed to get solid and connected information.

On the other hand, the integration of the financial and healthcare information has allowed the carrying out of a process reengineering to increase efficiency. Thus, the work procedures have been revised while the resulting tasks were reassigned in the line pointed out by Davenport and Stoddard (1994). This was done taking into consideration the alignment of the technological tools with the organization's skills, strategy and environment (Añez & Petit, 2010).

The integration of the information in the hospital has involved the automating of the processes implicated. As a result, numerous routine tasks that the staff did manually have been suppressed. The integration has allowed the staff involved to be moved toward other tasks and activities in the hospital with a greater value added.

At the same time, with the integration of the information a greater ease and speed in accessing information has been achieved: there is information in real time and the organizational management is more transparent. All this allows not only the increasing of efficiency in the financial and administrative processes but also of efficacy in the decision-making process and the hospital's corporate process.

To sum up, it may be said that the implementing of the integrated information system has allowed HUFA to attain higher quality levels in its services provision. In the hospital case, this is centered on the improvement of the healthcare services provision to people.

4. CONCLUSIONS

The presentation of the specific case of HUFA is an example of the integration of different agents of a hospital's inherent activity, as well as the automating of the processes involved in this integration. The new system in HUFA fosters a cultural change toward interrelated work systems in which tasks are shared and common aims are established. This in turn allows the organization to improve the quality of the information handled.

This study has done a systematic evaluation of the solution adapted to carry out integration. The results show how the new system has improved the users' attitude and the perceived value of the information system. The quality of the decision-making processes has also improved, both in the sense of altering the decision-making process – due to the managers having higher quality information and in the sense of being able to pose new problems and situations.

Once the project was finished, HUFA continues advancing toward the design of systems based on the complete integration of information. This last goal would allow HUFA to have a complete description of all its internal and external processes with users, institutions, suppliers and customers in a common platform.

This way, all the hospital's team would function with the same tool. This would allow all the users to be interconnected and the information to be shared through the same tool.

The organizational complexity which is a characteristic of hospitals - mainly due to the cultural differences between the different areas - can make advancing in this line difficult. Nevertheless, the need to manage economic resources in an increasingly more efficient manner means achieving the complete integration of information through a single platform.

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CAPÍTULO 4

CONSIDERACIONES FINALES Y FUTURAS LÍNEAS DE TRABAJO

Las conclusiones que se presentan a continuación han sido elaboradas a partir de los objetivos planteados con este trabajo de investigación. Si bien, el objetivo general propuesto en el mismo ,ha sido analizar los aspectos relacionados con la actitud hacia el uso de los sistemas ERP en los hospitales públicos, hay que tener en cuenta, que para el desarrollo de la investigación, se han planteado tres objetivos específicos.

El primer objetivo específico propuesto en esta investigación ha sido identificar como influyen, en los hospitales públicos, las características personales de los usuarios y el apoyo organizativo, en la actitud hacia el uso de los sistemas ERP. A partir del desarrollo del trabajo de investigación realizado se puede establecer que las principales conclusiones han sido las siguientes:

- Esta investigación extiende el uso del modelo TAM hacia las características personales y la estructura organizativa de las entidades sanitarias, dentro del contexto de la actitud hacia el uso de los sistemas ERP en los hospitales públicos españoles.

- El modelo TAM resulta ser un modelo válido para predecir la actitud del personal sanitario en el uso de los sistemas ERP en los hospitales.

- El estudio confirma las tres hipótesis en las que se sustenta el modelo propuesto, basado en las tres relaciones principales de TAM, y sugiere una relación significativa positiva entre la facilidad de uso percibida y la utilidad percibida.

- Los hallazgos presentados en este trabajo también muestran una relación significativa entre la facilidad de uso percibida y la actitud hacia el uso de los sistemas ERP.

- De modo similar a otros hallazgos presentados en la literatura actual acerca de TAM, este estudio muestra que la utilidad percibida tiene una relación positiva significativa con la actitud hacia el uso de los sistemas ERP.

Los hallazgos de esta investigación apuntan implicaciones prácticas en la actitud hacia el uso de sistemas ERP, y permiten desarrollar vias de entendimiento acerca de como mejorar esta actitud en los hospitales.

De acuerdo con el primer objetivo específico planteado, los resultados de la investigación, permiten identificar los factores críticos que intervienen en la formación de la actitud hacia el uso de los sistemas ERP, tales como la experiencia previa, y la edad de los usuarios. La relevancia de las características personales de los usuarios del sistema ERP, en este hospital español, explican la actitud hacia el uso de este tipo de sistemas

Por un lado, la experiencia previa presenta una relación significativa con la utilidad percibida y con la facilidad de uso percibida. El conocimiento, y la experiencia previa de los usuarios, en el uso de este tipo de sistemas, generan actitudes personales positivas hacia el uso de las nuevas tecnologías a implantar. Asimismo la falta de experiencia, por parte de otros usuarios, puede llegar a crear actitudes que incidan negativamente en la intención de uso de los sistemas ERP

Por otro lado, en cuanto a la influencia de la edad de los usuarios, los hallazgos de este trabajo presentan una relación significativa con la actitud hacia el uso de los sistemas ERP, mostrando su influencia en la percepción de la utilidad percibida hacia el uso de los sistemas ERP. En el caso de este hospital español, los usuarios más jóvenes muestran una mayor percepción de la utilidad de este tipo de sistemas frente a aquellos usuarios con mayor edad, que tienden trasladar a sus actitudes una mayor reticencia hacia el cambio y la innovación.

Por último hay que destacar, que de acuerdo con este primer objetivo específico , y tras el análisis de los resultados obtenidos, no se desprende la existencia de una relación significativa entre la edad y la facilidad de uso percibida, y tampoco entre el soporte de la organización con la utilidad percibida, ni con la facilidad de uso percibida de los sistemas ERP. Por tanto, los hallazgos de la investigación, conducen a reflexionar acerca de

la idoneidad del soporte ofrecido, por parte de la organización, a los usuarios, mediante los programas y cursos de formación impartidos en el hospital.

Con referencia al segundo objetivo específico, planteado en esta investigación, se ha tratado de identificar como influyen los factores culturales en la actitud hacia el uso de los sistemas ERP en los hospitales públicos. A la vista de los resultados mostrados en la investigación se deducen las siguientes consideraciones:

- Además de la contribución teórica, el presente trabajo aporta evidencia empírica acerca de la adecuación de utilizar TAM para analizar el impacto de los factores culturales sobre la aceptación de los sistemas integrados de gestión en los hospitales públicos

- Una estrategia de actuación dirigida a alcanzar mejoras en la aceptación y en la intencion de uso del sistema en el hospital implica acciones dirigidas a la reducción de la resistencia a ser controlado, de la resistencia al cambio, y del riesgo percibido por parte del personal al utilizar una determinada tecnologia.

En resumen, de acuerdo con el segundo objetivo específico planteado en esta investigación, se ha podido identificar una relación existente y directa entre la resistencia al cambio, la resistencia a ser controlado y el riesgo

percibido, con la utilidad percibida, y la facilidad de uso percibida en un hospital público español.

En primer lugar, y a tenor de los hallazgos de la investigación, se pone de manifiesto la relevancia del factor resistencia al cambio, por parte de los usuarios, posicionándose éste como factor crítico, a considerar, en la implantación de un sistema ERP, ya que sus efectos afectan a la facilidad de uso y a la utilidad percibida

En segundo lugar, la incorporación de la resistencia a ser controlado como factor influyente en la actitud hacia el uso de los sistemas ERP muestra su relevancia a la hora de planificar un proyecto de implantación de un sistema ERP en un hospital. Los resultados del trabajo muestran que la percepción, por parte del personal sanitario, en cuanto a que el sistema ERP facilita las tareas de control y supervisión puede llega a causar "resistencia" al uso de este tipo de sistemas por parte de los usuarios del entorno hospitalario.

Por último, también los resultados del trabajo de investigación sugieren que los usuarios que perciben riesgos de fallos del sistema no encuentran fácil el uso del sistema. El riesgo percibido por los usuarios también debe ser considerado en un proceso de implantación. Los usuarios que perciben altos riesgos de pérdidas de datos o fallos del sistema no califican la herramienta como fácil de usar. En el caso de que los usuarios detecten

incompatibilidades o ausencia de cobertura tecnológica para poder realizar las tareas mediante el nuevo sistema, percibirán una dificultad en su utilidad, y su comportamiento, afectará directamente con una disminución en el uso del sistema.

Por el contrario, la relación entre el riesgo percibido y la utilidad percibida no resulta significativa en esta investigación.

En resumen, de acuerdo con el segundo objetivo específico planteado en la ib¡nvestigación, y a la vista de lso resultados obtenidos, se puede concluir que en el sector hospitalario, la influencia de los factores: resistencia al cambio, resistencia a ser controlado y riesgo percibido afectan directamente a la actitud de los usuarios. El éxito o fracaso en la implantación de un sistema ERP puede quedar condicionado a la interacción de estos tres factores y su impacto en la actitud de los usuarios. La implantación de un sistema ERP en la organización, instrumentada mediante líneas de actuación enfocadas a gestionar estos tres factores, permitirá influir en la actitud de los usuarios hacia el uso de los sistemas ERP, y previsiblemente, facilitará mayores logros y avances en su implantación en el hospital.

Los cursos de formación de usuarios se presentan como el vehículo de difusión de la cultura de la organización y pueden ser dirigidos hacia la reducción de la resistencia al cambio, la resistencia a ser controlado , y a

minimizar los riesgos percibidos por el personal sanitario. Los cursos de formación no solo deben explicar el uso del sistema, sino tambien mostrar la habilidad de los sistemas de informacion para facilitar las operativa diaria, de modo que estén centrados en difundir los factores culturales en la organización. Con esta estrategia, los cursos de formación se pueden orientar a reducir la resistencia a ser controlado y a minimizar los riesgos percibidos por el personal ante el uso de las nuevas tecnologías. Asimismo, una estrategia de innovación cuenta con equipos de desarrolladores y de implantación de proyectos de integración, en los cuales es esencial promover la adaptación de los sistemas a las necesidades y al entorno de trabajo de los usuarios

Por último, y en cuanto al tercer objetivo específico de la investigación, planteado en términos de realizar una evaluación sistemática, de la experiencia de integración de la información en una organización sanitaria, los hallazgos de la investigación permiten determinar las siguientes conclusiones:

- El nuevo sistema ha aumentado la calidad de los procesos de toma de decisiones, tanto en el sentido de alterar el proceso de toma de decisiones, por disponer los gestores de una información de mayor calidad, como en el sentido de poder abordar desde una perspectiva más eficaz determinados problemas o situaciones.

- En lo que se refiere a la utilidad de la información, el nuevo sistema la hace más accesible, fiable, y oportuna.

- La presentación del caso particular de este hospital supone un ejemplo de la integración a nivel económico, y a tiempo real, de los diferentes agentes de la actividad, inherentes de un hospital, así como de la automatización de los procesos implicados en dicha integración.

- El nuevo sistema dirige a la organización hacia una cultura "nueva" impregnada de una visión de trabajo interrelacionado, en la que se comparten tareas y se establecen objetivos en común, y a la vez, permite a la organización elevar la calidad de la información gestionada.

A la vista de las principales conclusiones, y del resultado de esta investigación, se puede afirmar que con este trabajo de investigación se ha dado respuesta al objetivo general establecido con esta tesis, que ha sido analizar los aspectos relacionados con la actitud hacia el uso de los sistemas ERP en los hospitales públicos.

Sin embargo, en orden a extender el modelo, es necesario obtener evidencia adicional acerca de los factores culturales que condicionan dicha aceptación, lo cual permitirá validar los resultados de las investigaciones

existentes, particularmente aquellas que involucran diferentes tecnologías, usuarios, y/o contextos organizativos.

Una futura línea de investigación de la actitud hacia el uso de los sistemas ERP, en los hospitales públicos, podría llevarse a cabo mediante la aplicación del modelo de investigación, utilizado en este trabajo, para el caso de otros hospitales, de carácter público, con diferentes modelos de gestión que cuenten con ERP. Este sería el caso de los seis últimos hospitales constituidos en la Comunidad de Madrid mediante la fómula *Privare Finance Initiative* (PFI), y también el de aquellos hospitales de gestión totalmente pública integrados en el proyecto NEXUS emprendido en la Comunidad Autónoma de Madrid, para la implantación de un sistema ERP común a todos lor organismos de la administración autonómica de esta comunidad

En concreto, sería interesante establecer la existencia o inexistencia de una relación entre el modelo de gestión del hospital y el mayor o menor uso del sistema ERP por parte de su personal, así como la influencia de la relación laboral existente con el personal del hospital (personal laboral, personal estatutario o personal funcionario) que utiliza el ERP y el grado de uso del sistema ERP en el hospital.

También sería interesante continuar la linea de investigacion abierta acerca del alcance de los cursos impartidos por la organización en proyectos de

implantación de ERP en hospitales públicos, con vistas a revelar la existencia o inexistencia de una relación de los mismos, con los resultados de la implantación el ERP, y el uso final del sistema por parte de los usuarios en el hospital.

Para finalizar, a la vista del modelo de aceptación de nuevas tecnologías , aplicado en esta investigación, sería interesante continuar la exploración mediante la aplicación del modelo TAM en hospitales públicos que cuenten con ERP, con vistas a realizar prediciciones acerca del uso del sistema ERP en aquello hospitales con diferentes modelos de gestión, y adscripción de su personal

También, en el contexto de la aceptación de un sistema integrado de información en los hospitales públicos, posteriores trabajos de investigación, podrían aportar luz acerca de la importancia de las diferencias individuales de los usuarios, el grado de experiencia, el nivel educativo de cada uno, y su influencia en la aceptacion de las nuevas tecnologías en el entorno hospitalario.