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IMPACTOS DOS SISTEMAS DE GESTÃO INTEGRADOS NO DESEMPENHO ORGANIZACIONAL: UMA PERSPECTIVA MULTIDIMENSIONAL DOS TRABALHADORES

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Dissertação apresentada ao Programa de Pós-Graduação em Engenharia de Produção e Sistemas, da Universidade Federal da Paraíba, como requisito parcial para a obtenção do grau de Mestre em Engenharia de Produção.

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Esta Dissertação foi julgada e aprovada em sua forma final para obtenção do grau de Mestre em Engenharia de Produção pelo Programa de Pós-Graduação em Engenharia de Produção e Sistemas da Universidade Federal da Paraíba.

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Dedico este trabalho a minha esposa, Aglaucibelly Maciel Barbosa, a minha mãe, Luiza Clotildes de Souza, a meu pai, Agerson Barbosa de Oliveira (em memória) e a minha família.

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“Não sois máquina! Homens é o que sois!”

Charles Chaplin.

RESUMO

Nas últimas décadas, muitas organizações estão implantando simultaneamente os três principais sistemas de gerenciamento, os quais possuem normas específicas: o Sistema de Gestão da Qualidade (SGQ), consoante com a ISO 9001; o Sistema de Gestão Ambiental (SGA), consoante com a ISO14001; e o Sistema de Gestão da Saúde e Segurança Ocupacional (SGSSO), consoante com a ISO 45001 / BS OSHAS 18001. As semelhanças estruturais entre eles permitiram a integração de diferentes modelos em um único, em vez de implementá-los separadamente. Desta forma, a lacuna de pesquisa foi avaliar os benefícios e impactos no desempenho organizacional da companhia, de cada um dos sistemas propostos neste trabalho (SGQ, SGA e SGSSO, delimitação desta dissertação), quando implementados de forma simultânea e integrada, sob a perspectiva de seus trabalhadores. Isto posto, o principal objetivo desta dissertação foi propor e aplicar um modelo de mensuração dos impactos dos sistemas integrados de gerenciamento no desempenho organizacional em uma empresa de grande porte, através da percepção multidimensional de seus trabalhadores. O procedimento metodológico, utilizando uma abordagem multimétodo, iniciou com as diretrizes dos Itens de Relatório Preferidos para Revisões Sistemáticas e Meta-análises (PRISMA), desencadeando uma consistente Revisão Sistemática da Literatura (RSL) baseada em uma amostra de artigos científicos extraída das bases de conhecimentos científicos *Web of Science* (WoS) e *Scopus*. Em seguida foi utilizado o método estatístico da Teoria de Resposta ao Item (TRI) com o intuito de validar a habilidade do instrumento de coleta de dados, discernindo sobre a robustez de distinção e o grau de dificuldade da compreensão das variáveis observáveis, como também mensurar, através de uma escala, o grau de percepção dos trabalhadores em relação aos impactos dos Sistemas de Gestão Integrados (SGI) no desempenho organizacional de uma empresa de grande porte. Por fim, fez-se uso da metodologia estatística de análise multivariada, utilizando-se inicialmente da Análise de Cluster (AC) para agrupar as variáveis observáveis, posteriormente, realizou-se a Análise Fatorial Exploratória (AFE) para determinar as cargas fatoriais e o percentual de explicação dos itens e, em conclusão, implementou-se a Modelagem de Equações Estruturais (MEE) para mensurar as ligações entre as variáveis latentes e observáveis. Os resultados obtidos nesta pesquisa revelaram vários ganhos importantes e interessantes oferecidos pela integração dos sistemas de gerenciamento e uma ampla disposição para integrá-los. O instrumento de pesquisa foi composto por 25 itens, e os resultados do *Alpha de Cronbach* e do *Ômega de McDonald* foram de 0,964 e 0,970, respectivamente. Quanto aos cálculos dos Coeficientes de Validade de Conteúdo (CVC) os resultados da eficácia de conteúdo do instrumento de medição foram 0,94 para clareza e coerência e 0,95 para relevância. Os parâmetros da TRI demonstraram discriminação elevada em 100% das variáveis observáveis, sendo

desenvolvida uma escala de dificuldade interpretativa de 6 níveis. Os resultados mostraram ainda que os itens se agruparam em função da similaridade e da distância formando 3 vetores (SGQ, SGA e SGSSO), que a AFE multidimensional explicou em 73% os traços latentes, e que os parâmetros obtidos relacionados ao MEE constatou que o modelo é estatisticamente significativo (aceitável), haja vista ter alcançados excelentes índices de ajuste. Desta forma, conclui-se que há diversos benefícios gerados pelos SGI, que o instrumento de pesquisa foi aprovado, pois apresentou adequados parâmetros de confiabilidade e validade, que foi capaz de medir o que se propôs a mensurar e as informações puderam ser interpretadas, pois cada nível do traço latente foi especificado pelas peculiaridades dos itens congruentes ao questionário. Isto posto, as contribuições deste estudo estão no aspecto de propor e aplicar uma ferramenta de pesquisa (questionário), de como realizar uma análise robusta de uma *survey*, de nortear um passo a passo didático da metodologia estatística aplicada e de como orientar a organização a saber como investir em SGI, pois através dessas informações a empresa poderá avaliar e planejar melhor que direção seguir.

Palavras-chave: Sistema de Gestão Integrado. Modelagem de Equações Estruturais. Teoria de Resposta ao Item. Análise Fatorial Exploratória. Análise de Cluster. Coeficiente de Validação de Conteúdo.

ABSTRACT

In the past few decades, many organizations are simultaneously implementing the three main management systems, which have specific standards: The Quality Management System (QMS), in accordance with ISO 9001; the Environmental Management System (EMS), in accordance with ISO14001; and the Occupational Health and Safety Management System (OHSMS), in accordance with ISO 45001 / BS OSHAS 18001. The structural similarities between them allowed the integration of different models in a single one, instead of implementing them separately. Thus, the research gap was to assess the benefits and impacts on the company's organizational performance, of each of the systems proposed in this work (SGQ, SGA and SGSSO, delimitation of this dissertation), when implemented simultaneously and integrated, from the perspective of its workers. That said, the main objective of this dissertation was to propose and to apply a model for measuring the impacts of integrated management systems on organizational performance in a large company, through the multidimensional perception of its workers. The methodological procedure, using a multi-method approach, started with the guidelines of the Preferred Report Items for Systematic Reviews and Meta-analyzes (PRISMA), triggering a consistent Systematic Literature Review (SLR) based on a sample of scientific articles extracted from the scientific knowledge bases Web of Science (WoS) and Scopus. Then, the Item Response Theory (IRT) statistical method was used in order to validate the ability of the data collection instrument, discerning the robustness of the distinction and the degree of difficulty in understanding the observable variables, as well as measuring , through a scale, the degree of perception of workers in relation to the impacts of Integrated Management Systems (IMS) on the organizational performance of a large company. Finally, the statistical methodology of multivariate analysis was used, initially using Cluster Analysis (CA) to group the observable variables, later, the Exploratory Factor Analysis (EFA) was performed to determine the factor loads and the percentage of explanation of the items and, in conclusion, the Structural Equation Modeling (SEM) was implemented to measure the links between the latent and observable variables. The results obtained in this research revealed several important and interesting gains offered by the integration of the management systems and a wide disposition to integrate them. The research instrument consisted of 25 items, and the results for Cronbach's Alpha and McDonald's Omega were 0.964 and 0.970, respectively. As for the calculations of the Content Validity Coefficients (CVC) the results of the content effectiveness of the measuring instrument were 0.94 for clarity and coherence and 0.95 for relevance. The IRT parameters demonstrated high discrimination in 100% of the observable variables, with a 6-level interpretative difficulty scale being developed. The results also showed that the items were grouped according to similarity and distance, forming 3 vectors (QMS, EMS and OHSMS), that multidimensional EFA explained the latent traits in 73%, and that the parameters

obtained related to the EMS found that the model is statistically significant (acceptable), since excellent adjustment rates have been achieved. Thus, it is concluded that there are several benefits generated by the IMS, that the research instrument was approved, as it presented adequate parameters of reliability and validity, which was able to measure what it was intended to measure and the information could be interpreted, because each level of the latent trait was specified by the peculiarities of the items congruent to the questionnaire. That said, the contributions of this study are in the aspect of proposing and applying a research tool (questionnaire), how to carry out a robust analysis of a survey, to guide a didactic step by step of the applied statistical methodology and how to guide the organization to know how to invest in SGI, because through this information the company will be able to better assess and plan which direction to follow.

Keywords: Integrated Management System. Structural Equation Modeling. Item Response Theory. Exploratory Factor Analysis. Cluster Analysis. Content Validation Coefficient.

SUMÁRIO

1 INTRODUÇÃO

Para criar vantagens competitivas, contribuir para o desenvolvimento sustentável e propiciar um ambiente laboral adequado muitas organizações implementaram de forma integrada os três principais sistemas de gerenciamento, os quais possuem normas específicas: o Sistema de Gestão da Qualidade – SGQ, consoante com a ISO 9001; o Sistema de Gestão Ambiental – SGA, consoante com a ISO14001; e o Sistema de Gestão da Saúde e Segurança Ocupacional – SGSSO, consoante com a ISO 45001 / BS OSHAS 18001; tornando-se uma prática difundida em todo o mundo (Esquer-Peralta; Velazquez; Munguia, 2008; Jørgensen; Remmen; Mellado, 2006). Em consequência disso, surgiu um grande número de sistemas de gestão, com demandas diferentes e às vezes divergentes, exigindo uma reconsideração das estratégias empresarias de introdução desses padrões e apontando para a questão de adaptação por meio de um Sistema de Gestão Integrado – SGI (Santos & Carvalho, 2019).

Muthu Samy, Palani Samy e Ammasaiappan (2015) entendem a integração como o estabelecimento de um único modelo de gerenciamento "central" de nível superior com preceitos de suporte modulares opcionais que cobrem requisitos específicos. A integração dos sistemas de gestão da qualidade, meio ambiente e saúde e segurança ocupacional significa vinculá-los de alguma forma e normalmente leva a um sistema de gestão forte e abrangente (Karapetrovic & Jonker, 2003). Incorporando funções das mais diversificadas áreas da corporação, os SGI promovem um aprimoramento da competitividade organizacional, considerando as especificidades de cada área, respeitando as necessidades da companhia e assegurando a adesão, de todos, no programa de gestão (Fresner & Engelhardt, 2004; Hamidi et al., 2012).

Desta forma, a implantação de SGI tem como objetivos - além de promover impactos positivos na qualidade da empresa, no ambiente laboral, de eliminar ou minimizar os acidentes de trabalho, de melhorar a saúde dos colaboradores, de favorecer a qualidade de vida no local de labor e de reduzir os custos da empresa - o aumento constante do valor vislumbrado pelos clientes (internos e externos) dos bens ou serviços ofertados, o êxito na fração de mercado conquistado (por meio do aperfeiçoamento ininterrupto das soluções operacionais), o contentamento dos colaboradores com a empresa e a satisfação da própria sociedade com a cooperação social da empresa (Santos et al., 2011; Zeng et al., 2007).

Certas complicações surgem quando as empresas adotam mais de um sistema de gerenciamento separadamente. Zeng et al. (2007) apontam problemas como a duplicação de esforços em termos de documentação, formas e procedimentos de controle e a dificuldade de garantir o alinhamento da estratégia em todos os diferentes sistemas.

Bernardo et al. (2015) afirmam que, quando uma organização decide integrar seus sistemas de gerenciamento, obtém uma máxima eficiência relacionada ao gerenciamento de vários sistemas, além de melhorar a imagem externa e o relacionamento com as partes interessadas.

Com o intuito de corroborar com esta afirmação, no Capítulo II desta dissertação, foi realizada uma Revisão Sistemática da Literatura (RSL) para mapear os benefícios e impactos decorrentes da implementação de Sistemas de Gestão Integrados. Foram analisados 118 estudos empíricos e os resultados mostraram que as empresas que integram seus sistemas de gestão obtiveram mais benefícios quando comparadas aos sistemas de gestão separados.

Constatou-se também, através dessa RSL, a lacuna de pesquisa, que foi a necessidade de avaliar os benefícios e impactos no desempenho organizacional das companhias, de cada um dos sistemas propostos neste trabalho (SGQ, SGA e SGSSO, delimitação desta dissertação), quando implementados de forma síncrona e integrada, sob a perspectiva de seus trabalhadores. Para tanto, foi elaborado um instrumento de pesquisa (questionário) com 25 itens, a partir dos resultados da RSL.

Com o intuito de validar a ferramenta de pesquisa, no Capítulo III foi implementada a metodologia da Teoria de Resposta ao Item (TRI), a qual investiga as propriedades de cada variável em relação a seu poder de discriminação e o grau de dificuldade de percepção das questões (Nunes et al., 2008).

Isto posto, o objetivo principal de pesquisa deste estudo, caracterizado no Capítulo IV, foi mensurar os impactos estimulados pela integração dos sistemas de gerenciamento no desempenho organizacional em uma empresa de grande porte, através da percepção multidimensional de seus colaboradores, fazendo uso da metodologia estatística de análise multivariada.

Por conseguinte, um questionamento sobre a influência que a integração dos sistemas estimula no desempenho organizacional de uma companhia precisa de esclarecimento: Quais os impactos dos Sistemas de Gestão (SGQ, SGA e SGSSO), quando conduzidos de forma simultânea e integrada, no desempenho organizacional de uma empresa de grande porte, de acordo com a percepção multidimensional de seus trabalhadores?

1.1 JUSTIFICATIVA

As alterações que estão acontecendo no contexto social, econômico, político e tecnológico no mundo exigem das corporações a necessidade de se aplicar novas estratégias empresariais e deixam claro que os modelos de gestão implementados isoladamente não são suficientes para responder aos novos desafios surgidos, devendo essa prática ser reavaliada para atender às exigências de competitividade do mercado e dos clientes (Zeng et al., 2007). Não obstante, não basta se diferenciar no mercado pela competitividade e lucro, também é necessário evidenciar e demonstrar de forma

inequívoca às partes interessadas uma atuação ética e responsável quanto às condições de qualidade, do ambiente laboral, da saúde ocupacional, da segurança do trabalho e da qualidade de vida no local de labor (Sui et al., 2018).

A implementação de Sistemas de Gestão Integrados é um agente multiplicador da capacidade das companhias em operar com maior qualidade, baixos custos e fomentar a inovação tecnológica. Desta forma, o SGI consegue atender às carências empresariais, uma vez que, na luta permanente pela sobrevivência, as corporações estão se desgastando para se adaptarem aos novos pensamentos e aptidões, consumindo forças que podem ser poupadas (Salomone, 2008).

Nesse sentido, a integração dos sistemas de gerenciamento, tema desta pesquisa, ganha importância, pois constitui ferramenta administrativa que auxilia as organizações na reavaliação dos seus modelos de gestão e na criação de novas referências condizentes com o atual padrão, e que apresentam características sistêmicas, trazendo a melhoria contínua do nível de desempenho por meio da redução dos impactos negativos tanto para as empresas quanto para os trabalhadores (Ofori et al., 2002).

Sendo assim, devido ao amplo propósito e à crescente implementação de Sistemas de Gestão Integrados nas empresas, torna-se necessário estudos a respeito da integração desses sistemas, principalmente no que se refere às dificuldades e benefícios da implantação, para fornecer informações e soluções sobre como melhorar a qualidade organizacional; como evitar a degradação do meio ambiente laboral e de como conviver de forma sustentável com o mesmo; como prevenir, eliminar ou minimizar os riscos de acidentes e doenças ocupacionais através de medidas de higiene e segurança do trabalho, melhorando assim a saúde e a qualidade de vida das pessoas; como saber o quanto o SGI é capazes de atuar como instrumentos promotores de melhorias dentro do contexto da conjuntura social, econômica e ambiental na qual se depara a sociedade no cotidiano; e como mostrar que essas questões podem ser obtidas através de programas contínuos de gestão, com o envolvimento de todos os gestores e colaboradores da organização.

Desta forma, os Sistemas de Gestão Integrados devem ser vistos como uma ferramenta gerencial que contribui para a melhoria no desempenho das empresas, o que é uma necessidade fundamental para as organizações, para os trabalhadores e para a sociedade (Ikram et al., 2019).

Sabendo-se disso, a implementação de Sistemas de Gestão (SGQ, SGA e SGSSO), quando praticada de forma simultânea e integrada, pode contribuir diretamente para o desempenho organizacional das empresas, em concordância com a percepção de seus trabalhadores.

1.2 OBJETIVOS

1.2.1 Objetivo Geral

O objetivo geral de pesquisa deste estudo é propor e aplicar um modelo de mensuração dos impactos dos sistemas integrados de gerenciamento (SGQ, SGA e SGSSO) no desempenho organizacional em uma empresa de grande porte, através da percepção multidimensional de seus trabalhadores.

Esta dissertação foi desencadeada através do embasamento teórico de uma Revisão Sistemática da Literatura (RSL) a qual teve por finalidade diagnosticar os impactos no desempenho organizacional promovidos pela condução integrada dos sistemas de gestão. De posse das informações angariadas na RSL, o desfecho do trabalho prosseguiu com a construção de uma ferramenta de coleta de dados (questionário), sua validação através da Teoria de Resposta ao Item (TRI) e uma análise estatística multivariada dos dados adquiridos.

1.2.2 Objetivos Específicos

Os objetivos específicos desta pesquisa foram os desenvolvidos nos 3 artigos que compõem está dissertação:

a) Mapear e analisar a literatura sobre os impactos no desempenho organizacional estimulados pela integração de sistemas de gerenciamento;
b) Propor e validar um instrumento para mensurar esses impactos dos SGI;
c) Mensurar os impactos organizacionais da integração dos sistemas de gestão sob a perspectiva multidimensional dos trabalhadores.

1.3 ESTRUTURA DA DISSERTAÇÃO

A estrutura desta dissertação está em conformidade com a resolução interna, nº 01/2020, do Programa de Pós-Graduação em Engenharia de Produção e Sistemas - PPGEPS, da Universidade Federal da Paraíba - UFPB, que trata sobre as orientações relacionadas a elaboração, apresentação e defesa dos trabalhos de dissertações, homologada pelo Colegiado em 04 de maio de 2020.

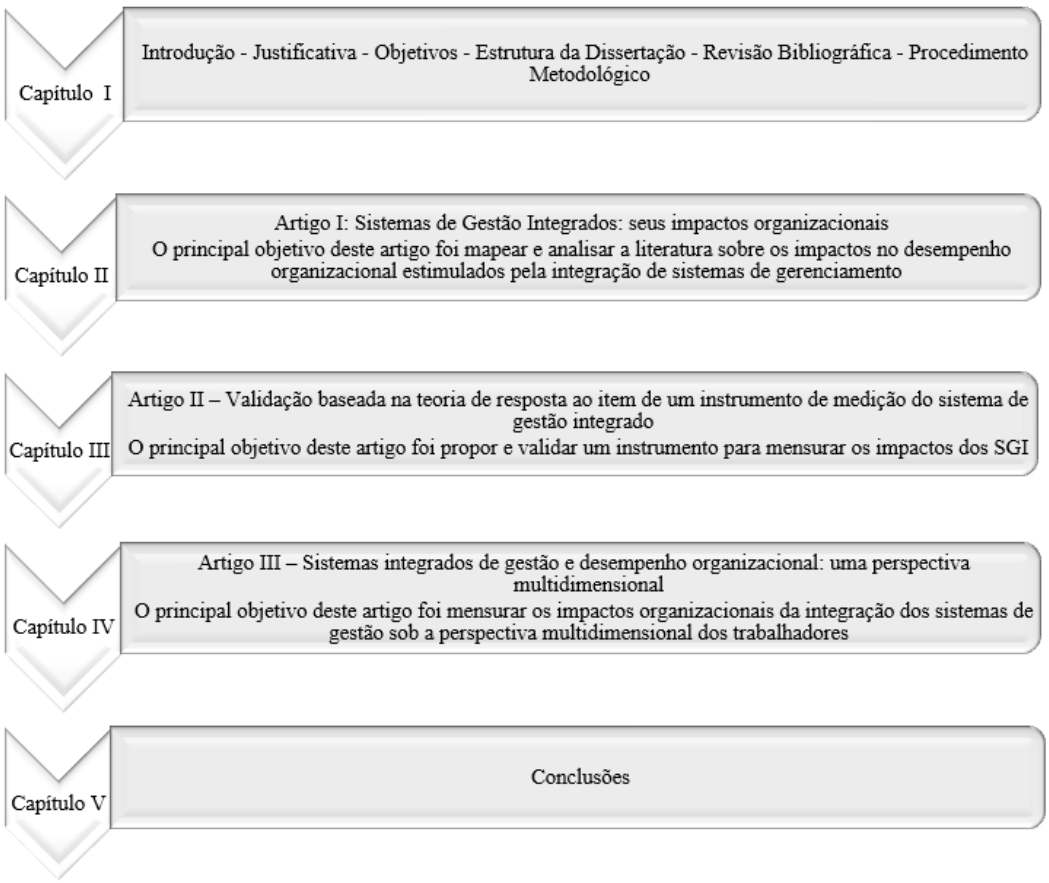
Está escrita principalmente em inglês e dividida em 5 capítulos, incluindo esta introdução (Capítulo 1) que expõe o contexto geral do tema, denota o problema, a justificativa, a hipótese e os objetivos da pesquisa, como também evidência a estrutura do trabalho, a revisão bibliográfica e os procedimentos metodológicos basilares do estudo.

Os Capítulos 2, 3 e 4 correspondem a artigos já publicados ou em revisão em periódicos indexados em uma das bases científicas *Web of Science* ou *Scopus*, com *Journal Citation Reports (JCR)* igual ou superior a 0,5, como forma de melhorar a visibilidade da pesquisa.

Em particular, o Capítulo 2 evidencia uma Revisão Sistemática da Literatura (RSL) sobre Sistemas de Gestão Integrados (SGI), tema desta dissertação, que condiz ao primeiro artigo publicado em um periódico com *JCR* igual a 2.922. O Capítulo 3 representa o segundo artigo submetido (encontra-se em revisão) a um periódico com *JCR* igual a 7.246, que trata sobre a validação do instrumento de pesquisa através da metodologia da Teoria de Resposta ao Item. De forma similar, o Capítulo 4 constitui o terceiro artigo que versa sobre a mensuração dos impactos de SGI no desempenho organizacional de uma empresa de serviços elétricos, também já submetido (encontra-se em revisão) a um periódico com o mesmo critério de submissão (*JCR* igual a 2.922).

O quinto e último capítulo apresenta uma discussão e uma conclusão relacionadas a todos os capítulos anteriores e suas contribuições para esta pesquisa, como também denota sobre as limitações e sugestões para trabalhos futuros. A Figura 1.1 apresenta essa estrutura.

Figura 1.1: Estrutura da Dissertação.



Fonte: Próprio autor.

1.4 REVISÃO BIBLIOGRÁFICA

Esta revisão bibliográfica aborda os principais assuntos relacionados a esta pesquisa. Versa sobre os conceitos, os princípios, os benefícios e as perspectivas dos sistemas de gerenciamento quando conduzidos de forma concomitante e integrada. Faz referência a metodologia estatística de análise multivariada, explanando sobre sua robustez, características relevantes, forma de tratamento de dados não paramétricos, entre outros. Aborda também sobre Análise Fatorial e Análise de Agrupamento, métodos específicos de análise multivariada utilizados nesta dissertação para investigar as informações coletadas para obtenção de constructos. E por fim, explana sobre o coeficiente de confiabilidade de questionários, *Alpha de Cronbach* e *Ômega de McDonald*.

1.4.1 Sistemas de Gestão Integrados - SGI

No entendimento de Beckmerhagen et al. (2003) integração é a conciliação de um conjunto de produtos e operações dissociados inseridos em algo mais amplo. Um sistema genuinamente integrado é aquele que combina sistemas de gerenciamento usando o foco do funcionário, uma visão de processo e uma abordagem de sistemas, que possibilita colocar todas as práticas padrão de gerenciamento relevantes em um único sistema (Ionescu et al., 2018). Desta forma, a integração de sistemas de gestão pode ser compreendida como uma operação para unificar diversas funções específicas dos sistemas de gestão em um mesmo sistema, que passa a ser chamado de Sistema de Gestão Integrado - SGI (Samy et al., 2015).

Al-Darrab at al. (2013), Siva et al. (2016), Moumen et al. (2017) e Carvalho et al. (2020) consideram ainda que a implementação de SGI tem a perspectiva de atender as necessidades de desempenho das empresas e as expectativas de seus clientes (internos e externos) e está baseada em alguns princípios, como por exemplo: (i) Qualidade - por intermédio de ações simples e eficientes, garantir a qualidade dos produtos e serviços considerando os benefícios às partes interessadas, procurando atender aos requisitos definidos pela companhia; (ii) Meio Ambiente - procurar o aperfeiçoamento constante do desenvolvimento sustentável, priorizando práticas que possam ser compreendidas claramente pelos trabalhadores, contribuindo com a qualidade do ambiente laboral; e (iii) Saúde e Segurança - proporcionar a todos os colaboradores engajados nos processos produtivos, um ambiente laboral salubre e seguro, evidenciando a prevenção de incidentes, de acidentes e de doença ocupacionais, proporcionando qualidade de vida no local de labor.

Desta forma, com a intenção de melhorar o desempenho, as organizações empresariais estão implementando voluntariamente diversos sistemas de gerenciamento, como por exemplo: Sistema de Gestão da Qualidade - SGQ, de acordo com a ISO 9001; Sistema de Gestão Ambiental - SGA, de

acordo com a ISO 14001; e Sistema de Gestão em Saúde e Segurança Ocupacional – SGSSO, de acordo com a OSHAS 18001; entre outros (Rueda and Gomez, 2016; Rebelo et al., 2014).

Em consequência disto, a solução de integrar os sistemas de gestão ocorre quando mais de um sistema se agrupam de modo que a autonomia (independência) de um deles ou de todos seja anulada, mas sem abandonar suas identidades e valores individuais (Domingues et al., 2015). Cada sistema de gerenciamento opera em uma determinada área específica e agrega valores nessa área e a integração depende da relação entre alcance e controle da operação de cada sistema (Bernardo et al., 2015).

Como exemplo, quando uma determinada companhia adota o SGQ, diversos são os ganhos agregados, tais como o melhor desempenho de produtos, de serviços e da qualidade dos processos, há uma melhor satisfação dos clientes (interno e externo) referente à qualidade da empresa, aumenta a confiança e a credibilidade dos produtos, reduz os custos (melhorando a eficiência dos processos), a uma melhora na tomada de decisões, diminuição dos riscos de se ter atividades redundantes e contraditórias, aperfeiçoamento da comunicação, utilização eficiente de recursos e aumento da motivação das pessoas, entre outros (Holm et al., 2015; Silva et al., 2020; Trierweiller et al., 2016). De forma semelhante, para uma organização obter um consumo eficiente dos insumos, uma redução da poluição, promover um meio ambiente equilibrado, entre outros benefícios, ela implanta um SGA (Bąk & Nowak, 2019; Savino & Shafiq, 2018). Seguindo a mesma linha, o SGSSO pode proporcionar eliminação ou minimização dos riscos no local de trabalho (promovendo um ambiente salubre), redução dos acidentes e doenças ocupacionais, melhor satisfação dos colaboradores e do empregador, melhor imagem da organização, entre outros ganhos (Rebelo et al., 2017; Majerník et al., 2017).

Um sistema de gestão, em qualquer companhia, é dirigido através de objetivos. Todavia, constata-se que nem sempre tal sistema de gestão é documentado. De acordo com o crescimento organizacional, a ausência de transparência pode contribuir de forma negativa para o desempenho da empresa (Abad et al., 2016; Simon, Karapetrovic, & Casadess, 2012; York & Miree, 2004).

Para que isso não aconteça, as lideranças das organizações devem primeiramente, e de forma exemplar, se engajar no processo para que possam conduzir a integração, considerando as vantagens e os custos da implantação. Em seguida, é de extrema valia definir o modelo agregado, isto é, analisar quais normas serão assimiladas e em que ordem (Karapetrovic & Casadesús, 2009). O próximo passo é o planejamento da integração, seguido da etapa de levantamento das premissas a serem incluídas. Após o conhecimento de quais são os requisitos, é importante implementá-los de forma unificada (Khair et al., 2018). O penúltimo trecho consiste em manter e melhorar continuamente a integração. Na etapa final, para que se aprenda com a experiência vivenciada, é estabelecido que sejam aplicadas as lições aprendidas ao longo do tempo pelas as empresas (Carvalho; Domingues; Sampaio, 2019; Siva et al., 2016; Tepaskoualos; Chountalas, 2017).

Quando se comenta em SGI, há principalmente dois níveis de integração. Um deles propõe meramente a disposição dos arranjos das normas, tendo simplesmente como objetivo maior redução dos custos. Já o outro nível é mais robusto, procura uma integração na qual se obtenha valores não exclusivamente financeiros, mas também obtenha valores agregados referentes à gestão do desempenho de forma geral (Gapp et al., 2008; Karapetrovic & Jonker, 2003). Para tanto, há dois elementos que contribuem para uma integração mais abrangente, o estratégico e tático. A parte estratégica consiste na decisão e na definição da integração principal dos procedimentos, com a adoção compulsória de metas. A parte da tática consiste na formulação de planos, elaboração de procedimentos, tomada de decisões de controle e composição de relatórios referentes ao nível estratégico (Moumen & Elaoufir, 2018).

Em consequência disso, quando as empresas resolvem integrar seus sistemas de gerenciamento, para atender as expectativas das partes interessadas, elas têm se preocupado de forma mais específica com as questões que compreendem a satisfação dos clientes (internos e externos), a qualidade dos produtos ou serviços, a proteção do meio ambiente e os aspectos sociais, inclusive os que abrangem a saúde e segurança de seus funcionários (Domingues et al., 2016; Simon et al., 2011).

Pensando nisso, para que as organizações possam se desenvolver e enfrentar o cenário comercial, altamente competitivo e dinâmico, há a necessidade de um planejamento futuro de seus investimentos (Samy et al., 2015). Para tanto, é interessante haver uma ferramenta que analise os impactos de Sistemas de Gestão Integrados, para que através dessas informações se possa promover uma otimização dos investimentos para se atingir um grau maior de valores agregados.

1.4.2 *Alpha de Cronbach* e *Ômega de McDonald*: Confiabilidade do Questionário

A confiabilidade de uma ferramenta de aferição é a principal característica para verificar sua eficiência. Um dos métodos estatísticos utilizados para avaliar a confiabilidade de um questionário aplicado a uma pesquisa é o Coeficiente de *Alpha de Cronbach*. É um único número que mede (informa) quanto um conjunto de respostas, sobre determinado assunto (característica), estão relacionadas entre si. Avalia a correlação entre as opiniões dos pesquisados através da análise do perfil das respostas, refere-se a uma correlação média entre as perguntas (Taber, 2018).

Para se calcular o *Alpha de Cronbach* elabora-se uma matriz *n x k* (*n* perguntas e *k* pesquisados) que pode representar as respostas quantificadas de um questionário que possui uma escala que varia de 1 a 5, isto é, as respostas para cada pergunta podem ser escalonadas como "nunca" (valendo 1), "poucas vezes" (valendo 2), "algumas vezes" (valendo 3), " muitas vezes" (valendo 4) e "sempre" (valendo 5) (Amaral et al., 2013).

Intrínseco do modelo de resposta da população pesquisada, o coeficiente é uma característica, não uma particularidade, da escala por si só, isto é, o valor de alfa modifica-se de acordo com a amostra na qual se aplica a escala (Zinbarg et al., 2005).

A consistência interna avaliada pela medida *Alpha de Cronbach* de um questionário é tanto maior quanto mais perto de 1 estiver o valor da estatística (Cronbach, 1951). Há muita discussão sobre os valores aceitáveis de alfa: em geral, variam entre 0,70 e 0,95 (Amaral et al., 2013).

O coeficiente *alpha* é calculado através da variância da soma das respostas dos pesquisados e da soma das variâncias das perguntas, pela seguinte fórmula (Equação I):

$$\alpha = \frac{k}{k-1}\left[\frac{\sigma_t^2 - \sum_{i=1}^{k}\sigma_i^2}{\sigma_t^2}\right] \quad \text{(Equação I)}$$

Em que:

k - corresponde ao número de questões (k deve ser maior que 1);

σ_t^2 - corresponde à variância da soma das respostas dos pesquisados;

σ_i^2 - corresponde à soma das variâncias das perguntas.

Já o coeficiente de *Ômega de McDonald* (ω) é um indicador de consistência interna dos itens de um instrumento com cálculos baseados em análise fatorial. Ao contrário do coeficiente *alpha*, o coeficiente *ômega* trabalha com as cargas fatoriais, o que torna os cálculos mais estáveis, com nível de confiabilidade maior e de forma independente do número de itens do instrumento. *Ômega (ω)* > 0,70 indica confiabilidade do conjunto de fatores (Viladrich et al., 2017).

1.4.3 Teoria de Resposta ao Item

A Teoria de Resposta ao Item (TRI) é um conjunto de modelos estatísticos que associam traços latentes com a perspectiva de uma determinada resposta a itens de múltipla escolha constituindo um instrumento de investigação. Isto é, consiste em um conjunto de modelos probabilísticos destinados a representar parâmetros importantes para a mensuração incluindo as características das variáveis observáveis e as medidas dos indivíduos (Chalmers, 2012).

A TRI fornece modelos matemáticos para os traços latentes, propondo formas de representar a relação entre a probabilidade de um indivíduo dar uma determinada resposta a um item, seu traço latente e características (parâmetros) dos itens, na área de conhecimento em estudo (Da Silva Nunes et al., 2008). A partir de um conjunto de respostas apresentadas por um grupo de respondentes a um conjunto de variáveis, a TRI permite a estimação dos parâmetros dos itens e dos entrevistados em uma escala de medida (Menegon et al., 2019). Por exemplo, considerando o construto da percepção

dos trabalhadores dos impactos de Sistemas de Gestão Integrados no desempenho organizacional em uma empresa de grande porte, uma análise feita através da TRI pode estimar o nível da percepção do respondente (isto é, um parâmetro do indivíduo) e também os parâmetros dos itens, de modo a criar uma escala de medida do nível da percepção dos colaboradores dos impactos de SGI no desempenho organizacional da empresa.

Os modelos da Teoria de Resposta ao Item dependem do tipo de variável observável e do tipo de processo de resposta. Eles podem ser acumulativos ou não acumulativos (Menegon et al., 2017).

1.4.4 Análise Multivariada

A Estatística Multivariada é entendida como um conjunto de ferramentas estatísticas empregadas em conjunturas nas quais múltiplas variáveis são mensuradas concomitantemente em cada fragmento experimental, ou seja, é o âmbito da estatística que tem por propósito a síntese, a concepção, a apreciação e a compreensão de elementos que fazem parte da amostra de populações nas quais para cada exemplo empírico são calculadas distintas variáveis respostas, contínuas ou não (Saccenti et al., 2014). As primeiras ideias sobre a análise de dados utilizando múltiplas respostas, surgem das contribuições de Pearson (1901), Fisher (1928), Hotelling (1931), Wilks (1932) e Bartlett (1937), que iniciam o desenvolvimento de procedimentos analíticos para tratar dessas situações.

É um mecanismo estatístico robusto que possibilita mensurar, concomitantemente, relações entre múltiplos construtos. Leva em consideração inúmeros modelos de técnicas estatísticas para qualificar conexões entre aspectos percebidos, com o propósito de contemporizar o cumprimento de pesquisas quantitativas sobre exemplos teóricos hipotetizados pelo pesquisador (Anderson & Gerbing, 1988).

Um estudo abrangente dessas variáveis é admitido através dos procedimentos de análise de dados multivariados, mantendo em destaque as correlações, afinidades ou contradições entre elas, extraviando o mínimo de informação (Lee et al., 2008).

Possibilita também responder, de uma maneira simplificada, a uma soma de questionamentos concernentes entre si, sistematizada e abrangente. Alcança este propósito ao modelar sincronicamente os vínculos entre múltiplos construtos endógenos (dependentes) ou exógenos (independentes) (Maccallum & Austin, 2000).

Tem-se evidenciado como um procedimento adaptável e importante para estimar indicadores em uma abrangente família de modelos lineares composto pelo “teste *t Student*”, “ANOVA”, “MANOVA” e modelos de regressão múltipla. Não obstante a característica mais marcante da Análise Multivariada é seu prolongamento para conceder a estimação de desvios de medidas através da utilização de fatores ou variáveis latentes múltiplas (Hair et al., 2012).

Nesses modelos consegue-se englobar parâmetros que não são mensurados de forma direta, mas sim através de seus impactos, designados por indicadores, ou de suas origens observáveis. Esses parâmetros não mensuráveis são conhecidos por variáveis latentes, construtos ou fatores (Golob, 2003).

Outra característica relevante dessa sistematização é a perspectiva de que uma mesma variável seja o resultado em uma equação e apresente-se como variável explanatória em outra equação. É ainda plausível a identificação de um resultado bilateral, isto é, aquele no qual duas variáveis impactam uma à outra por meio de um *feedback loop* (Zeng et al., 2011).

A aplicabilidade dessa modelagem é embasada na teoria empregada pelo pesquisador para elucidação das correlações entre um conjunto de variáveis, que são capazes de serem categorizadas como endógenas (dependentes) ou exógenas (independentes). Esse método teórico consegue ser ainda representado por meio de diagramas, que sintetizam um conjunto de hipóteses (Tomarken & Waller, 2005).

1.4.5 Análise de Agrupamento

Com suporte nas similaridades e distâncias das características que possuem as amostragens, a análise de agrupamento, também conhecida por análise de *cluster* ou análise de conglomerado, é uma ferramenta estatística que possibilita compilar variáveis, componentes, indivíduos, produtos e até mesmo comportamentos de elementos de uma amostra (Clatworthy et al., 2005; Van Rooden et al., 2010).

A metodologia de análise c*luster* é um procedimento exploratório no qual tem o propósito de segmentar em grupos uma população (ou amostra) visto que em diversas situações a quantidade de agrupamentos não é conhecida por pressuposição, mas necessita ser presumido através das informações amostrais pesquisadas. Procura conglomerar variáveis amostrais baseando-se na similaridade ou diferença entre os componentes. Os clusters são estipulados de maneira a alcançar homogeneidade dentro dos grupos e heterogeneidade entre os mesmos (Haughton et al., 2009; Shannon et al., 2003).

Utilizada adequadamente, a análise de agrupamento pode adicionar várias informações que poderiam não ser identificadas por outros meios, auxiliando dessa forma a necessidade indispensável de determinadas pesquisas (Giacomino et al., 2011).

Na análise de conglomerado, é extremamente necessário ter especial prudência na definição das variáveis de partida (mensuradas) que irão pormenorizar cada elemento (objeto), e estipular, em última instância, qual o agrupamento em que esse deve ser engajado. Não há qualquer espécie de interdependência entre as variáveis nesta análise, ou seja, os grupos se caracterizam por si mesmo

não havendo necessidade de ser delineada uma vinculação ocasional entre as variáveis aplicadas, principalmente propiciar hipóteses, mais do que experimentá-las, sendo indispensável a ratificação decorrente dos resultados adquiridos por meio da utilização de outras abordagens estatísticas (Bart et al., 2011; Fritz et al., 2013).

Comumente, a análise de agrupamento compreende cinco etapas (Kaoungku et al., 2018; Samyn et al., 2014):

1. A escolha de componentes ou de uma amostra de componentes a serem agrupados;
2. A determinação de um conglomerado de variáveis a partir do qual serão adquiridos elementos primordiais ao agrupamento das informações;
3. A determinação de uma dimensão de semelhança ou distância entre as variáveis;
4. A seleção de um algoritmo estatístico de partição/classificação;
5. Por último, a validação dos resultados encontrados.

1.4.6 Análise Fatorial - AF

Com o propósito de delinear o arranjo existente entre as variáveis compreendidas no processo, a Análise Fatorial (AF) é entendida como um agrupamento de técnicas de interdependência, determinando, assim, conjuntos de aspectos que são estreitamente interrelacionadas e que são denominados como fatores. Proporciona as metodologias para se investigar a estrutura das interrelações (correlações) presentes em um diverso número de variáveis (Ledesma et al., 2019).

É uma técnica multivariada que pode sintetizar os dados de uma relevante quantidade de dimensões em uma porção bem mais reduzida de variáveis ou fatores, contribuindo com assimilação das informações. Um fator é uma combinação linear das variáveis originais. A análise fatorial pode derivar tantos fatores quantos forem as variáveis investigadas (Adachi, 2019).

A Análise Fatorial abrange redução e/ou simplificação das informações cujo propósito elementar é sintetizar os dados contidos em distintas dimensões originais constituídas em um grupo menor de novos aspectos ou variáveis estatísticas (fatores) com uma perda mínima de informação (Iantovics et al., 2019). É aplicada quando se tem uma ampla quantidade de observações, em sua maior parte correlacionada, e que necessitam ser reduzidas a um patamar gerenciável (De Vet et al., 2005).

A AF não faz distinção entre as variáveis endógenas e exógenas e é considerada um método de interdependência, pois explora todo o agrupamento de relações interdependentes, o que a diferencia da análise de variância, regressão múltipla e análise discriminante (Gaskin & Happell, 2014).

A metodologia da Análise Fatorial Exploratória (AFE) possui basicamente dois tipos de aplicabilidade: (i) redução: compilar um grupo de variáveis em uma quantidade inferior de fatores, justificando o máximo possível de variância do conjunto inicial; normalmente, para esta função, orienta-se a remoção por componentes principais; (ii) reconhecer fatores não considerados de modo direto e que originam as similaridades que verificamos nas variáveis; para esta função, orienta-se as estratégias de remoção do tipo fator comum, como por exemplo fatoração de imagem, fatoração de eixo principal, fatoração alfa, mínimos quadrados generalizados ou mínimos quadrados não ponderados, máxima verossimilhança (Conway & Huffcutt, 2003; Flora et al., 2012; Reise et al., 2000).

Quando o pesquisador dispor de insuficiente discernimento a respeito da estrutura latente por trás do agrupamento de indicadores da pesquisa, deve-se proceder a aplicação exploratória (AFE). Isto significa: quando não houver estudos empíricos precedentes ou quando a teoria estrutural do evento é incipiente, de maneira que não se conhece por pressuposição quantos vetores devem surgir e nem a estrutura dos construtos. Neste caso, o emprego exploratório possibilita que se tenha conhecimento da estrutura latente e se evolua no discernimento do fenômeno (Howard, 2016; Yuan et al., 2002).

Em contraposição, a metodologia da Análise Fatorial Confirmatória (AFC) é conveniente na ocasião em que a teoria relativa ao fenômeno já é consubstanciada. É a situação, por exemplo, em que as pesquisas que implementam replicações de escala. Isto posto, o pesquisador já dispõe de discernimento amplo a respeito do fenômeno e das suas interrelações, de modo que a análise fatorial permite confirmar (ou experimentar), para uma estipulada amostra ou contexto, a estrutura fatorial já publicada na literatura. Desta forma, já é de conhecimento antecipado a quantidade de fatores que serão mensurados e quais as suas interpretações (DiStefano & Hess, 2005; Flora et al., 2012; Goossens et al., 2009).

Como já mencionado, a principal incumbência dos distintos métodos de análise fatorial é restringir um amplo número de variáveis consideradas em uma quantidade limitada de fatores. Tais fatores caracterizam as dimensões latentes (construtos) que sintetizam ou demonstram o agrupamento de variáveis observadas (Brazill & Grofman, 2002).

Ao restringir informações, a análise fatorial adquiri dimensões latentes que pormenorizam os dados em uma quantidade reduzida de conceitos do que as variáveis individuais originais, a análise fatorial não se concerne a apenas um único método estatístico, mas sim a uma pluralidade de técnicas correlacionadas para transformar as informações observadas mais simplesmente interpretáveis (Kim et al., 2016).

1.4.7 Modelagem de Equações Estruturais

Tronando-se um dos mais importantes métodos estatísticos imersos na análise de relações entre variáveis, o Modelo de Equações Estruturais (MEE) tem sido adotado nas conexões que são observadas e estimadas, cujos modelos podem compreender dados observados ou latentes (Huang & Lai, 2012).

O MEE é um método estatístico multivariado de peculiaridade genérica, que está sendo extensamente aplicada em diversas áreas de estudo. Pode ser entendido como um arranjo de análise fatorial e regressão. A perspectiva de muitos estudiosos e outros profissionais em MEE provém, muitas vezes, das concepções teóricas que podem ser concebidas a partir dos construtos latentes (Boccia & Sarnacchiaro, 2014; Cheung, 2008).

As conexões entre as estruturações teóricas são caracterizadas por coeficientes de regressão entre variáveis observadas e/ou latentes. O Modelo de Equações Estruturais pressupõe um arranjo para as covariâncias entre as variáveis observadas. Fornece uma condição generalizada e conveniente para análises estatísticas que compreendem diversas estratégias multivariadas tradicionais, em especial, análise fatorial, análise de regressão, análise discriminante e correlação canônica, como casos particulares (Chandra, 2015; Ramli et al., 2014).

Os MEE são, na maioria das vezes, idealizados por um diagrama de trajetórias. O modelo estatístico normalmente pode ser demonstrado em um agrupamento de equações matriciais. Desta forma, os pesquisadores tinham que condicionar a interpretação da matriz a partir do diagrama de trajetórias para os diversos conjuntos de parâmetros, como cargas fatoriais e coeficientes de regressão (Abdullah et al., 2012; Shahyad et al., 2011).

Os Modelos de Equações Estruturais são, por conseguinte, singularmente significativos pelos seguintes benefícios: i) admitem que se trabalhe simultaneamente com estimação e mensuração; ii) possibilitam que sejam calculados efeitos diretos e indiretos de variáveis explicativas sobre variáveis respostas; iii) são bastante consistentes, em função da desobrigação de pressupostos, quando contrapostos, por exemplo, com o modelo de regressão de mínimos quadrados e; iv) expressão simplicidade interpretativa decorrente de suas interfaces gráficas. Em função desses benefícios, os MEE alcançaram amplo espaço entre os estudiosos e profissionais das mais diversas áreas de pesquisa (Jöreskog, 1994; Kalapouti et al., 2020).

1.5 PROCEDIMENTO METODOLÓGICO

O estudo buscou, por intermédio da teoria e da aplicação prática, investigar e ponderar, por meio de uma Revisão Sistemática da Literatura (RSL), da Teoria de Resposta ao Item (TRI) e através de uma Análise Multivariada, os impactos estimulados pelos sistemas de gerenciamento de uma

empresa de grande porte quando conduzidos de forma simultânea e integrada, expondo os graus de influência que cada um dos sistemas (SGQ, SGA e SGSSO) tem sobre o desempenho da organização, mediante a percepção multidimensional de seus trabalhadores.

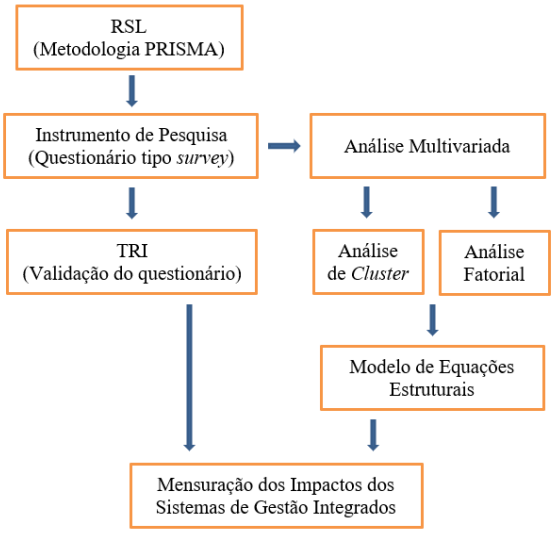
A RSL, elaborada no estágio preliminar da pesquisa, pretendeu contextualizar o tema, discernir sobre sua pertinência e proporcionar uma perspectiva abrangente sobre Sistemas e Gestão Integrados (SGI). Com os resultados alcançados foi possível municiar insumos para a estruturação do instrumento de coleta das informações (Apêndice I).

Na fase posterior da dissertação foi efetuada uma interlocução com 3 especialistas profissionais da empresa, os quais são incumbidos pelo gerenciamento coorporativo dos 3 sistemas de gestão discutidos neste trabalho (SGQ, SGA e SGSSO). A finalidade foi de investigar a clareza, coerência e relevância das questões elencadas para a ferramenta de coleta de dados enumeradas através da RSL, como também promover novas perguntas naturais do campo prático relevantes para o fortalecimento da pesquisa. Em seguida e após as observações dos especialistas foi aplicado um estudo piloto com o propósito de aferir a consistência e a confiabilidade do questionário.

No estágio seguinte e de posse das informações adquiridas na íntegra dos trabalhadores da organização foi verificada a proficiência do instrumento de pesquisa por intermédio da TRI, diferenciando a força de caracterização e o grau de obstáculo do entendimento das variáveis observáveis do questionário.

Já na etapa de conclusão da pesquisa foi aplicada a metodologia estatística de Análise Multivariada com a intenção de identificar quais os fatores (vetores) que mais propiciam impactos positivos no desempenho organizacional, através do discernimento multidimensional de seus colaboradores. A Figura 1.2 apresenta a integração do procedimento metodológico, no qual foi utilizada uma abordagem multimétodo.

Figura 1.2: Integração do procedimento metodológico.



1.5.1 Tipo de Pesquisa

A pesquisa foi planejada através de uma intensa e substancial RSL, da qual pôde-se obter os itens (variáveis observáveis) necessários para estruturar a ferramenta de avaliação (questionário), como também por intermédio de um levantamento tipo "*Survey*" (análise quantitativa que pode ser determinada como um método de coletar dados e informações a partir de peculiaridades e perspectivas de conjuntos de indivíduos), baseada no método dedutivo (parte de um princípio geral verdadeiro e chega a conclusões particulares devido a sua lógica), de natureza exploratória (procura solucionar um problema através da coleta e análise de dados), com objetivo descritivo (descreve as características de um fenômeno e estabelece relação entre as variáveis de estudo), de abordagem predominantemente quantitativa (análise estatística dos resultados), com coleta qualitativa de dados através de um questionário tipo *likert* (escala para questionários utilizada para mensurar posturas e opiniões com um nível maior de variação), para mensurar (por meio da metodologia estatística de análise multivariada) os impactos dos SGI no desempenho organizacional de uma empresa de grande porte através da percepção multidimensional de seus colaboradores.

1.5.2 Local da Pesquisa e População Pesquisada

A pesquisa foi realizada na ENGESELT - Engenharia e Serviços, que é uma empresa de grande porte formada por profissionais experientes do setor elétrico e de soluções em Tecnologia da Informação - TI. Com foco em Projetos em *Utilities*, Projetos de Distribuição de Energia e Processos Produtivos. Com aproximadamente 12 anos no mercado, a ENGESELT possui um corpo técnico capacitado e bem treinado de aproximadamente 850 colaboradores, dos quais 485 participaram deste estudo (o que corresponde a 57,06%). A ENGESELT está presente em vários estados do Brasil (PB, SE, MG, MT, ES, SP, GO, AC) e no Distrito Federal, com sede em João Pessoa, na Paraíba, oferecendo serviços de qualidade e cumprindo prazos definidos com seus clientes.

Possui a missão de fornecer serviços de engenharia elétrica eficazes e diferenciados para aumentar a qualidade e produtividade dos seus clientes de forma sustentável, com a visão de estender suas atividades para todo território nacional até o final do ano de 2020. Seus valores: CONFIABILIDADE – buscando estabelecer um relacionamento sólido com seus clientes, colaboradores e empresas parceiras, consubstanciado na confiança mútua; TRANSPARÊNCIA - trabalhando com clareza, de forma que todos os envolvidos, desde clientes e colaboradores conheçam as ações e os respectivos resultados; INOVAÇÃO - buscando sempre o aperfeiçoamento, incentivando a criatividade e a liberdade de ideias na descoberta de novos caminhos; COMPROMETIMENTO - firmando compromisso sério com seus clientes, atendendo

suas necessidades da melhor forma possível, bem como com seus colaboradores, contribuindo para o crescimento profissional e pessoal de cada um deles; e CREDIBILIDADE - agindo corretamente, de acordo com o que se compromete junto aos seus clientes, transmitindo confiança aos parceiros da empresa.

1.5.3 Solicitação de Autorização

A ENGESELT possui 2 sócios proprietários. Desta forma, foi agendada uma reunião para apresentação do projeto de pesquisa e foi solicitada a assinatura do Termo de Anuência (Apêndice II). Em seguida o estudo foi apresentado ao setor responsável pela gestão da empresa e ao setor de recursos humanos. Posteriormente agendou-se uma nova reunião com os colaboradores para expor os objetivos da pesquisa, a metodologia para coleta das informações, os aspectos éticos do estudo, os direitos de sigilo na participação ou não da pesquisa - que constam no Termo de Consentimento Livre e Esclarecido – TCLE (Apêndice III), que foi assinado por todos os participantes do estudo - a orientação de como responder o questionário e para que fim teve esses dados.

1.5.4 Coleta dos Dados

Para a coleta das informações necessárias dos 485 trabalhadores foi realizado um levantamento de dados nas áreas envolvidas, junto aos colaboradores da base, supervisores, coordenadores e gerentes (conforme hierarquia da empresa) com a aplicação de um questionário em formato eletrônico.

O questionário foi desenvolvido de acordo com os impactos oriundos da integração dos três sistemas de gerenciamento, tema desta dissertação (Gestão da Qualidade, Gestão Ambiental e Gestão da Saúde e Segurança Ocupacional), observados na Revisão Sistemática de Literatura realizada no Capítulo 2, de maneira a contemplar as variáveis dos diversos níveis dos colaboradores e a contemplar as medidas para a melhoria da gestão integrada na empresa, que incluiu 25 perguntas relacionadas com cada um dos seguimentos de gestão estudados.

Os participantes da pesquisa foram convidados a avaliar a importância dos indicadores com uma escala *Likert* variando de 1 a 5 com a seguinte equivalência: 1 = nunca; 2 = poucas vezes; 3 = algumas vezes; 4 = muitas vezes; e 5 = sempre.

Mediante a conclusão da coleta desses dados, os mesmos evidenciaram os graus de influência da integração de cada sistema de gerenciamento sobre a organização.

1.5.5 Análise dos Dados

Após a coleta, as informações foram mapeadas em planilhas eletrônicas utilizando-se o programa Microsoft Excel® 2019 e analisadas por meio da estatística descritiva simples. Utilizou-se também os *softwares* MINITAB 17 *Statistical* e *R Project for Statistical* para aplicar as metodologias da Teoria de Resposta ao Item e de Análise Multivariada (análise de *cluster*, análise fatorial e modelagem de equações estruturais) capazes de mensurar os impactos dos Sistemas de Gestão Integrados no desempenho organizacional.

1.5.6 Aspectos Éticos

Neste estudo foram respeitados os aspectos éticos e legais da Resolução Nº 510/2016, do Conselho Nacional de Saúde, que expressa os direitos dos indivíduos participantes em pesquisa, assegurando o direito à privacidade, anonimato, entre outros.

A coleta de dados ocorreu após a aprovação do projeto de pesquisa, processo CAAE 37320620.8.0000.5185, pelo Comitê de Ética e Pesquisa com Seres Humanos.

2 ARTICLE I - INTEGRATED MANAGEMENT SYSTEMS: THEIR ORGANIZATIONAL IMPACTS

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2.1 INTRODUCTION

According to a survey carried out by López-Fresno (2010), a debate has begun in the 90's about Integrated Management Systems – IMS. It was found that the main discussion on the integration of management systems is mainly directed to standards related to quality management (suitable with ISO 9001), environment (suitable with ISO 14001) and occupational health and safety (suitable with ISO 45001 / BS OSHAS 18001) (von Ahsen, 2014). The IMS are characterized for a loss of the unique identity of the subsystems and can be defined as a set of interconnected processes that share human information, materials, infrastructure and financial resources, in order to achieve satisfaction goals from a variety of stakeholders (de Nadae & de Carvalho, 2019; Nunhes et al., 2017).

As a result, organizations started to implement more than one management system simultaneously and, therefore, started to seek their integration to avoid repetition of similar measures, increasing the efficiency and adding value to the companies (Jørgensen et al., 2006; Karapetrovic & Casadesús, 2009). There is no specific certification for IMS. Yet, there are different certifications for the other management systems separately. However, these management systems implemented according to different standards can be integrated (Bernardo et al., 2009).

In order to add value to the corporation, the Integrated Management Systems have the role of improving interaction between the various processes and sectors of the company in order to improve them in general or specifically. Integrated management systems make the implementation of policies, objectives, procedures and practices more efficient than if it were only through individual management systems (separately) for each process of an organization (Labodová, 2004; Masuin et al., 2020). In this sense, the theme of this research gains importance since IMS are management tools that assist organizations reassessing their management models and creating new references consistent with the current standard. They have systemic characteristics, bringing continuous improvement of the performance level by reducing the negative impacts for both business and employees (Ofori et al., 2002).

Therefore, due to the broad purpose and the increasing implementation of IMS in companies, it is necessary to study the impacts of the integration of these systems, especially regarding the benefits of implementation, with the perspective of providing information and solutions on how to improve organizational quality; how to live sustainably with the work environment; how to prevent, eliminate or minimize the risks of accidents and occupational diseases, thus improving people's health and life quality; and how to know how much the Integrated Management Systems are able to act as instrument that promotes improvements. Thus, there is a need to better understand the organizational impacts derived by the integration of management systems considering that integration brings many benefits.

This research did not find in the analyzed articles studies conducting quantitative analysis of the proportion of the impacts on organizational performance that each of the 3 management systems presents with their integration. Part of what was found in the RSL were research that points out the benefits, the maturities and the levels of integration, as mentioned by the studies carried out by Domingues, Sampaio and Arezes (2016) that refer to a 6-level hybrid IMS maturity model that allows comparison between systems as to their relative stage of evolution; by Cabecinhas *et al*. (2018) that dissects the dissemination of the number of organizations that have implemented multiple management systems in the countries of Southern Europe and assesses the extent to which multiple certifications should occur in each country studied; and by Cabecinhas *et al*. (2020) that updates and reports the models of diffusion and forecasting of integrated management systems in Portuguese companies. In the case of integration levels, the paper by Jorgensen, Remmen and Mellado (2006) only checks whether the systems are partially or fully integrated.

In this sense, the main objective of this paper was to map and analyze the literature on the organizational performance impacts provided by integrated management systems. To achieve the proposed objective the research addressed the following research questions:

1. What are the main characteristics of the literature on IMS (annual evolution, main areas of study, most cited articles, published magazines, among others)?
2. What are the main subjects addressed by the IMS literature?
3. What are the main impacts of IMS on organizational performance addressed by the literature?

To answer the research questions presented, this study is based on a Systematic Literature Review – SLR, showing studies that deal with the advantages and maturity of management systems, as evidenced by studies of Bernardo *et al*. (2015), Ionescu *et al*. (2018), Moumeen and Elaoufir (2018).

2.2 METHODOLOGY

The study was carried out with the support of a Systematic Literature Review - SLR, using the methodology of Preferred Reporting Items for Systematic Reviews and Meta-Analysis- PRISMA. The PRISMA methodology is a guideline that aims to support scholars to improve the quality of the research data exposure, as well as to guide the critical evaluation of published papers review (Moher et al., 2010).

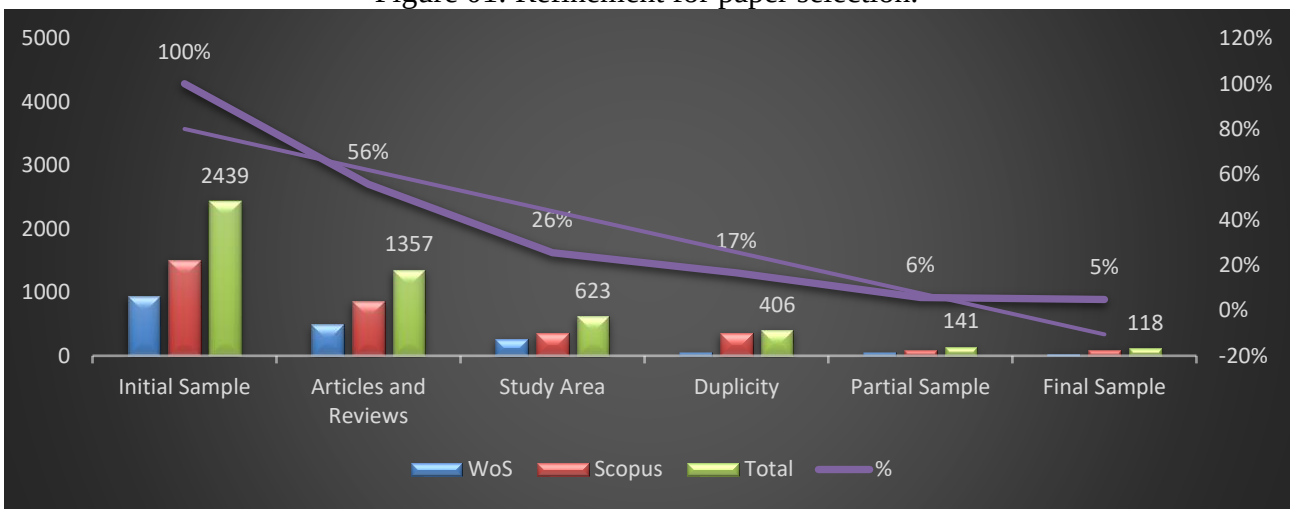
As a basis for this SLR, two scientific knowledge bases were used: The Web of Science (WoS) and Scopus, in order to identify articles about the management systems addressed in this study (integrated management, quality management, environmental management or health and safety management). The quality level and the number of publications were the criteria of choice for these two databases: the Web of Science to be able to cover the indexed journals with an impact factor calculated as the JCR (Journal Citation Report) (Carvalho et al., 2013). The Scopus, was chosen because it is the largest scientific knowledge base in the peer-reviewed literature (Morioka & Carvalho, 2016). Another factor also considered was that both databases provide 'metadata' compatible with the Mendeley software, used to support the bibliometric analysis, encompassing the respective abstracts, references, citation indexes, authors, years of publication, areas of study, institutions, countries, among others (Carvalho et al., 2013).

The strategy used to choose the articles was to filter by specific search terms. The first analysis used the terms 'Integrated Management System*' or 'Management system* Integration', applied as 'Topic' in the WoS database and as 'Article title, Abstract, Keywords' in the Scopus database, resulting in 935 and 1,504 documents respectively, with a total of 2,439 articles.

Subsequently, the first exclusion criterion was a refinement applied as 'Document type' on both databases by selecting only 'Article' and 'Review', samples results reduced to 490 works in WoS and 867 works in Scopus, totalizing 1,357 papers. The 'metadata' were stored in an electronic spreadsheet (Microsoft Excel 2019). The second elimination criterion was the study area (in this case, the databases themselves indicated to which field of study the scientific articles referred). Researches that did not address engineering and environmental scopes were withdrawn, resulting in the exclusion of 734 articles, 224 of WoS and 510 of Scopus. Therefore, samples were reduced to 266 documents in WoS and 357 documents in Scopus. Then, an analysis of duplicate titles was carried out as a third exclusion criterion, indicating 217 duplicate works, which were removed from the WoS database, leaving 49 articles (exclusive from this database) and keeping 357 articles from Scopus. Following exclusion criterion was the titles and abstracts analysis using the PRISMA methodology to identify the most relevant researches on the proposed theme. Studies that did not show agreement with the research, that is, that did not address integrated management, quality management, environmental

management or health and safety management were eliminated. Thus, 49 papers from WoS and 92 papers from Scopus remained in the paper sample, after eliminating no papers from WoS and 265 papers from Scopus. This resulted in a paper sample 141 publications. The next step was to import the paper sample in 'pdf' reading format, from both scientific bases. Full paper of 23 articles of the WoS base were not accessible for the researches, causing the last exclusion criterion. Thereby, the consolidated sample includes 118 articles, 26 WoS surveys and 92 Scopus studies, until June 2020, as shown in Figure 01. The percentages correspond to the number of articles after each exclusion criterion in both scientific bases.

Figure 01: Refinement for paper selection.



Source: Web of Science and Scopus

Based on the final sample obtained and with the aid of the VOSviewer software (free software whose function is to support bibliometric analysis by providing visualization of similarities among paper sample), a network analysis was carried out to highlight groups of bibliographic data. In an expanded way, the points from the bibliographic network are applied in such a way that the spacing between them recommends an association according to specific aggregation criteria, forming a map (Sarkodie & Strezov, 2019).

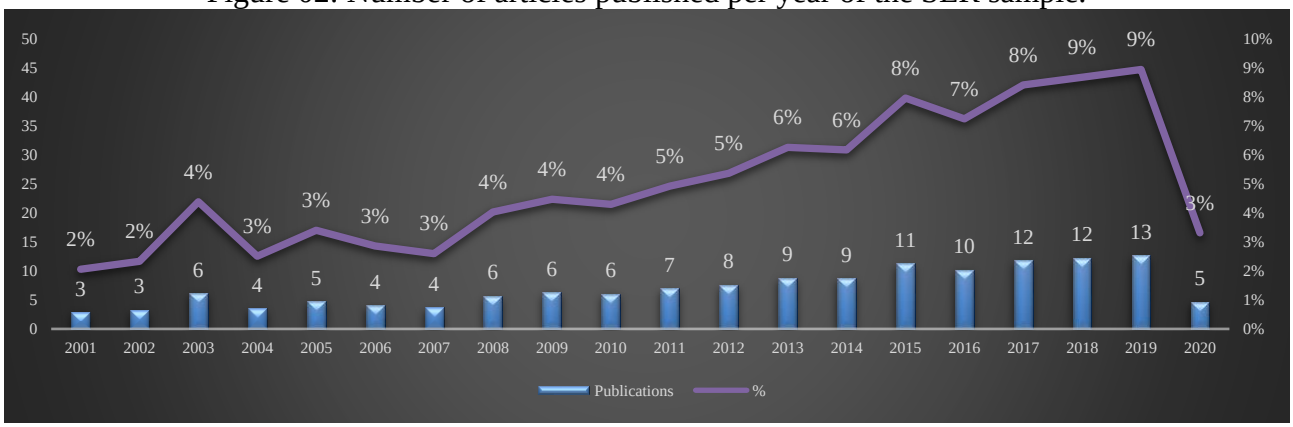
The next step was the content analysis of the paper sample full texts to identify the main factors affecting the IMS, the drivers for its implementation, the benefits of integration and the focus of the organizations' interest (costumer, company, society and worker). Regarding the focus, the analysis served to support the management of suppliers, customers, products, employees and the social role of the company.

2.3 RESULTS AND DISCUSSION

2.3.1 General Overview of the Paper Sample

To answer the first research question (What are the main characteristics of the literature on IMS?), Figure 02 shows the number of publications per year in the last 20 years, of the chosen sample, in both scientific knowledge bases. The percentages correspond to the number of articles published per year of the defined sample.

Figure 02: Number of articles published per year of the SLR sample.



Source: Web of Science and Scopus.

Over the years, there has been a growth in studies related to Integrated Management Systems. Characteristic similar to what occurs with the interest of organizations in implementing the integration of management systems (Trierweiller et al., 2016).

Still answering the first question of the objectives, Table 01 shows the articles from the selected paper sample, which have more than 100 citations in the scientific database Scopus and classified by the most relevant authors.

Table 01: Number of citations per article.

Reference	Citations	Year	Citations / Year	Research Area
Asif, M., Searcy, C., Zutshi, A., Fisscher, O.A.M.	162	2013	23	Engineering & Environmental
Zeng, S.X., Shi, J.J., Lou, G.X.	199	2007	15	Engineering & Environmental
Jørgensen, T.H., Remmen, A., Mellado, M.D.	213	2006	15	Engineering & Environmental
Santos, G., Mendes, F., Barbosa, J.	128	2011	14	Engineering & Environmental
Bernardo, M., Casadesus, M., Karapetrovic, S., Heras, I.	154	2009	14	Engineering & Environmental
Salomone, R.	167	2008	14	Engineering & Environmental

Karapetrovic, S., Casadesús, M.	135	2009	12	Engineering & Environmental
Zutshi, A., Sohal, A.S.	166	2005	11	Engineering
Gapp, R., Fisher, R., Kobayashi, K.	127	2008	11	Business
Labodová, A.	146	2004	9	Engineering
York, K.M., Miree, C.E.	104	2004	7	Business
Karapetrovic, S., Jonker, J.	106	2003	6	Business
Beckmerhagen, I.A., Berg, H.P., Karapetrovic, S.V., Willborn, W.O.	105	2003	6	Engineering

Source: Scopus.

The research by Asif *et al*. (2013), stands out for having been published in 2013 and has 162 citations, which gives an average of 23 citations per year.

The Figure 03 shows the main journals that appeared more than once in the paper sample.

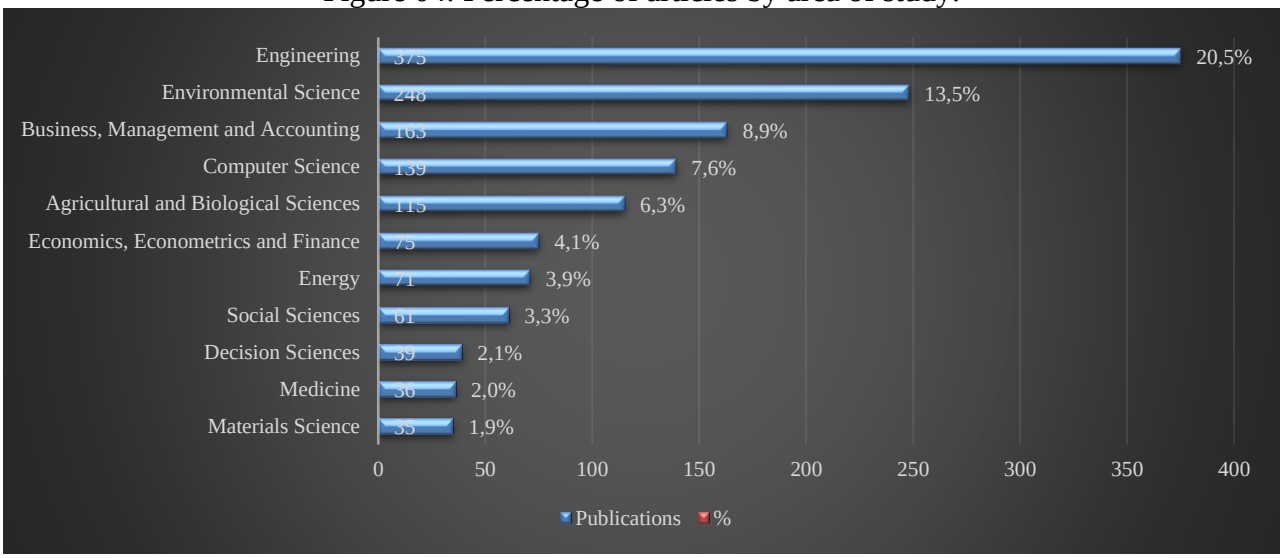
Figure 03: Number of publications per Journal.

Source: Web of Science and Scopus.

The main topics covered by the paper sample (information provided by the two scientific knowledge bases), which already starts the answer to the second research question (How does the literature address the Integrated Management Systems and their impact on organizational performance?) are the Engineering and Environmental Science areas of study, as shown in Figure 04.

Figure 04 shows both the absolute number of papers related to each area of study and the corresponding percentages value. It is worth noting that the same paper can be allocated to more than one area of study.

Figure 04: Percentage of articles by area of study.

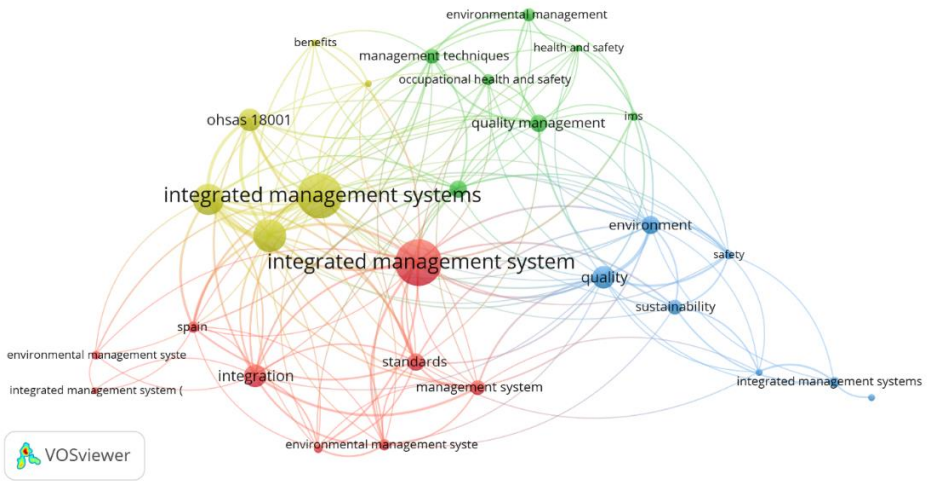


Source: Web of Science and Scopus.

Figure 05 shows, through VOSviewer analysis, the relationship between the keywords used at least 4 times by the papers in the sample. This cluster analysis allows a better clarification of the existing convergence between the terms found, as well as facilitating to distinguish that there are sets entirely associated with their operational factors. Four clusters were identified, represented by different colors. The 4 sets of keywords contain the term 'Integrated Management System'. In addition to this term, groups 1 and 2 (in green and blue, respectively) are the groups that are most associated with aspects of quality, environmental and occupational health and safety management. The groups 3 and 4 (in colors red and yellow) tend more to the characteristics of environmental management and occupational health and safety management, respectively.

Thus, this graphic provides an idealization of more recurrent content in the literature, providing a better understanding of the connection between them.

Figure 05: Network analysis of keywords.



Source: Web of Science and Scopus.

2.3.2 Content Analysis of the Paper Sample

To address the second research question **(**How does the literature address IMS and its impact on organizational performance?), content analysis of the full texts of the sample articles was carried out. It was found that only seven studies on Integrated Management Systems refer quantitatively (which corresponds to 5.93% of the studies), but none of them performs a mapping and analysis of the proportion of impacts that each of the three management systems provides to the organizations, when implemented in an integrated manner.

For example, the article by Zeng *et al*. (2011), which uses structural equation modeling to empirically exam benefits obtained with the implementation of Integrated Management Systems. In this study, structural equation modeling, a multivariate statistical technique, is used to analyze the data. It is suitable for data on which a series of regressions is being performed. The dependent variable for a regression analysis is also the independent variable for the other. Essentially, structural equation modeling consists of two components: (1) the measurement model, which reduces the observed variables to a smaller number of latent factors; and (2) the structural equation model, which defines causal relationships between these latent factors (Hussey & Eagan, 2007).

Another example is Masuin and Latief (2019), which deal with the implementation of integrated risk management, with the aim of improving the organization's performance. The results of this study were investigated through quantitative analysis using the Analytic Hierarchy Process (AHP) method and Failure Mode and Effect Analysis (FMEA). They verified variables with the greatest impact and frequency to increase the organization’s performance, specifically in a construction company.

The study conducted by Kruse, Veltri and Branscum (2019) used the quantitative analysis of the variation in related data to investigate the variability within the company and between companies on the motivating factors for adopting integrated systems and methods used to implement integrated systems.

Another example is the paper of Ikram *et al*. (2019), which assessed whether adopting an environmental management system, as part of an integrated management system, would help improving business sustainability. Through descriptive testing and exploratory factor analysis to test the hypothesis and internal reliability, they used structural equation modeling in their study to measure a corporate social responsibility performance index in relation to the environment, weighted by the stakeholders and companies participating in the study, evaluating the various useful links between latent variables observed.

The other 111 articles, which correspond to 94.07% of the studies, deal in a qualitative way on maturity, the benefits of integration, points of improvement and levels of integration. Regarding

integration levels, the work found is limited to observing whether the Integrated Management Systems are partially or fully integrated.

Regarding maturity of IMS, Poltronieri, Gerolamo and Carpinetti (2017) developed an instrument to assess in a qualitative way the degree of maturity of IMS in order to improve organizational performance, identifying strengths and weaknesses, thus contributing for comparative evaluation. The maturity representation used the number of cumulative stages to facilitate visualization where the company is and the extent to which best practices must be achieved, with the lower stages serving as support to achieve the requirements of the upper stages.

Regarding IMS integration levels, Muthusamy, Palanisamy and Mohanraj (2018) used a comprehensive model and a holistic perspective to exemplify how the elements of the existing management systems can be integrated into different levels, reflecting better the significant integration through a four-stage approach: awareness, cooperation, consonance and combination. Moreover, the declared holistic vision serves as a process-based strategy for configuration, implementation and institutionalization of the management systems, taking into account their level analysis.

Although the contribution of all articles is desirable, a summary of the 118 articles divided by subthemes covered by the research was carried out with the main findings. The most mentioned subthemes were “Conceptual Proposal” and “Integration Models”. Table 02 shows the main highlights which answers the second research question (What are the main subjects addressed by the IMS literature?).

In addition, several researchers found similarities when raising the significant impacts of integration of management systems regarding the performance of companies. The articles are distributed according to the focus and impacts presented in their research. Table 03 shows the results which answers the third research question (What are the main impacts of IMS on organizational performance addressed by the literature?).

Table 02: Main highlights.

Subthemes	Authors	Highlights
Audit	(LAAL et al., 2019)	The annual implementation of audits at the IMS has had a significant impact on reducing accident rates and improving occupational safety.
	(DOMINGUES; SAMPAIO; AREZES, 2015)	Possibility to distinguish types of audit and the adoption of these types must consider the availability of resources and the knowledge of the audit team.
	(SIMON et al., 2011)	How companies with more than one standardized management system conduct audits and the extent to which they integrate audit elements to benefit from the advantages of having a single, integrated audit system.
	(SAVINO; MAZZA, 2014)	Methodical approach to integrate the development of environmental and quality audits, prioritizing corrective actions.
	(SIMON; DOUGLAS, 2013)	Differences in relation to the practices of integration between organizations in the audit process and the difficulties and benefits encountered during the implementation of IMS.
Benefits	(MORA-CONTRERAS, 2019)	The implementation methodology favors the fulfillment of the organizational model, the reduction of inefficient bureaucracy and offers specific performance benefits.
	(BĄK; NOWAK, 2019)	IMS implementation contributes to a more harmonious functioning of the company and to the elimination of recurring activities in the areas related to individual systems and, therefore, to the optimization of costs related to its implementation and maintenance.
	(RAMOS; AFONSO; RODRIGUES, 2020)	Understanding how the implementation of IMS influences the improvement of the occupational health and safety risk management process in companies.
	(SANTOS; CARVALHO, 2019)	Important and interesting benefits offered by IMS and broad scope of integration.
	(MOUMEN; EL AOUFIR, 2017)	Most experienced benefits and difficulties during IMS implementation.
	(NUNHES; MOTTA BARBOSA; DE OLIVEIRA, 2017)	Main difficulties and challenges faced during the IMS implementation process.
	(BERNARDO et al., 2015)	Benefits of IMS, comparing them with the benefits obtained from individual implementation.
	(REBELO; SANTOS; SILVA, 2014b)	An IMS tends to integrate some or all components of the business, maximizing its integration is increasingly a strategic priority and constitutes an opportunity for companies to be more competitive.
	(ZENG et al., 2011)	Benefits obtained with the implementation of an integrated management system for companies.
	(BLASCO-TORREGROSA et al., 2019)	Main benefits and difficulties encountered during the process of integrating management systems.
	(NADAE; CARVALHO; VIEIRA, 2019)	The impact of integrating management systems that include economic, social and environmental standards on economic performance.
	(CASADESÚS; KARAPETROVIC; HERAS, 2011)	Organizations with more than one management system really see more benefits from implementing ISO 9001.
Conceptual Proposal	(TRIERWEILLER et al., 2016)	The importance of IMS 'strategic positioning in the organization, involving the entire product chain and stakeholders.
	(JAIN A., ASWAR N., KALE K., 2016)	The integration of multidisciplinary approaches and the collaborative model of central and peripheral industries to protect safety risks in the workplace.
	(YAZDANI; WELLS, 2012)	Techniques for preventing Musculoskeletal Disorders in Occupational Health and Safety Management Systems and Integrated Management Systems.
	(MASUIN; LATIEF, 2019)	Strategy to improve the performance of the organization through the risk management of the IMS implementation.
	(KRUSE; VELTRI; BRANSCUM, 2019)	Lean IMS structure and available strategies to simultaneously protect workers, the environment and support corporate results.
	(CHOUNTALAS; TEPASKOUALOS, 2019)	Factors that can lead an organization to consciously choose not to integrate all of its management systems.

	(DE NADAE; DE CARVALHO, 2019)	Conceptual structure that relates management systems to sustainability, defining the variables and presenting four relational propositions among the main variables.
	(MUHAMAD KHAIR et al., 2018)	Strategy for an IMS to improve the adoption and implementation of the Responsible Care program.
	(MAJERNÍK et al., 2017)	Innovative model concept for IMS implementation and maintenance.
	(MANZANERA et al., 2014)	Guidelines and recommendations for the creation of an IMS adapted to small and compact administrative organizations that operate with different perspectives and interests.
	(LÓPEZ-FRESNO, 2010)	Model based on a systemic approach that has proved successful for the design and implementation of an IMS.
	(ASIF et al., 2009)	The main processes are integrated with the main individual management systems to form a composite and holistic management system.
	(SALOMONE, 2008)	The potential for integrating management systems based on an analysis of common aspects.
	(GAPP; FISHER; KOBAYASHI, 2008)	The importance of the technical (visible) and philosophical (invisible) approaches necessary for an integrated management approach.
	(MILLIMAN et al., 2005)	Overall assessment of the applicability of the "SEH & S" approach integrated with security and risk management.
	(BECKMERHAGEN et al., 2003)	Meaning of IMS implementation for existing organizational structures.
	(REBELO; SANTOS; SILVA, 2014a)	Generic IMS model for eliminating conflicts between individual management systems with resource optimization.
	(RIBEIRO et al., 2017)	The future of Integrated Management Systems encompasses the full integration of Management Systems.
	(DROŻYNER, 2020)	Perception of a company's operational services changes depending on whether the company has an IMS.
	(ZALOGA et al., 2019)	The implementation of IMS allows you to control the process and make appropriate decisions to improve organizational performance.
	(SOUZA; ALVES, 2018)	Innovative IMS model to improve corporate sustainability aimed at cleaner production.
	(SIMON et al., 2013)	How management system standards can be integrated into a single system across organizations.
	(GANGOLELLS et al., 2013)	Innovative model to improve the integration of management systems.
	(BOTTA; COMOGLIO; PETROSILLO, 2013)	Theoretical framework for the development of an Environmental and Social IMS.
	(JAROENROY; CHOMPUNTH, 2019)	Conceptual framework for an alternative integrated management system.
	(ALGHERIANI et al., 2019)	Integrated risk management model for management systems.
	(BARBOSA; OLIVEIRA; SANTOS, 2018)	Propositions that assist the alignment of IMS as a business strategy.
Integration Level	(MUTHUSAMY; PALANISAMY; MOHANRAJ, 2018)	Holistic approach and the implementation of IMS at different levels.
	(TEPASKOUALOS; CHOUNTALAS, 2017)	The company's dedication to meeting critical success factors and the identical structure of management systems facilitated the result on the level of integration achieved.
	(LUO; LI; LI, 2015)	IMS from different perspectives: system level and operational level.
	(BERNARDO et al., 2009)	Level of integration of management systems in relation to documentation and human resources, in addition to procedures.
	(JØRGENSEN; REMMEN; MELLADO, 2006)	The trend towards greater compatibility between management systems and how to understand the different aspects of integration.
	(DAHLIN; ISAKSSON, 2017)	The effects of an IMS, scope, level and extent of integration.

	(SIMON; KARAPETROVIC; CASADESUS, 2012)	Level of integration of different elements of management systems.
	(BERNARDO et al., 2012)	Difficulties encountered in the process of integrating management systems and the level of integration achieved.
Integration Models	(HERNANDEZ-VIVANCO et al., 2019)	The IMS model can be a relevant factor to improve the company's performance.
	(MAJERNÍK et al., 2017)	Innovative model concept for implementing and maintaining integrated management systems.
	(DEL PRADO MARTÍNEZ; NAVARRO, 2016)	IMS model of documents and information for organizations with a process-focused approach.
	(ALVARADO RUEDA; PEREZ GOMEZ, 2016)	Model that contributes to the design and integration of management systems.
	(REBELO; SANTOS; SILVA, 2015)	Model to support organizations in the development and structuring of the integration process of their management systems.
	(BINIECKA; CAMPANA; IANNILLI, 2005)	IMS to control safety and environmental health monitoring processes.
	(LABODOVÁ, 2004)	Effective forms of IMS currently separated for quality management, environmental management and health and safety.
	(HOLDSWORTH, 2003)	Practical applications to design, develop and implement an integrated management system.
	(VULANOVIC et al., 2020)	General model for the design of an IMS based on the risk assessment of the organization's processes.
	(IKRAM; ZHANG; SROUFE, 2020)	Strategy to manage various systems, meeting the needs and expectations of stakeholders.
	(ABISOUROUR et al., 2020)	It allows a company to ensure proper alignment between IMS policy and business operations and to identify loss categories.
	(ĆWIKLICKI; PILCH; ŻABIŃSKI, 2019)	The Quality Management System is dominant in Polish local government institutions.
	(MOUMEN; ELAOUFIR, 2018)	IMS concept and define the different approaches.
	(EL YACOUBI EL IDRISSI; BOUAMI; CHERKAOUI, 2014)	Usefulness and scope for the potential development and adoption of a single IMS model.
	(WALKER; MCALEER, 2014)	An IMS needed to be appropriate for accreditation and integrated with an emerging corporate management framework.
	(VON AHSEN, 2014)	IMS are considered to be more effective and more efficient than separate and distinct management systems.
	(HAMIDI; OMIDVARI; MEFTAHI, 2012)	The definition of indexes can be useful for the effectiveness of IMS and its continuous improvement.
	(KARAPETROVIC; CASADESÚS, 2009)	The importance of the different possibilities that organizations can choose when considering the implementation of a management system.
	(YORK; MIREE, 2004)	The relationship between Total Quality Management (TQM) and financial performance.
	(KARAPETROVIC; JONKER, 2003)	The 'ingredients' and 'recipe' for the integration of standardized internal management systems.
	(WRIGHT, 2000)	For any organization that intends to implement management systems, the simplest route is via integration, using existing systems as a base.
	(ZENG; LOU; TAM, 2006)	An IMS with a combination of standards provides a possible solution for effective and efficient management.
	(CHAN et al., 1998)	An IMS serves to increase the company's competitiveness, successfully meeting its rapidly changing needs.
	(BEREZYUK; RUMYANTSEVA; CHEBOTAREVA, 2017)	The integration of management systems is a necessary condition for the management of industrial security.
	(MARIOURYAD et al., 2015)	Improvement trend after the establishment of an IMS for health, safety and environment indicators.
	(AZADEH; HASANI FARMAND; JIRYAEI SHARAHI, 2012)	Integrated approach to performance evaluation and optimization of the management system based on the analysis of diffuse data.

	(SAMPAIO; SARAIVA; DOMINGUES, 2012)	Different strategies to achieve integration, with various levels of intensity, depth and authenticity between the different management subsystems.
	(NUNHES; BERNARDO; OLIVEIRA, 2019)	Guiding principles of IMS and the essential elements for its development and maintenance.
	(LLONCH; BERNARDO; PRESAS, 2018)	Simultaneous implementation of an integrated management system.
Limitations	(TAYLOR, 2002)	Differences in the scope of management systems will give rise to different subcultures that will make integration difficult, and scope and culture are more important than compatibility.
	(ABAD; CABRERA; MEDINA, 2016)	The integration of management systems is conditioned by the sequence of systems integration, the level of integration achieved and the structure of the new integrated system.
	(AL-DARRAB; GULZAR; ALI, 2013)	Although the implementation of individual management systems is generally unproductive and the concept of integration has not gained much acceptance.
	(SIMON; KARAPETROVIC; CASADESS, 2012)	Model of the difficulties related to the integration of systems that affect the level of integration of several specific items of the management systems involved.
	(ZENG; SHI; LOU, 2007)	The main problems for companies to operate multiple management systems in an integrated manner.
	(GIANNI; GOTZAMANI, 2015)	Possibility of failure of an IMS.
Maturity	(POLTRONIERI; GEROLAMO; CARPINETTI, 2017)	An instrument that assesses the degree of maturity of IMS can be used in organizations to improve integration.
	(DRAGOMIR et al., 2017)	Instrument developed to assess and communicate the maturity reached by an IMS.
Social Responsability	(IONESCU et al., 2018)	There is a direct correlation between the implementation of integrated management systems and the existence of corporate social responsibility initiatives and the increase in companies' market value.
	(CARVALHO; SANTOS; GONÇALVES, 2020)	The nature of the content disclosed and the profile of a company that disseminates information about IMS.
	(ASIF et al., 2013)	Design business processes to accommodate the social requirements of stakeholders in an integrated manner.
	(MEŽINSKA; LAPIŅA; MAZAIS, 2015)	The IMS must be designed so that it can be used to build a socially responsible organization that contributes to sustainable development.
Structure	(SILVA, 2020)	Implementation of the GIS contributed to the transparency and rationalization of research spaces and came to be seen as a strategic asset in asset management.
Sustainable Development	(FONSECA; CARVALHO, 2019)	Organizations with certified management systems can play a significant role in advancing Sustainable Development.
	(CARVALHO; DOMINGUES; SAMPAIO, 2019)	Commitments to customers and human resources fit properly with the premises of stakeholders and, in turn, the commitment to continuous improvement and sustainable development.
	(SAVINO; SHAFIQ, 2018)	Environmental Management and Safety Management result in the strategic use of resources to improve production performance.
	(HOLM; VUORISALO; SAMMALISTO, 2015)	As an integration of process and procedure structures, they can be used to promote sustainable development.
	(MUTHU SAMY; PALANI SAMY; AMMASAIAPPAN, 2015)	The identification of the main factors that affect the implementation of IMS and the benefits of integration for sustainable development.
	(ABOUETTAHIR; SEGHIOUER; EL AMARTI, 2013a)	Evaluation of the commitment to sustainable development, considering the Occupational Health and Safety management system as the basis for this approach.
	(FRESNER; ENGELHARDT, 2004)	IMS is an effective way to begin to understand sustainable development and develop sustainable strategies in companies.
	(IKRAM et al., 2019)	The adoption of an environmental management system as part of an IMS helps to improve corporate sustainability.
	(SIVA et al., 2016)	Quality management is considered adequate as a support for the integration of sustainability considerations.
	(POLTRONIERI et al., 2018)	Instrument to assess the integration of different management systems and their effects on sustainable performance.

Certification	(BEVILACQUA; CIARAPICA; DE SANCTIS, 2016)	The certification of management systems has a positive correlation with the success factors necessary for the implementation of the standard and are fundamental for the improvement of the company.
	(ABAD; LAFUENTE; VILAJOSANA, 2013)	The effect of the OHSAS 18001 standard on safety performance and work productivity, paying special attention to the returns from certified safety experience.
	(SUI; DING; WANG, 2018)	Implementation of an IMS.
	(DE OLIVEIRA, 2013)	The integration of certifiable management systems is an effective alternative for companies operating in turbulent environments characterized by intense competitiveness.
	(SANTOS; MENDES; BARBOSA, 2011)	Main benefits that companies obtained with the certification of management systems.
	(PHENG; KWANG, 2005)	The costs and benefits of implementing IMS and the significant improvements in IMS certification.
	(OFORI; GANG; BRIFFETT, 2002)	The perceptions and expectations of companies regarding the certification of management systems.
	(DOMINGUES; SAMPAIO; AREZES, 2017)	Evidence of an effective integration of policies and the existence of a system manager integrated in the organizational structure of companies.
	(PHENG; PONG, 2003)	Compatible requirements that justify the integration of management systems.
	(ABOUETTAHIR; SEGHIOUER; EL AMARTI, 2013b)	Commitments to sustainable development, considering the Occupational Health and Safety management system.
	(CHAUDHURI; JAYARAM, 2019)	Social and technical integration is in fact a significant facilitator for positive relationships on sustainable quality performance.
	(MARINKOVIC et al., 2016)	Certified management systems support companies to improve the business environment and the sustainability of management.
	(REBELO; SANTOS; SILVA, 2016)	Proactive approach and commitment to cleaner production, supported by an IMS, brings relevant savings to organizations.
	(ESCORCIA; VALENCIA OCHOA; ACEVEDO, 2018)	Relationship and points of convergence between management system standards.

Source: Own author.

Table 03: Impacts of the Integration of Management Systems.

Integrated Management Systems - IMS			
Focus	**Positive Impacts**	**Authors**	**References**
Client	Improve the company's image	(Bernardo et al., 2015; Blasco-Torregrosa et al., 2019; Nunhes et al., 2017; M. Rebelo et al., 2014; Salomone, 2008; Sampaio et al., 2012; G. Santos et al., 2011; G. Santos & Carvalho, 2019)	8
	Improve the quality of goods and services	(Bernardo et al., 2015; Bevilacqua et al., 2016; Drożyner, 2020; Fresner & Engelhardt, 2004; López-Fresno, 2010; Majerník et al., 2017; Manzanera et al., 2014; Moumen & El Aoufir, 2017; Nunhes et al., 2017; M. F. Rebelo et al., 2014; Sampaio et al., 2012; G. Santos & Carvalho, 2019)	12
	Improve stakeholder satisfaction	(Algheriani et al., 2019; Alvarado Rueda & Perez Gomez, 2016; Asif et al., 2009; L. C. F. M. Barbosa et al., 2018; Bernardo et al., 2015; F. Carvalho et al., 2019; Casadesús et al., 2011; Dahlin & Isaksson, 2017; Dragomir et al., 2017; Drożyner, 2020; Fresner & Engelhardt, 2004; Holdsworth, 2003; Muhammad Ikram et al., 2020; Ionescu et al., 2018; Jaroenroy & Chompunth, 2019; Jørgensen et al., 2006; Karapetrovic & Jonker, 2003; Kruse et al., 2019; López-Fresno, 2010; Manzanera et al., 2014; Marinkovic et al., 2016; M. Rebelo et al., 2014, 2015; M. F. Rebelo et al., 2016; Siva et al., 2016; Zeng et al., 2006, 2007)	27
Company	Increase organizational competitiveness	(Alvarado Rueda & Perez Gomez, 2016; Bernardo et al., 2015; Chan et al., 1998; De Oliveira, 2013; Escorcia et al., 2018; Jørgensen et al., 2006; Majerník et al., 2017; Manzanera et al., 2014; Muthusamy et al., 2018; M. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Zeng et al., 2011)	12
	Control business risks	(Algheriani et al., 2019; Azadeh et al., 2012; Blasco-Torregrosa et al., 2019; Holdsworth, 2003; Muhammad Ikram et al., 2020; Labodová, 2004; Masuin & Latief, 2019; Milliman et al., 2005; Ramos et al., 2020; M. Rebelo et al., 2015; M. F. Rebelo et al., 2014; Sampaio et al., 2012; Simon, Karapetrovic, & Casadesus, 2012)	13
	Improve communication	(Jesus Abad et al., 2016; Asif et al., 2013; Blasco-Torregrosa et al., 2019; F. Carvalho et al., 2020; del Prado Martínez & Navarro, 2016; J. P. T. Domingues et al., 2015; Dragomir et al., 2017; El Yacoubi El Idrissi et al., 2014; López-Fresno, 2010; Nunhes et al., 2017; M. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Simon, Karapetrovic, & Casadesus, 2012)	13
	Improve decision making	(Azadeh et al., 2012; Blasco-Torregrosa et al., 2019; Gapp et al., 2008; Muhammad Ikram et al., 2020; Nunhes et al., 2017; Camila Fabrício Poltronieri et al., 2017; M. Rebelo et al., 2015; G. Santos & Carvalho, 2019; Zaloga et al., 2019; Zeng et al., 2011)	10
	Improve operational performance	(Jesús Abad et al., 2013; Abisourour et al., 2020; Algheriani et al., 2019; Alvarado Rueda & Perez Gomez, 2016; Bąk & Nowak, 2019; L. C. F. M. Barbosa et al., 2018; Beckmerhagen et al., 2003; Bernardo et al., 2009, 2012, 2015; Biniecka et al., 2005; Casadesús et al., 2011; Chaudhuri & Jayaram, 2019; Ćwiklicki et al., 2019; Dahlin & Isaksson, 2017; De Oliveira, 2013; Hamidi et al., 2012; Hernandez-Vivanco et al., 2019; M. Ikram et al., 2019; Muhammad Ikram et al., 2020; Jaroenroy & Chompunth, 2019; Jørgensen et al., 2006; Karapetrovic & Casadesús, 2009; Llonch et al., 2018; Majerník et al., 2017; Moumen & Elaoufir, 2018; Muthusamy et al., 2018; Nunhes et al., 2017, 2019; Ramos et al., 2020; M. Rebelo et al., 2015; M. F. Rebelo et al., 2014, 2016; Savino & Shafiq, 2018; Simon, Karapetrovic, & Casadess, 2012; Simon & Douglas, 2013; Sui et al., 2018; Vulanovic et al., 2020; Walker & McAleer, 2014; Yazdani & Wells, 2012; Zeng et al., 2011)	41
	Improve strategic planning	(Jesus Abad et al., 2016; Algheriani et al., 2019; Blasco-Torregrosa et al., 2019; Holdsworth, 2003; Luo et al., 2015; Nunhes et al., 2019; Sampaio et al., 2012; G. Santos & Carvalho, 2019; Trierweiller et al., 2016)	9
	Audit optimization	(Beckmerhagen et al., 2003; Blasco-Torregrosa et al., 2019; J. P. T. Domingues et al., 2015; Dragomir et al., 2017; Jaroenroy & Chompunth, 2019; Laal et al., 2019; Nunhes et al., 2017; M. F. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Savino & Mazza, 2014; Simon et al., 2011; Simon, Karapetrovic, & Casadesus, 2012; Wright, 2000; Zeng et al., 2011)	14
	Time optimization	(Bernardo et al., 2015; Blasco-Torregrosa et al., 2019; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Sampaio et al., 2012; Simon et al., 2013)	6
	Management standardization	(Muhammad Ikram et al., 2020; Nunhes et al., 2019; Ribeiro et al., 2017; G. Santos & Carvalho, 2019; Simon & Douglas, 2013)	5

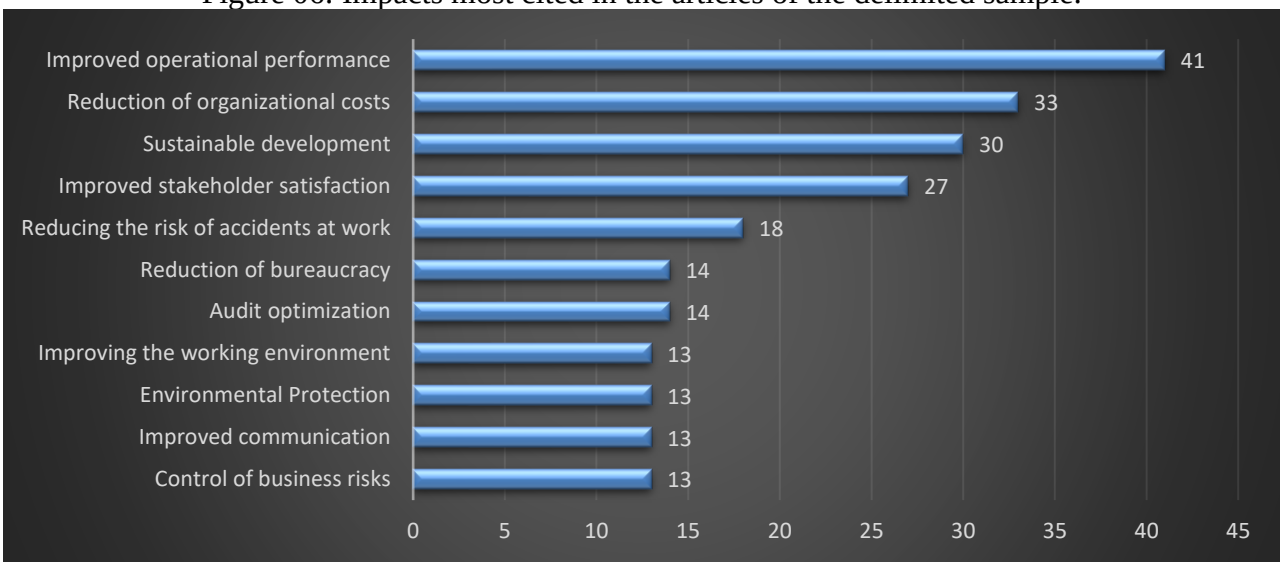
	Organizational policy	(Abisourour et al., 2020; P. Domingues et al., 2017; El Yacoubi El Idrissi et al., 2014; Muhamad Khair et al., 2018; Ofori et al., 2002; Pheng & Pong, 2003; G. Santos & Carvalho, 2019)	7
	Reduction of bureaucracy	(Beckmerhagen et al., 2003; Bernardo et al., 2009, 2015; del Prado Martínez & Navarro, 2016; Holdsworth, 2003; Muhammad Ikram et al., 2020; Mora-Contreras, 2019; Muthu Samy et al., 2015; Nunhes et al., 2017; Ribeiro et al., 2017; Simon, Karapetrovic, & Casadesus, 2012; Souza & Alves, 2018; Vulanovic et al., 2020; Zeng et al., 2011)	14
	Reduction of redundant activities	(Bąk & Nowak, 2019; J. P. T. Domingues et al., 2015; Muhammad Ikram et al., 2020; Camila Fabrício Poltronieri et al., 2017; G. Santos & Carvalho, 2019; Souza & Alves, 2018; Trierweiller et al., 2016)	7
	Reduction of organizational costs	(Abisourour et al., 2020; Asif et al., 2009; Bąk & Nowak, 2019; Beckmerhagen et al., 2003; Bernardo et al., 2015; Biniecka et al., 2005; Casadesús et al., 2011; Dahlin & Isaksson, 2017; J. P. T. Domingues et al., 2015; Escorcia et al., 2018; Fresner & Engelhardt, 2004; Llonch et al., 2018; López-Fresno, 2010; Milliman et al., 2005; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Muthu Samy et al., 2015; Muthusamy et al., 2018; Nadae et al., 2019; Ofori et al., 2002; Pheng & Kwang, 2005; Camila Fabricio Poltronieri et al., 2018; M. Rebelo et al., 2014; Ribeiro et al., 2017; Salomone, 2008; G. Santos et al., 2011; Simon et al., 2013; Souza & Alves, 2018; Tepaskoualos & Chountalas, 2017; Wright, 2000; York & Miree, 2004; Zaloga et al., 2019; Zeng et al., 2011)	33
Society	Sustainable development	(Abouettahir et al., 2013a, 2013b; Bernardo et al., 2015; F. Carvalho et al., 2020; Chaudhuri & Jayaram, 2019; de Nadae & de Carvalho, 2019; De Oliveira, 2013; Drożyner, 2020; Fonseca & Carvalho, 2019; Fresner & Engelhardt, 2004; Holm et al., 2015; M. Ikram et al., 2019; Jørgensen et al., 2006; Mežinska et al., 2015; Muhamad Khair et al., 2018; Muthu Samy et al., 2015; Muthusamy et al., 2018; Nadae et al., 2019; Ofori et al., 2002; Camila Fabricio Poltronieri et al., 2018; Camila Fabrício Poltronieri et al., 2017; M. Rebelo et al., 2014, 2015; M. F. Rebelo et al., 2014, 2016; Savino & Shafiq, 2018; Simon, Karapetrovic, & Casadess, 2012; Siva et al., 2016; Souza & Alves, 2018; Zeng et al., 2011)	30
	Improve social responsibility	(Asif et al., 2013; Bevilacqua et al., 2016; Botta et al., 2013; F. Carvalho et al., 2020; Fresner & Engelhardt, 2004; M. Ikram et al., 2019; Ionescu et al., 2018; Karapetrovic & Jonker, 2003; Mežinska et al., 2015; Camila Fabricio Poltronieri et al., 2018; M. Rebelo et al., 2014; von Ahsen, 2014)	12
	Environmental Protection	(Bąk & Nowak, 2019; Berezyuk et al., 2017; Blasco-Torregrosa et al., 2019; Botta et al., 2013; Gangolells et al., 2013; Jaroenroy & Chompunth, 2019; Kruse et al., 2019; Labodová, 2004; Mariouryad et al., 2015; Milliman et al., 2005; Pheng & Kwang, 2005; G. Santos & Carvalho, 2019; von Ahsen, 2014)	13
	Waste reduction	(Biniecka et al., 2005; Fresner & Engelhardt, 2004; Ramos et al., 2020; M. F. Rebelo et al., 2014; G. Santos & Carvalho, 2019)	5
Worker	Improve working environment	(Bevilacqua et al., 2016; Biniecka et al., 2005; Casadesús et al., 2011; Jain A., Aswar N., Kale K., 2016; Labodová, 2004; Marinkovic et al., 2016; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; G. Santos & Carvalho, 2019; A. L. I. F. Silva et al., 2020; Siva et al., 2016; Zeng et al., 2006, 2007)	13
	Improve employee satisfaction	(Bernardo et al., 2015; Fresner & Engelhardt, 2004; M. Ikram et al., 2019; Ionescu et al., 2018; López-Fresno, 2010; Manzanera et al., 2014; Moumen & El Aoufir, 2017; Muthu Samy et al., 2015; Muthusamy et al., 2018; Ramos et al., 2020; M. Rebelo et al., 2014)	11
	Changing the company's culture	(Alvarado Rueda & Perez Gomez, 2016; Biniecka et al., 2005; Gianni & Gotzamani, 2015; Holdsworth, 2003; Holm et al., 2015; Jørgensen et al., 2006; Ramos et al., 2020; Taylor, 2002; Wright, 2000; Zeng et al., 2007, 2006)	11
	Optimization of the organizational structure	(Alvarado Rueda & Perez Gomez, 2016; Chountalas & Tepaskoualos, 2019; Gapp et al., 2008; Kruse et al., 2019; Pheng & Kwang, 2005; G. Santos et al., 2011; G. Santos & Carvalho, 2019; Souza & Alves, 2018; Sui et al., 2018; Zeng et al., 2007, 2006)	11
	Training optimization	(Abouettahir et al., 2013b; Berezyuk et al., 2017; P. Domingues et al., 2017; Labodová, 2004; Nunhes et al., 2017; G. Santos et al., 2011; G. Santos & Carvalho, 2019; Yazdani & Wells, 2012; Zeng et al., 2007)	9

Qualification of labor	(Blasco-Torregrosa et al., 2019; Karapetrovic & Jonker, 2003; Manzanera et al., 2014; Sampaio et al., 2012; G. Santos & Carvalho, 2019; Zeng et al., 2006, 2007)	7
Reducing the risk of accidents at work	(Jesús Abad et al., 2013; Abouettahir et al., 2013a; Al-Darrab et al., 2013; Bąk & Nowak, 2019; Bevilacqua et al., 2016; Fresner & Engelhardt, 2004; Gangolells et al., 2013; Hamidi et al., 2012; Jain A., Aswar N., Kale K., 2016; Jaroenroy & Chompunth, 2019; Kruse et al., 2019; Laal et al., 2019; Labodová, 2004; Mariouryad et al., 2015; Milliman et al., 2005; Pheng & Kwang, 2005; Ramos et al., 2020; Yazdani & Wells, 2012)	18

Source: Own author.

Figure 06 shows the most mentioned impacts addressed by the paper sample, presented in Table 02. The three most important were: the improvement in operational performance (which should be a continuous search for every manager) was the most referenced; the reduction of organizational costs (which is closely related to organizational efficiency), the second most mentioned, makes the company leaner and consequently more profitable; and sustainable development (which meets the needs of the current generation, without compromising the ability to meet the needs future generations), one of the most relevant concerns of companies, being the third most cited impact.

Figure 06: Impacts most cited in the articles of the delimited sample.



Source: Table 03.

2.4 CONCLUSIONS

The main objective of this paper was to map and analyze the literature on impact on organizational performance provided by integration of management systems (see Table 03). For this purpose, a Systematic Literature Review - SLR was carried out using the PRISMA methodology that allowed selection of the most relevant papers for this research. The SLR showed an increase in the number of publications on Integrated Management Systems – IMS, in the Journals with the most significant impacts. In 2007, there were only 4 published works. In 2019, this number increased to 13 manuscripts, also expanding the number of citations of the predominant authors. The most studied areas were engineering and environment (20.5% and 13.5% of searches, respectively). This study also revealed that the quantitative approach of the articles was only 5.93%, while the qualitative approach was 94.07 %.

The contribution of this research is in the aspect of guiding the corporations with regards to understanding how the integration of management systems can positively impact in the organization’s performance, providing the optimization of investments and a better business planning. Another

important contribution of this article was identification of a low number of studies using a quantitative approach on measuring benefits derived from IMS. In particular, no researches were identified that quantitatively mapped and analyzed the impacts' intensity of each management system (quality, environmental, and occupational health and safety) when implemented in an integrated manner. This indicates opportunities for further studies.

Also, some important conclusions related to the IMS can be obtained. It was observed that many companies, regardless of nationality, follow the guidelines of management systems' integration and such a procedure brings many benefits, such as: to improve the organization's image to stakeholders; to increase the corporation's competitiveness; to promote sustainable development; to improve health of the workplace; to improve quality of life at work, among others.

Based on several bibliographic references, Figure 06 (Section 3) synthesized the main benefits identified in the literature that companies may aim at implementing a process for integrating management systems. The benefits can be internal or external. Internal benefits are those that can improve performance and reduce organizational costs, as well as improving the work environment and stakeholder satisfaction. While the external advantages improve the interaction between the company and the entities (government, competitors, society).

The limitations of this article include bibliometric criteria, that is, some relevant articles were not considered eligible due to the inclusion criteria adopted. Other approaches could have been explored in bibliometrics, as well as the choice of other scientific databases.

Regarding the direction of future research, other SLR can be performed with a different sample of studies from this article, considering other interest management systems, such as Social Responsibility Management System and Risks Management System, among others. This would allow to confirm, in a more comprehensive way, the positive impacts generated by the Integrated Management Systems.

3 ARTICLE II – ITEM RESPONSE THEORY-BASED VALIDATION OF AN INTEGRATED MANAGEMENT SYSTEM MEASUREMENT INSTRUMENT

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3.1 INTRODUCTION

The integration of management systems (Quality Management System - QMS, Environmental Management System - EMS and Occupational Health and Safety Management System - OHSMS) includes technical and organizational principles and takes into consideration several internal and external aspects, such as: quality of goods and services, cost reduction, social responsibility, stakeholder satisfaction, sustainable development, reduction of accidents and occupational diseases, among others (Asif *et al*., 2013).

Integrated Management Systems (IMS) have become an important management tool that can determine the success or failure of an organization (Jørgensen *et al.*, 2006). Thus, the evaluation of IMS is an essential concern. To this end, studies are being conducted applying elaborate instruments that use items to capture the perception of stakeholders with the aid of *Likert-type* scales (Mariouryad *et al*., 2015).

Items usually contain a self-descriptive argumentation and then a scale of values with categorical representations, e.g., I never perceive (1), I perceive infrequently (2), I perceive sometimes (3), I perceive often (4), and I always perceive (5), thus planning to measure the expressiveness of the characteristic represented in the item (O'Neill, 2017). Consistent with this discrimination, the design of questionnaires using *Likert-type* scales advocates, among other things, to ensure that all elements are good parameters of the same construct, that they have high variance and that they are correlated with each other.

In contrast, there are uncertainties regarding these recommendations (Dalbeth *et al*., 2014). For instance, one can ask him/herself: do the respondents understand in all situations, in the same "quantitative" sense, the values of the *Likert-type* scale, e.g., will the perspective assigned to the first category for a variable be permanently the same for more than one respondent? Subsequently, would the distance between the categories mean the same expressiveness of the construct measured

regardless of the variable being answered? Furthermore, do the respondents have a rigorous enough understanding to differentiate, for example, 5 different levels of expressiveness of the construct when elaborating *Likert* scales with 5 alternatives? Moreover, it is plausible the incident of semantic incongruences in the characteristics related to each category (Ferraro *et al*., 2017; Harpe, 2015).

These uncertainties have drawn the attention of scholars to research the parameters and opportunities for optimization of assessment scales. Among the more far-fetched analysis methodologies to mitigate these uncertainties are Item Response Theory (IRT) models (Massof, 2002).

The IRT techniques are a set of mathematical models that seeks to characterize the possibility of a respondent providing a given answer to a questionnaire as a function of item parameters and perceptions (latent traits) of the individual, that is, to enable the identification of peculiarities of the respondent that cannot be measured directly. The use of IRT techniques has been intensifying in various knowledge fields (Fraley *et al.*, 2000).

The most widely used IRT patterns rely on the conjecture that there is an exclusive latent trait that suggests the prospect of a given response, or, at least, that there is an exclusive dominant trait that reports for the individual's behavior in the survey. These models are referred to it as one-dimensional models (Reise *et al.*, 1993). However, this assumption is not always relevant in practice, in which usually more than one latent trait (multidimensional models) has a relevant role in the interpretation of the respondent throughout the questionnaire (Chalmers, 2012). For example, in a survey that intends to measure the perception of a worker to a particular management system, several factors may interfere with the appropriate response to an item, such as time in the company, amount of training, affinity with the organization's culture, among others.

At this juncture, a model that weights multiple latent traits must be implemented to detail the peculiarities of the population. Extensions of the one-dimensional IRT models are proposed cogitating that the latent trait θ is delineated as a vector $\theta = (\theta_1, \theta_2, ..., \theta_n)$ of latent traits that intervene in item responses (Massof, 2011). The amount of latent traits that should be explored in the model stems from the diversity of the sample population regarding the conjunctions of these dimensions and which traits truly impact the respondents' responses to the items (Santos *et al.*, 2013).

Overestimating the number of latent traits is not advisable due to the adversity in the interpretation of each trait. On the other hand, underestimating the number of dimensions may hinder the relevance of the model to the data (Smits et al., 2020). To this end, Factor Analysis (FA) techniques are applied and executed in statistical software *in* order to delimit the vector dimension of θ parameters (Lorenzo-Seva & Van Ginkel, 2016).

The equalization strategies and the elaboration of interpretable scales are important advances. The equalization strategies allow individuals assessed by a research tool (questionnaire) to be

positioned on the same scale, which makes it possible to compare them and understand their evolution (Silva *et al.*, 2020). The other significant progress of IRT is the feasibility of idealizing scales in which items and individuals are positioned concomitantly, which allows the understanding of this scale (Menegon et al., 2019). Moreover, IRT also has the opportunity to measure the probability of a given response to a particular item that the respondent has not answered (Menego *et al*., 2017).

Thus, the main objective of this article was to propose and validate a research instrument, by means of Item Response Theory, to measure the impacts of an Integrated Management System (QMS, EMS and OHSMS) from the multidimensional perspective of its workers on the organizational performance of a large company. The research tool derived from a Systematic Literature Review (SLR) conducted by (Barbosa *et al*., 2021) on IMS and organizational performance. This research assumes that IRT is a technique capable of validating a research tool (questionnaire) that makes use of observable variables collected with support of a *Likert-type* scale.

To achieve the proposed objective the following questions were proposed:

1. Is there a way to distinguish the discrimination power and the degree of difficulty of perception of the questionnaire variables using the IRT technique?
2. Is the IRT method a suitable technique to be applied in this research?
3. Can IRT verify the validation of the research instrument?

3.2 METHODOLOGICAL PROCEDURE

IRT was applied in this study with the purpose of validating a research instrument (questionnaire), which had the scope of diagnosing the aspects and parameters that sensitize the perception of workers about the impacts on the organizational performance of a large company promoted by the simultaneous and integrated conduct of management systems (QMS, EMS and OHSMS).

Survey research is a long procedure that requires, among other steps: (i) the existence of a theoretical model (in this study, was developed by a comprehensive SLR) and its respective translation to the empirical domain; (ii) the research design and the conduct of a pilot test (in this study, included a pilot questionnaire with a sample of 106 workers); (iii) the actual data collection (full survey comprising with 485 employees), the data analysis and the interpretation of the results (using IRT methodology) and, finally; (iv) the contextualization (Forza, 2002) .

In planning this survey, the analysis unit was determined to be a large company, and the data collection tool was an electronic web-based form called *Google Form*. This information collection form was extremely useful in the evaluation of the research elements, since it avoided incorrect filling

out or the absence of answers. This research was approved by the Ethics and Research with Human Beings Committee (CAAE: 37320620.8.0000.5185).

3.2.1 Systematic Literature Review and Expert Selection Criteria

A comprehensive SLR, conducted by Barbosa *et al*. (2021), analyzed a sample of 118 articles related to IMS and identified 25 organizational impacts of IMS (Table 1). These identified variables were organized into a questionnaire using a *Likert-type* scale for the respondents' appreciation of each possible impact of the IMS on the organization's performance.

Table 1: Impacts of the Integration of Management Systems.

Integrated Management Systems - IMS			
Focus	**Positive Impacts**	**Authors**	**References**
Client	Improve the company's image	(Salomone, 2008; Santos *et al.*, 2011; Sampaio *et al.*, 2012; Rebelo *et al.*, 2014; Bernardo *et al.*, 2015; Nunhes *et al.*, 2017; Blasco-Torregrosa *et al.*, 2019; Santos & Carvalho, 2019)	8
	Improve the quality of goods and services	(Fresner & Engelhardt, 2004; López-Fresno, 2010; Sampaio *et al.*, 2012; Rebelo *et al.*, 2014; Manzanera *et al.*, 2014; Bernardo *et al.*, 2015; Bevilacqua *et al.*, 2016; Majerník *et al.*, 2017; Moumen & El Aoufir, 2017; Nunhes *et al.*, 2017; Santos & Carvalho, 2019; Drożyner, 2020)	12
	Improve stakeholder satisfaction	(Algheriani *et al.*, 2019; Alvarado Rueda & Perez Gomez, 2016; Asif *et al.*, 2009; Barbosa *et al.*, 2018; Bernardo *et al.*, 2015; Carvalho *et al.*, 2019; Casadesús *et al.*, 2011; Dahlin & Isaksson, 2017; Dragomir *et al.*, 2017; Drożyner, 2020; Fresner & Engelhardt, 2004; Holdsworth, 2003; Ikram *et al.*, 2020; Ionescu *et al.*, 2018; Jaroenroy & Chompunth, 2019; Jørgensen *et al.*, 2006; Karapetrovic & Jonker, 2003; Kruse *et al.*, 2019; López-Fresno, 2010; Manzanera *et al.*, 2014; Marinkovic *et al.*, 2016; Rebelo *et al.*, 2016, 2014b, 2015; Siva *et al.*, 2016; Zeng *et al.*, 2006; Zeng *et al.*, 2007)	27
Company	Increase organizational competitiveness	(Chan *et al.*, 1998; Jørgensen *et al.*, 2006; Zeng *et al.*, 2011; De Oliveira, 2013; Rebelo *et al.*, 2014; Manzanera *et al.*, 2014; Bernardo *et al.*, 2015; Alvarado Rueda & Perez Gomez, 2016; Majerník *et al.*, 2017; Escorcia *et al.*, 2018; Muthusamy *et al.*, 2018; Santos & Carvalho, 2019)	12
	Control business risks	(Holdsworth, 2003; Labodová, 2004; Milliman *et al.*, 2005; Azadeh *et al.*, 2012; Sampaio *et al.*, 2012; Simon *et al.*, 2012; Rebelo *et al.*, 2014; Rebelo *et al.*, 2015; Algheriani *et al.*, 2019; Blasco-Torregrosa *et al.*, 2019; Masuin & Latief, 2019; Ikram *et al.*, 2020; Ramos *et al.*, 2020)	13
	Improve communication	(López-Fresno, 2010; Simon *et al.*, 2012; Asif *et al.*, 2013; El Yacoubi El Idrissi *et al.*, 2014; Rebelo *et al.*, 2014; Domingues *et al.*, 2015; Abad *et al.*, 2016; Del Prado Martínez & Navarro, 2016; Nunhes *et al.*, 2017; Dragomir *et al.*, 2017; Santos & Carvalho, 2019; Blasco-Torregrosa *et al.*, 2019; Carvalho *et al.*, 2020)	13
	Improve decision making	(Gapp e*t al.*, 2008; Zeng *et al.*, 2011; Azadeh *et al.*, 2012; Rebelo *et al.*, 2015; Nunhes *et al.*, 2017; Poltronieri *et al.*, 2017; Blasco-Torregrosa *et al.*, 2019; Santos & Carvalho, 2019; Zaloga *et al.*, 2019; Ikram *et al.*, 2020)	10
	Improve operational performance	(Beckmerhagen *et al.*, 2003; Biniecka e*t al.*, 2005; Jørgensen e*t al.*, 2006; Karapetrovic & Casadesús, 2009; Bernardo *et al.*, 2009, 2012, 2015; Casadesús e*t al.*, 2011; Zeng *et al.*, 2011; Hamidi e*t al.*, 2012; Simon e*t al.*, 2012; Yazdani & Wells, 2012; Abad e*t al.*, 2013; De Oliveira, 2013; Simon & Douglas, 2013; Rebelo e*t al.*, 2014; Walker & McAleer, 2014; Rebelo e*t al.*, 2015, 2016; Alvarado Rueda & Perez Gomez, 2016; Dahlin & Isaksson, 2017; Majerník *et al.*, 2017; Nunhes e*t al.*, 2017; Llonch e*t al.*, 2018; Moumen & Elaoufir, 2018; Muthusamy e*t al.*, 2018; Savino & Shafiq, 2018; Sui e*t al.*, 2018; Barbosa e*t al.*, 2018; Chaudhuri & Jayaram, 2019; Ćwiklicki e*t al.*, 2019; Hernandez-Vivanco *et al.*, 2019; Ikram *et al.*, 2019; Algheriani *et al.*, 2019; Jaroenroy & Chompunth, 2019; Nunhes e*t al.*, 2019; Bąk & Nowak, 2019; Abisourour *et al.*, 2020; Ikram e*t al.*, 2020; Ramos e*t al.*, 2020; Vulanovic *et al.*, 2020)	41
	Improve strategic planning	(Holdsworth, 2003; Sampaio e*t al.*, 2012; Luo e*t al.*, 2015; Abad e*t al.*, 2016; Trierweiller *et al.*, 2016; Algheriani *et al.*, 2019; Blasco-Torregrosa *et al.*, 2019; Nunhes e*t al.*, 2019; Santos & Carvalho, 2019)	9

	Audit optimization	(Wright, 2000; Beckmerhagen *et al.*, 2003; Simon *et al.*, 2011; Zeng *et al.*, 2011; Simon e*t al.*, 2012; Rebelo e*t al.*, 2014; Savino & Mazza, 2014; Domingues e*t al.*, 2015; Dragomir *et al.*, 2017; Nunhes e*t al.*, 2017; Blasco-Torregrosa *et al.*, 2019; Jaroenroy & Chompunth, 2019; Laal *et al.*, 2019; Santos & Carvalho, 2019)	14
	Time optimization	(Sampaio e*t al.*, 2012; Simon *et al.*, 2013; Bernardo *et al.*, 2015; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Blasco-Torregrosa *et al.*, 2019)	6
	Management standardization	(Simon & Douglas, 2013; Ribeiro *et al.*, 2017; Nunhes e*t al.*, 2019; Santos & Carvalho, 2019; Ikram e*t al.*, 2020)	5
	Organizational policy	(Ofori e*t al.*, 2002; Pheng & Pong, 2003; El Yacoubi El Idrissi e*t al.*, 2014; Domingues e*t al.*, 2017; Muhamad Khair *et al.*, 2018; Santos & Carvalho, 2019; Abisourour *et al.*, 2020)	7
	Reduction of bureaucracy	(Beckmerhagen *et al.*, 2003; Holdsworth, 2003; Bernardo *et al.*, 2009, 2015; Zeng *et al.*, 2011; Simon e*t al.*, 2012; Muthu Samy e*t al.*, 2015; Del Prado Martínez & Navarro, 2016; Nunhes e*t al.*, 2017; Ribeiro *et al.*, 2017; Souza & Alves, 2018; Mora-Contreras, 2019; Vulanovic *et al.*, 2020; Ikram e*t al.*, 2020)	14
	Reduction of redundant activities	(Domingues e*t al.*, 2015; Trierweiller *et al.*, 2016; Poltronieri e*t al.*, 2017; Souza & Alves, 2018; Bąk & Nowak, 2019; Santos & Carvalho, 2019; Ikram e*t al.*, 2020)	7
	Reduction of organizational costs	(Wright, 2000; Ofori e*t al.*, 2002; Beckmerhagen *et al.*, 2003; Fresner & Engelhardt, 2004; York & Miree, 2004; Milliman *et al.*, 2005; Pheng & Kwang, 2005; Biniecka e*t al.*, 2005; Salomone, 2008; Asif *et al.*, 2009; López-Fresno, 2010; Santos e*t al.*, 2011; Zeng *et al.*, 2011; Casadesús e*t al.*, 2011; Simon *et al.*, 2013; Rebelo e*t al.*, 2014; Muthu Samy e*t al.*, 2015; Bernardo *et al.*, 2015; Domingues e*t al.*, 2015; Moumen & El Aoufir, 2017; Ribeiro *et al.*, 2017; Tepaskoualos & Chountalas, 2017; Dahlin & Isaksson, 2017; Llonch e*t al.*, 2018; Moumen & Elaoufir, 2018; Muthusamy e*t al.*, 2018; Poltronieri *et al.*, 2018; Souza & Alves, 2018; Escorcia e*t al.*, 2018; Nadae e*t al.*, 2019; Bąk & Nowak, 2019; Zaloga *et al.*, 2019; Abisourour *et al.*, 2020)	33
Society	Sustainable development	(Ofori e*t al.*, 2002; Fresner & Engelhardt, 2004; Jørgensen e*t al.*, 2006; Zeng *et al.*, 2011; Simon e*t al.*, 2012; Abouettahir e*t al.*, 2013a, 2013b; De Oliveira, 2013; Rebelo e*t al.*, 2014; Rebelo e*t al.*, 2014; Holm e*t al.*, 2015; Mežinska e*t al.*, 2015; Muthu Samy e*t al.*, 2015; Bernardo *et al.*, 2015; Rebelo e*t al.*, 2015, 2016; Siva *et al.*, 2016; Poltronieri e*t al.*, 2017; Muhamad Khair *et al.*, 2018; Muthusamy e*t al.*, 2018; Poltronieri *et al.*, 2018; Savino & Shafiq, 2018; Souza & Alves, 2018; Ikram *et al.*, 2019; Nadae e*t al.*, 2019; Chaudhuri & Jayaram, 2019; de Nadae & de Carvalho, 2019; Fonseca & Carvalho, 2019; Carvalho e*t al.*, 2020; Drożyner, 2020)	30
	Improve social responsibility	(Karapetrovic & Jonker, 2003; Fresner & Engelhardt, 2004; Asif *et al.*, 2013; Botta e*t al.*, 2013; von Ahsen, 2014; Rebelo e*t al.*, 2014; Mežinska e*t al.*, 2015; Bevilacqua e*t al.*, 2016; Poltronieri *et al.*, 2018; Ionescu *et al.*, 2018; Ikram *et al.*, 2019; Carvalho e*t al.*, 2020)	12
	Environmental Protection	(Labodová, 2004; Pheng & Kwang, 2005; Milliman *et al.*, 2005; Botta e*t al.*, 2013; Gangolells *et al.*, 2013; von Ahsen, 2014; Mariouryad *et al.*, 2015; Berezyuk e*t al.*, 2017; Bąk & Nowak, 2019; Santos & Carvalho, 2019; Blasco-Torregrosa *et al.*, 2019; Jaroenroy & Chompunth, 2019; Kruse, Veltri & Branscum, 2019)	13
	Waste reduction	(Fresner & Engelhardt, 2004; Biniecka e*t al.*, 2005; Rebelo e*t al.*, 2014; Santos & Carvalho, 2019; Ramos e*t al.*, 2020)	5

Worker	Improve working environment	(Bevilacqua e*t al.*, 2016; Biniecka e*t al.*, 2005; Casadesús e*t al.*, 2011; Jain e*t al.*, 2016; Labodová, 2004; Marinkovic e*t al.*, 2016; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Santos & Carvalho, 2019; Silva e*t al.*, 2020a; Siva e*t al.*, 2016; Zeng e*t al.*, 2006; Zeng e*t al.*, 2007).	13
	Improve employee satisfaction	(Fresner & Engelhardt, 2004; López-Fresno, 2010; Rebelo e*t al.*, 2014; Manzanera *et al.*, 2014; Bernardo *et al.*, 2015; Muthu Samy e*t al.*, 2015; Moumen & El Aoufir, 2017; Ionescu *et al.*, 2018; Muthusamy e*t al.*, 2018; Ikram *et al.*, 2019; Ramos e*t al.*, 2020)	11
	Changing the company's culture	(Wright, 2000; Taylor, 2002; Holdsworth, 2003; Biniecka e*t al.*, 2005; Jørgensen e*t al.*, 2006; Zeng e*t al.*, 2006; Zeng e*t al.*, 2007; Gianni & Gotzamani, 2015; Holm e*t al.*, 2015; Alvarado Rueda & Perez Gomez, 2016; Ramos e*t al.*, 2020)	11
	Optimization of the organizational structure	(Pheng & Kwang, 2005; Zeng e*t al.*, 2006; Zeng e*t al.*, 2007; Gapp e*t al.*, 2008; Santos e*t al.*, 2011; Alvarado Rueda & Perez Gomez, 2016; Souza & Alves, 2018; Sui e*t al.*, 2018; Chountalas & Tepaskoualos, 2019; Kruse e*t al.*, 2019; Santos & Carvalho, 2019)	11
	Training optimization	(Labodová, 2004; Zeng e*t al.*, 2007; Santos e*t al.*, 2011; Yazdani & Wells, 2012; Abouettahir e*t al.*, 2013b; Berezyuk e*t al.*, 2017; Domingues e*t al.*, 2017; Nunhes e*t al.*, 2017; Santos & Carvalho, 2019)	9
	Qualification of labor	(Karapetrovic & Jonker, 2003; Zeng e*t al.*, 2006; Zeng e*t al.*, 2007; Sampaio e*t al.*, 2012; Manzanera *et al.*, 2014; Blasco-Torregrosa *et al.*, 2019; Santos & Carvalho, 2019)	7
	Reducing the risk of accidents at work	(Labodová, 2004; Fresner & Engelhardt, 2004; Milliman *et al.*, 2005; Pheng & Kwang, 2005; Yazdani & Wells, 2012; Hamidi e*t al.*, 2012; Abad e*t al.*, 2013; Abouettahir e*t al.*, 2013a; Al-Darrab e*t al.*, 2013; Gangolells *et al.*, 2013; Mariouryad *et al.*, 2015; Bevilacqua e*t al.*, 2016; Jain e*t al.*, 2016; Kruse e*t al.*, 2019; Laal *et al.*, 2019; Bąk & Nowak, 2019; Jaroenroy & Chompunth, 2019; Ramos e*t al.*, 2020)	18

Source: Barbosa *et al*. (2021).

In the subsequent stage, the content analysis of the Research Instrument was performed using the Content Validity Coefficient (CVC) technique proposed by Hernandez-Nieto (2002), which evaluates the proficiency of the observable variables of the questionnaire among the judges. To this end, an interview was conducted with 3 professional specialists of the organization, who are corporately responsible for the 3 management systems addressed in this article (QMS, EMS and OHSMS). The purpose was to verify the clarity, coherence and relevance of the questions elaborated for the data collection tool identified in the SLR, as well as to foment new questions, arising from the practical domain, important for the development of the study.

3.2.2 Sample Analysed

Two groups of individuals answered the items of the Instrument: (i) a smaller group of workers for the pilot study; (ii) a larger group of workers for validation of the final Instrument. The pilot study was conducted to test, evaluate, review and improve the instrument for collecting information and the research procedures, as well as to assess the consistency of the questionnaire. On this occasion, a reduced version of the complete research was implemented, which involves carrying out all the procedures foreseen in the research design to allow identification of alterations needs and/or improvement opportunities of the research strategy before the full survey application (Valière *et al*., 2007).

A sample of 106 workers was randomly selected from a total of 850 company employees, corresponding to 12.47%, to answer the pilot questionnaire. For preliminary studies, Hair *et al.* (1998) pondered that, regarding the issue of sample size, the researcher is unlikely to perform a multivariate analysis with a sample of less than 50 observations. Preferably, the sample size should be greater than or equal to 100 appreciations. Therefore, the pilot questionnaire that was answered by 106 employees was adequate for the initial analysis.

The workers were asked to rate their perception of the impacts of the IMS on the company's organizational performance using a *Likert-type* scale with 5 response options: 1 = never; 2 = a few times; 3 = sometimes; 4 = often; and 5 = always.

As for a full (conclusive) research, the study with 485 respondents, which corresponds to 57.06% of the total number of employees was conducted without the need for further improvements in the research instrument (questionnaire), given that the propositions were listed as a result of an SLR of extremely relevant articles on IMS, in addition to the ratification of the organization's professional experts concerning their proficiency. Hair *et al.* (1998) went on to state that, as a general rule, the minimum is to have at least five times as many observations as the number of variables to be analyzed, and the most acceptable size would have a ratio of ten to one.

3.2.3 Statistical Procedures

In possession of the preliminary results (pilot study) and with the help of the MINITAB 17 *Statistical software*, the reliability of the questionnaire was analyzed, through the calculation of *Cronbach's Alpha* coefficient. This is a traditional procedure and indicates whether the items of the instrument have good internal consistency.

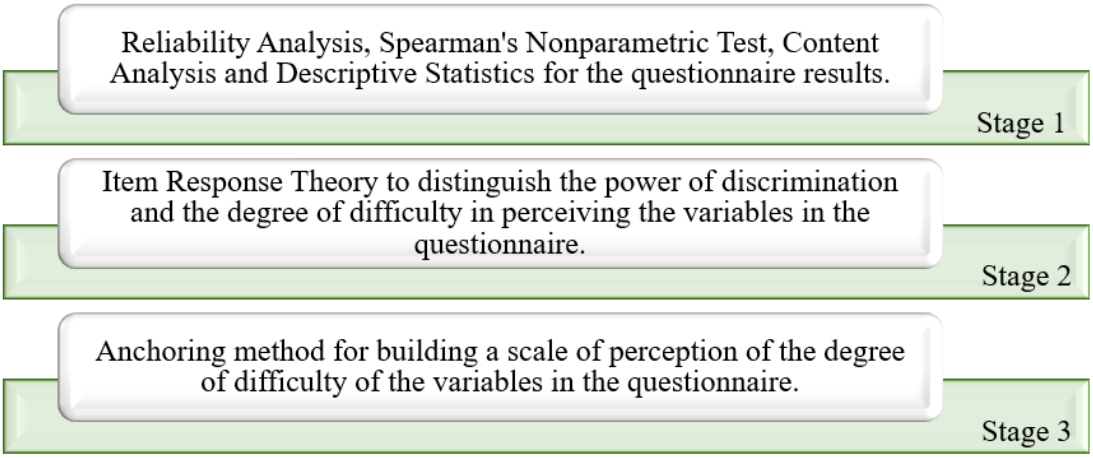
In relation to the full survey data, *Cronbach's Alpha* value was calculated, and to reinforce the reliability of the data, *McDonald's Omega* was calculated. The CVC technique was again repeated on the items of the Instrument. The correlation between items was analyzed using *Spearman*'s *non-parametric* test, and the multicollinearity between variables was checked using the Variance Inflation Factor (VIF). Descriptive analysis of the responses was performed, as well as of the respondents' characteristics.

Next, we proceeded with the dimensionality analysis of the instrument. To this end, the adequacy of the data to the Factor Analysis (FA) method was verified through the *Bartlett's sphericity* test and *Kaiser-Meyer-Olkin's* (KMO) test. The factor loadings (F) and communality (h2) of the items were determined using the "*Principal Components*" extraction method, through the "*Polyporic*" correlation matrix and with "*Oblimin*" rotation. Parallel analysis was used to confirm the number of dimensions of the FA.

The IRT gradual response method (Samejima, 1969) was used to verify the discriminative power of the items and the level of difficulty of their response alternatives. The characteristic curves of the items were analyzed in order to determine their behavior as a function of the increase in the value of the latent trait analyzed. Similarly, the information gain curve of the Instrument as a function of the total score and the information gain curve as a function of the latent trait were plotted in order to determine the region of the scale that is predominantly covered by the items.

The parameters of item discrimination and difficulty of the response alternatives were also estimated. Items are considered of good quality when they have discrimination value greater than 0.70 and increasing difficulty (Tezza e*t al.*, 2011). To build the scale to measure the impacts of the IMS from the perspective of workers, the anchoring procedure was adopted, based on Alvarenga *et al.* (2020) and Silva *et al.* (2020), so that an alternative answer will be fixed at a level of the scale when its cumulative probability is greater than 50%. Finally, the number of workers at each level was verified. All these statistical procedures were performed with the help of the *software R Project for Statistical* with a significance level of 5%. Figure 1 summarizes the methodological procedures.

Figure 1: Steps of the methodological procedure.



Source: Own author.

3.3 RESULTS

3.3.1 Content Validation by Experts

The content validation procedure of the collection instrument was performed by 3 professional experts from the organization through the CVC (Table 2). The coefficients for clarity and coherence were equal to 0.940 and for relevance was equal to 0.950. Hernandez-Nieto (2002) considers as acceptable the scale items that obtain CVC > 0.800, which demonstrates the content validity of the questionnaire of this research.

3.3.2 Pilot Study

None of the respondents reported difficulties in understanding the content of the Instrument's items. There were also no suggestions for semantic changes in the content of the items, providing evidence that the instrument is sufficiently clear. *Cronbach's Alpha* value for the pilot study data was 0.977, which represents a good value, since the internal consistency of the questionnaire is close to 1, the maximum value for this coefficient (Cronbach, 1951).

3.3.3 Full Search

The values of *Cronbach's Alpha* and *McDonald's Omega* for the full survey data were 0.964 and 0.977, respectively. For Zinbarg *et al*. (2005) there is strong evidence of reliability when *Cronbach's Alpha* and *McDonald*'s *Omega* values are greater than 0.700, such that *McDonald's Omega* is greater than *Cronbach's Alpha* value.

Table 2: Content Validity Coefficient (CVC) values.

System Management	Item	Discrimination	CVC (0.04 error)			*Cronbach' α* (0.964)
			Clarity (0.94)	Coherence (0.95)	Relevance (0.95)	
QMS	Q1	In your perception, is there a commitment of the organization to improve the quality of products, services and processes visible in the daily work, enhancing the company's image?	1.00	1.00	1.00	0.935
	Q2	In your perception, is there a quality awareness process developed by the organization known by all involved, satisfying the stakeholders?	1.00	1.00	1.00	
	Q3	In your perception, does the organization use procedures to correct possible problems in goods, services and/or work processes, improving the operational performance and increasing the company's competitiveness?	1.00	1.00	1.00	
	Q4	In your perception, is there an organizational cost reduction policy in the company?	1.00	1.00	1.00	
	Q5	In your perception, in order to make decisions, does the organization seek all the available information so as not to make a mistake, controlling the business risks?	1.00	1.00	1.00	
	Q6	In your perception, does the organization optimize training by adapting it to the needs of employees to qualify the workforce?	1.00	1.00	1.00	
	Q7	In your perception, is there a standardized management in the organization, aiming at reducing redundant activities and bureaucracy?	0.93	1.00	0.87	
	Q8	In your perception, is there an optimization of time to ensure the quality of the goods/services offered?	1.00	0.80	1.00	
	Q9	In your perception, is there a strategic planning in the organization?	1.00	1.00	1.00	
	Q10	In your perception, does the administration of your organization (directors, managers, supervisors and other top management positions) demonstrate commitment to quality in their decisions?	1.00	1.00	1.00	
	Q11	In your perception, are there audits (internal or external) in the organization?	1.00	1.00	1.00	
	Q12	In your perception, is there good communication within the organization?	1.00	1.00	1.00	
	Q13	In your perception, is there an optimization of the organization's physical structure?	1.00	1.00	0.80	
EMS	Q14	In your perception, is there a culture of sustainable development formally inserted in the organization's strategy?	0.93	0.93	1.00	0.924
	Q15	In your perception, is there a commitment of the organization to social responsibility?	1.00	1.00	1.00	
	Q16	In your perception, is there a structured organizational policy for environmental education?	1.00	1.00	1.00	
	Q17	In your perception, does the organization proactively contribute to environmental protection and improvement of the working environment?	1.00	1.00	1.00	
	Q18	In your perception, does the organization consider climate change adaptation in the design of its undertakings, processes, products and services?	0.93	0.87	1.00	
	Q19	In your perception, is the organization concerned with reducing the amount of solid waste generated?	1.00	1.00	1.00	
OHSMS	Q20	In your perception, does the organization care about your health and safety?	1.00	1.00	1.00	0.906
	Q21	In your perception, does the organization provide quality of life in the work environment, increasing employee satisfaction?	1.00	1.00	1.00	
	Q22	In your perception, does the organization offer preventive measures to avoid work accidents?	1.00	1.00	1.00	
	Q23	In your perception, is the work environment in your organization salubrious (healthy)?	1.00	1.00	1.00	
	Q24	In your perception, is there quality of life in the work environment?	1.00	1.00	1.00	
	Q25	In your perception, are you satisfied with your working hours?	1.00	1.00	1.00	

Source: Own author.

Correlation between items was checked, in which an average *Spearman's* ρ equal to 0.490 was observed, with the smallest and largest ρ equal to 0.223 and 0.754, respectively. Multicollinearity was also tested, in which an average VIF equal to 2.707 was found, with the smallest and largest value equal to 0.617 and 4.109, respectively. Petrini *et al*. (2012) suggest that if no VIF exceeds 10 there is absence of significant multicollinearity among the items. Therefore, there were no indications of the need for exclusion of the items due to similarity of content and responses.

Descriptive statistics of the respondents (Table 3) and of the information gathered (Table 4) were performed. It was observed that most of the respondents are male, between 22 and 25 years old, with time of service and current position between 1 and 4 years, and with a technical medium level of education. With respect to the information gathered, it was evident that most workers perceive "often" or "always" that there is a direct contribution in the organizational performance of the company stimulated by the positive impacts of the QMS, EMS and OHSMS management systems when conducted simultaneously and in an integrated manner.

Table 3: Characterization of the respondents

Variable	**N°**	**%**
Sex		
Male	297	61,24
Female	188	38,76
Age (years)		
From 16 to 18	12	2,47
From 19 to 21	73	15,05
From 22 to 25	138	28,45
From 26 to 30	120	24,74
From 31 to 40	101	20,83
From 41 to 50	35	7,22
Above 50	6	1,24
Company time (years)		
Less than 1	139	28,66
From 1 to 4	270	55,67
From 5 to 9	58	11,96
Above 10	18	3,71
Current position time (years)		
Less than 1	210	43,30
From 1 to 4	245	50,52
From 5 to 9	28	5,77
Above 10	2	0,41
Education level		
Medium	81	16,70
Medium Technical	187	38,56
Superior	181	37,32
Post-graduation	36	7,42

Source: Own author.

Table 4: Descriptive analysis of the information

Item	Results n° (%)				
	Never	**few times**	**sometimes**	**often**	**always**
Q1	1 (0.2)	9 (1.9)	34 (7.0)	138 (28.4)	303 (62.5)
Q2	4 (0.8)	13 (2.7)	49 (10.1)	174 (35.9)	245 (50.5)
Q3	2 (0.4)	12 (2.5)	58 (12.0)	165 (34.0)	248 (51.1)
Q4	4 (0.8)	9 (1.9)	90 (18.6)	203 (41.9)	179 (36.9)
Q5	5 (1.0)	17 (3.5)	78 (16.1)	165 (34.0)	220 (45.4)
Q6	14 (2.9)	38 (7.8)	71 (14.6)	175 (36.1)	187 (38.6)
Q7	10 (2.1)	39 (8.0)	95 (19.6)	195 (40.2)	146 (30.1)
Q8	4 (0.8)	24 (5.0)	71 (14.6)	193 (39.8)	193 (39.8)
Q9	7 (1.4)	17 (3.5)	74 (15.3)	187 (38.6)	200 (41.2)
Q10	4 (0.8)	16 (3.3)	27 (5.6)	142 (29.3)	296 (61.0)
Q11	24 (4.9)	38 (7.8)	118 (24.3)	169 (34.8)	136 (28.2)
Q12	8 (1.6)	29 (6.0)	79 (16.3)	178 (36.7)	191 (39.4)
Q13	9 (1.9)	20 (4.1)	86 (17.7)	202 (41.7)	168 (34.6)
Q14	5 (1.0)	18 (3.7)	88 (18.1)	197 (40.7)	177 (36.5)
Q15	4 (0.8)	19 (3.9)	58 (12.0)	180 (37.1)	224 (46.2)
Q16	4 (0.8)	22 (4.5)	73 (15.1)	182 (37.5)	204 (42.1)
Q17	6 (1.2)	18 (3.7)	68 (14.0)	179 (36.9)	214 (44.2)
Q18	8 (1.6)	19 (3.9)	99 (20.4)	207 (42.8)	152 (31.3)
Q19	11 (2.3)	18 (3.7)	68 (14.0)	184 (37.9)	204 (42.1)
Q20	4 (0.8)	14 (2.9)	36 (7.4)	139 (28.7)	292 (60.2)
Q21	7 (1.4)	27 (5.6)	71 (14.6)	147 (30.4)	233 (48.0)
Q22	2 (0.4)	10 (2.1)	29 (6.0)	142 (29.2)	302 (62.3)
Q23	9 (1.9)	12 (2.5)	48 (9.9)	146 (30.1)	270 (55.6)
Q24	8 (1.6)	16 (3.3)	57 (11.8)	175 (36.1)	229 (47.2)
Q25	7 (1.4)	18 (3.7)	57 (11.8)	143 (29.5)	260 (53.6)

Source: Own author.

3.3.4 Instrument Dimensionality Assessment

The KMO test was equal to 0.970 and the *Bartlett*'s test of sphericity showed a chi-square equal to 212.61 (*p-value* equal to 2.2 x 10^{-16}). For Hair *et al.* (1998), a KMO value greater than 0.700 and a *p-value* less than 0.05 indicates a good fit of the data to the Factor Analysis technique (Table 5). It was evidenced that all items present quality by expressing F and h2 values greater than 0.400 and 0.200, respectively, in a single dimension (HAIR *et al*., 1998).

Table 5: Factorial loadings by variable (one-dimensional).

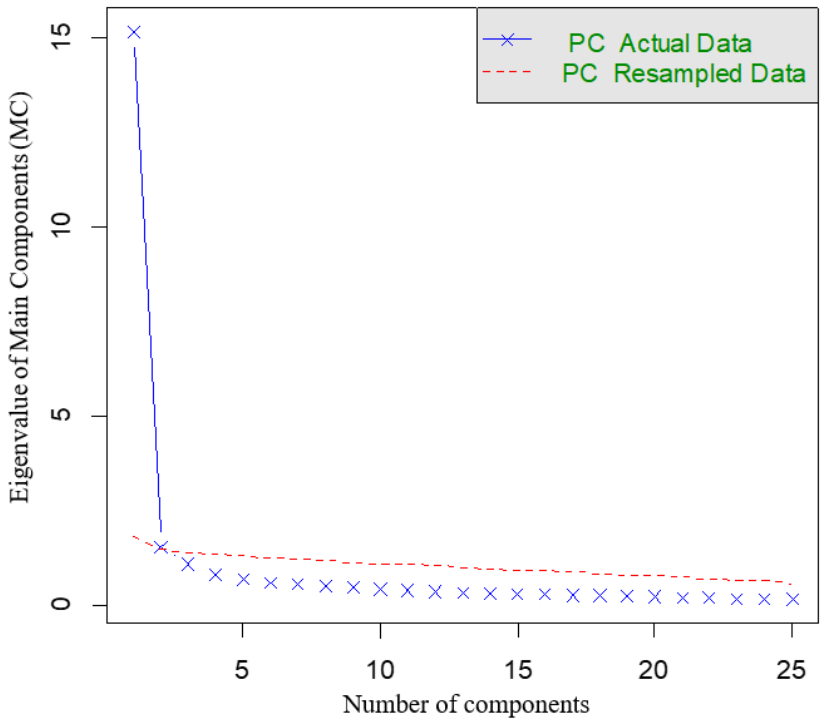
Dimension	Systems	Variable	F	h2	Cumulative
SGI	QMS	Q1	0.795	0.631	**65%**
		Q2	0.792	0.628	
		Q3	0.814	0.663	
		Q4	0.551	0.303	
		Q5	0.793	0.628	
		Q6	0.806	0.649	
		Q7	0.820	0.672	
		Q8	0.841	0.708	
		Q9	0.843	0.710	

	Q10	0.832	0.692
	Q11	0.746	0.556
	Q12	0.785	0.616
	Q13	0.805	0.648
EMS	Q14	0.812	0.660
	Q15	0.823	0.677
	Q16	0.791	0.626
	Q17	0.840	0.705
	Q18	0.827	0.684
	Q19	0.780	0.608
OHSMS	Q20	0.862	0.744
	Q21	0.860	0.740
	Q22	0.872	0.761
	Q23	0.818	0.669
	Q24	0.869	0.755
	Q25	0.712	0.507

Source: Own author.

The parallel analysis graph (Figure 2) reinforces the indication of unidimensionality of the Instrument generated by the factor analysis. The dominant dimension has a 65% explained variance, indicating the possibility of using unidimensional IRT models, given that the percentage of explained variance is greater than 20% (Reckase, 1979) .

Figure 2: Parallel Analysis.



Source: Own author.

3.3.5 IRT Evaluation of the Instrument

We estimated the parameters of the items of the gradual response model (Table 6), in which it can be observed that all items have discrimination parameters higher than 0.700 and increasing difficulty. Therefore, it is possible to answer the first question concerning the objective of this study ("*Is there a way to distinguish the discrimination power and the degree of difficulty of perception of the questionnaire variables using the IRT technique?*") given that by doing an analysis of the observable variables it is possible to infer that the parameters have been estimated satisfactorily.

The parameters of the degree of difficulty were estimated and it could be observed that the probability of an individual selecting a particular answer for a given item depends on his or her level of perception of the impacts of the integration of management systems in the organizational performance of the company. That is, employees with an assimilation level below "b1" are more likely to never perceive such impacts, while workers with an understanding level "b4" are more likely to always perceive the same impacts.

The characteristic curve of the items was also plotted (Figure 3) and, with the exception of items Q4 and Q23, none of the probability curves of the response alternatives were overlapping, reinforcing the importance of using IRT's gradual model rather than models with dichotomous responses.

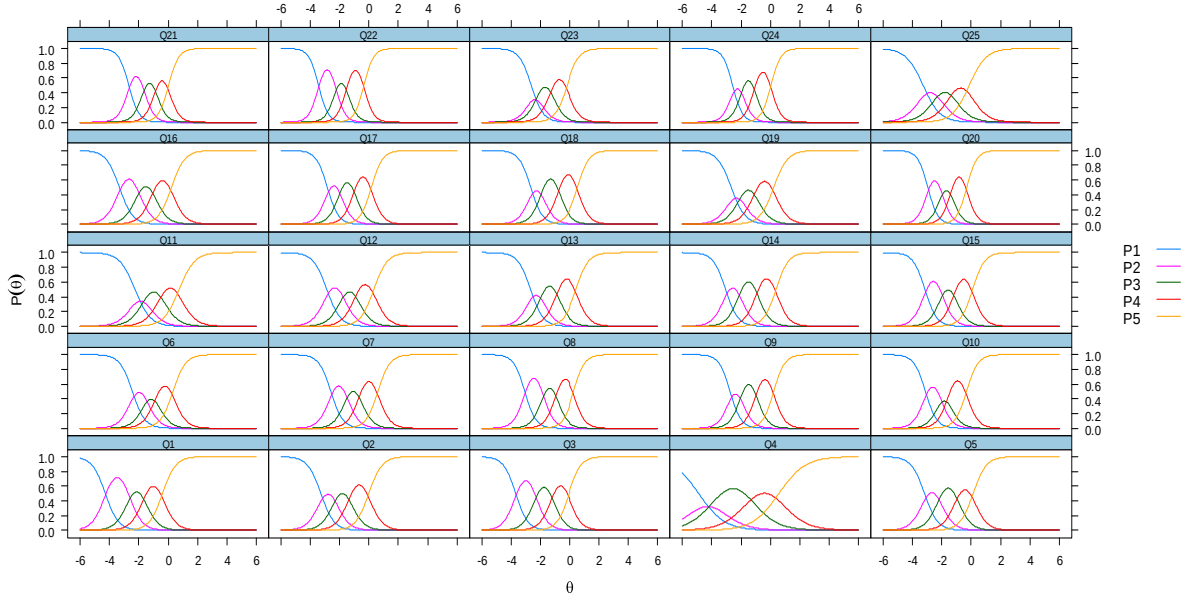
Table 6: Estimated parameters of workers' perception.

Items	**a**	**Difficulty**			
		b1	**b2**	**b3**	**b4**
Q1	2.227	-4.279	-2.660	-1.629	-0.391
Q2	2.209	-3.287	-2.316	-1.326	-0.030
Q3	2.389	-3.706	-2.343	-1.223	-0.055
Q4	1.123	-4.877	-3.676	-1.387	0.585
Q5	2.212	-3.185	-2.166	-0.985	0.128
Q6	2.314	-2.439	-1.517	-0.795	0.329
Q7	2.438	-2.607	-1.533	-0.631	0.594
Q8	2.647	-3.093	-1.851	-0.934	0.279
Q9	2.665	-2.736	-1.979	-0.952	0.235
Q10	2.553	-3.123	-2.131	-1.522	-0.327
Q11	1.905	-2.256	-1.511	-0.454	0.750
Q12	2.158	-2.884	-1.809	-0.867	0.320
Q13	2.310	-2.700	-1.925	-0.870	0.444
Q14	2.370	-3.043	-2.076	-0.898	0.396
Q15	2.462	-3.158	-2.011	-1.131	0.088
Q16	2.203	-3.320	-2.033	-1.009	0.225
Q17	2.630	-2.847	-1.973	-1.002	0.151
Q18	2.506	-2.684	-1.901	-0.765	0.547
Q19	2.121	-2.657	-1.959	-1.019	0.234

Q20	2.900	-2.958	-2.027	-1.348	-0.308
Q21	2.870	-2.681	-1.672	-0.852	0.028
Q22	3.033	-3.450	-2.284	-1.512	-0.357
Q23	2.420	-2.651	-2.128	-1.273	-0.190
Q24	2.984	-2.564	-1.911	-1.063	0.046
Q25	1.727	-3.281	-2.297	-1.299	-0.138

Source: Own author.

Figure 3: Plots of Perception (θ) as a function of Probability (P).



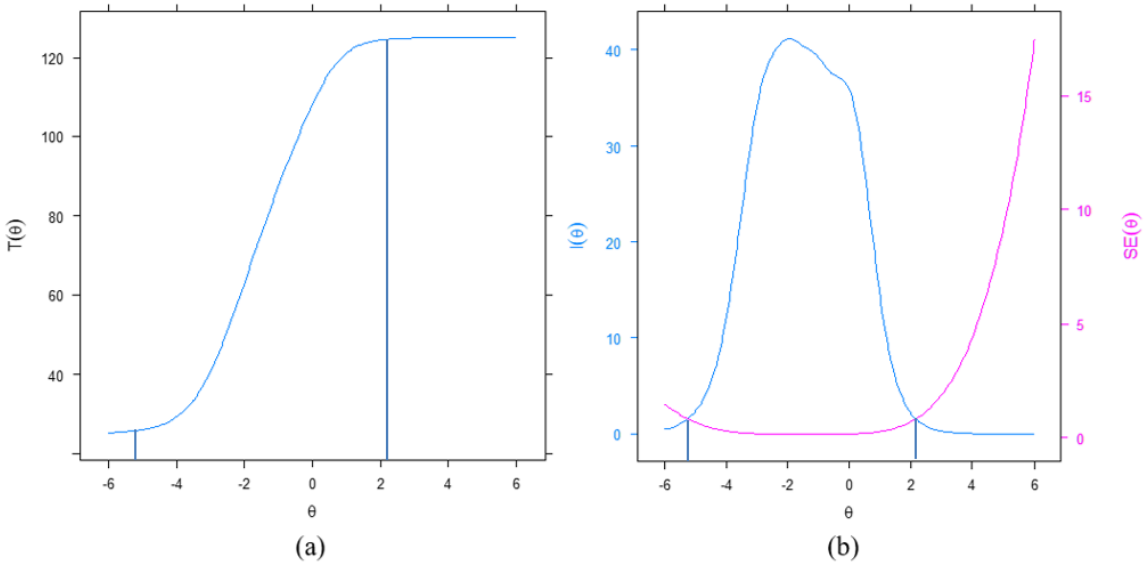
Source: Own author.

It can be demonstrated for each variable of the Instrument, by means of Figure 3, that the lower the perception of the worker (value of θ), in relation to the questioned item, the higher the probability of the respondent marking alternative 1 (never). As this perception improves, the probability of alternative 2 being ticked increases, and so on, so that the higher the worker's perception, the more likely the respondent is to tick alternative 5 (always). This characterizes a cumulative model, i.e., as the latent trait expands, the greater the amount of information acquired by the measuring instrument, which provides an increase in the probability of the employee marking a particular alternative.

Figures 4 (a) and (b) corroborate the diagnosis that the research tool is perfectly suited to IRT, given that the growth of the Instrument information grows with the latent trait and that this information covers a wide region of the latent trait evaluated, including items that measure the latent trait below and above the average perception. Such findings answer the last 2 questions related to the purpose of this paper ("*Is the IRT method a suitable technique to be applied in this research?*" and "*Can IRT verify the validation of the research instrument?*"), given that the expansion of information (probability of the employee marking a certain alternative) is proportional to the growth of the latent trait. This means that the more the company invests in management systems, in a simultaneous and

integrated way, the greater is the optimization of the organizational performance, from the understanding of its employees.

Figures 4 (a) and (b): Plots of Latent Trait (θ) x Expected Total Score T(θ) and Information I(θ) x Standardized Error SE(θ)



Source: Own author.

It is observed that in the region between -5.1 and 2.1 the model adds information (significant interval), demonstrating strong suitability of the questionnaire to measure the latent trait. Outside this range there is an increase in the SE(θ) error, this means that the measurement instrument loses information.

3.3.6 Anchorage of the Items and determination of the Level of Employee Perception

Table 3.7 shows how the anchoring of the response alternatives of the items of the Instrument was done, generating the scale of the latent trait. Each response alternative was anchored in a point of the scale from which its conditional probability was greater than 50% (Alvarenga et al., 2020; Silva et al., 2020). The anchoring resulted in six levels (10, 20, 30, 40, 50 and 60) already considering the linear transformation of the IRT parameters from the Normal scale (0±1) to the Normal scale (50±10) as described by Menegon *et al*., (2019) :

Table 7: Scale of the degrees of difficulty.

Systems	Anchor Levels					
	Minimal perception (10)	**Low perception (20)**	**Slight perception (30)**	**Moderate perception (40)**	**High Perception (50)**	**Maximum perception (60)**
QMS	Q1 (a2) Q4 (a2)	Q2 (a2) Q3 (a2) Q4 (a3) Q5 (a2) Q8 (a2) Q10 (a2)	Q1 (a3) Q2 (a3) Q3 (a3) Q5 (a3) Q6 (a2) Q7 (a2) Q9 (a2) Q10 (a3) Q11 (a2) Q12 (a2) Q13 (a2)	Q1 (a4) Q2 (a4) Q3 (a4) Q4 (a4) Q6 (a3) Q7 (a3) Q8 (a3) Q9 (a3) Q10 (a4) Q11 (a3) Q12 (a3) Q13 (a3)	Q1 (a5) Q2 (a5) Q3 (a5) Q4 (a4) Q6 (a4) Q7 (a4) Q8 (a4) Q9 (a4) Q10 (a5) Q11 (a4) Q12 (a4) Q13 (a4)	Q4 (a5) Q5 (a5) Q6 (a5) Q7 (a5) Q8 (a5) Q9 (a5) Q11 (a5) Q12 (a5) Q13 (a5)
EMS		Q14 (a2) Q15 (a2) Q16 (a2)	Q14 (a3) Q15 (a3) Q16 (a3) Q17 (a2) Q18 (a2) Q19 (a2) Q20 (a2 or a3)	Q14 (a4) Q15 (a4) Q16 (a4) Q17 (a3 or a4) Q18 (a3) Q19 (a3 or a4) Q20 (a4)	Q18 (a4) Q20 (a5)	Q14 (a5) Q15 (a5) Q16 (a5) Q17 (a5) Q18 (a5) Q19 (a5)
OHSMS		Q22 (a2) Q25 (a2)	Q21 (a2) Q22 (a3) Q23 (a2 or a3) Q24 (a2) Q25 (a3)	Q21 (a3) Q22 (a4) Q23 (a4) Q24 (a3 or a4) Q25 (a4)	Q21 (a4) Q22 (a5) Q23 (a5) Q25 (a5)	Q21 (a5) Q24 (a5)

Source: Own author.

The scale allows us to interpret the scores of individuals at each level (a1 = I never perceive, which is the reference value; a2 = I perceive a few times; a3 = I perceive a sometimes; a4 = I perceive often; and a5 = I always perceive). Since this scale comes from a cumulative model, it is expected that a worker with minimal perception (level 10) will mark the lowest answer options, being 'I perceive a few times' (a2) for items Q1 and Q4 and 'never perceive' for all other items. As the level of perception improves (level 20, for example), the employee is expected to mark the alternative 'I perceive a few times' (a2) for more items (Q2, Q3, Q4, for example). At the highest level of perception (level 60) employees tick the response alternative 'always perceive' (a5) for all items.

Table 8 shows the proportion of employees relative to their respective perceptions of the impacts of IMS on the company's organizational performance:

Table 8: Proportion x Perception

Latent Trait	Respondents	Percentage
Minimal perception	2	0,4%
Low perception	10	2,1%
Slight perception	45	9,3%
Moderate perception	194	40,0%
High Perception	165	34,0%
Maximum perception	69	14,2%
Total	**485**	**100,0%**

Source: Own author.

It can be observed that the expressive majority of the respondents (359 employees, 74%) have a moderate to high perception, which is quite significant for the organization's performance. The professionals who have the highest perception (69 employees, 14.2%) are those who have been with the company the longest or are from top management.

3.4 CONCLUSIONS

The metrics development to quantify and evaluate the integrated management system of companies has proven to be a relevant topic (Mariouryad et al., 2015). However, the scarcity of studies that measure the impacts of different management systems based on the perception of stakeholders ends up hindering decisions by the organizations' managers.

To the knowledge of the authors of this article, this is the first to propose and validate a measurement instrument to assess, by means of a scale generated by robust psychometric methods, the multidimensional perception of workers regarding the impacts promoted by integrated management systems (QMS, EMS and OHSMS) on organizational performance, when conducted simultaneously and in an integrated manner.

The questionnaire was designed (proposed) by means of a comprehensive SLR on IMS (Barbosa *et al*., 2021), from which resulted 25 observable variables (see Table 1) constituted on a 5-level *Likert-type* scale. The experts validated the Instrument's content, reaching parameters of clarity, coherence, and relevance higher than 90%. Likewise, in the pilot study and in the full survey, the validity parameters were all satisfactory.

The instrument was analyzed in its dimensionality through Parallel Analysis and Factor Analysis, which found a preponderant dimension that indicates the evaluation of the latent trait (perception of IMS workers) in a unidimensional way, sufficient condition to explain the data

collection tool, according to Figure 2 and Table 5. Therefore, the QMS, EMS and OHSMS behave as "facets" of the IMS, not requiring the use of multidimensional IRT models.

With the help of the IRT method it was possible to validate the Instrument, while determining the discrimination level of the items and the degree of difficulty of each response alternative of the *Likert* scale. Therefore, IRT added information regarding the aspects of each variable, distinguishing those that best discriminate the levels of perception of employees regarding the impacts on organizational performance. The recognition of the parameters of difficulty made it possible to situate each response alternative of an item on a scale with an interpretive model that demonstrates how much perception an employee should have to mark a given response alternative, given that the latent trait (θ) and the level of difficulty of the response alternative *k* of item *i* (b_{ik}) are in the same unit of measurement and are therefore easily comparable.

The information and expected total score curves, Figures 4 (a) and (b), indicate that the latent trait fits well to the cumulative model and that the information covers the different latent trait values, validating the Instruments. Validations of latent traits using this same procedure can be analyzed in the studies by Menegon *et al*. (2017 , 2019), Alvarenga *et al.* (2020) and Silva *et al*. (2020b) .

The anchoring process allowed the identification of response patterns, something that brings one of the great differentials of IRT models in relation to traditional models coming from the Classical Theory of Testing (Gorter *et al*., 2015) . Therefore, six levels were identified in which some findings can be identified. At level 10 (minimal perception of IMS impacts) workers respond 'I perceive a few times' (a2) that there is a commitment from the organization to improve products, services and processes (Q1); and that there is a policy to reduce organizational costs (Q4). For the other items, workers at this level reported that they 'never perceived' (a1) any action taken by the organization studied.

At level 20 (low perception of IMS impacts) workers reported 'sometimes perceive' (a3) for item Q4; and now report 'perceive a few times' (a2) that the company is aware of quality (Q2); that the organization uses procedures to correct quality problems (Q3); that searches for information so don`t commit failures (Q5); that optimizes time to guarantee quality (Q8); and that it has a management committed to quality (Q10). They also report 'perceiving a few times' that the organization seeks a culture of sustainable development (Q14), that it has a commitment to social responsibility (Q15), and that it has a policy structured on environmental education (Q16). Similarly, there is a 'perception of a few times' for the provision of accident prevention measures (Q22) and that one is satisfied with the working hours (Q25). For the other items the perception is that they 'have never perceived' (a1) any action on the part of the Organization studied.

At level 30 (slight perception of the impacts of the IMS), the workers began to answer that they 'perceive sometimes' (a3) the already mentioned items Q1, Q2, Q3, Q5, Q10, Q14, Q15, Q16,

Q22, and Q25, which indicates an improvement in these items. Also workers start to report 'perceive a few times' (a2) to the occurrence of training and qualification of labor (Q6); that a standardization management occurs (Q7); that there is a strategic planning (Q9); that there are internal and external audits (Q11); that there is good communication (Q12); that the physical structure is optimized (Q13) that the organization improves environmental protection and the work environment (Q17); that it is concerned about climate change (Q18); and that it strives to reduce waste generation (Q19); that it is concerned about employee satisfaction (Q21); and about quality of life at work (Q24). Still in these levels are the workers who answered 'perceive a few times' (a2) or 'perceive a few times' (a2) or 'perceive a sometimes' (a3) that the company is concerned with health and safety at work (Q20); and that the work environment is healthy or salubrious (Q23). For the other items (Q4 and Q8), the workers answered 'perceive it a few times' (a2).

At level 40 (moderate perception of IMS impacts) the self-report of workers' responses associated with 'perceive sometimes' increases (a3) for many items (Q6, Q7, Q8, Q9, Q11, Q12, Q13, Q18 and Q21). Also appearing are the first responses 'perceive often' (a4) for several items (Q1, Q2, Q3, Q4, Q10, Q14, Q15, Q16, Q20, Q22, Q23, and Q25). On the same level are the workers who reported 'perceive sometimes' (a3) and 'perceive often' (a4) for items Q17, Q19, and Q24. Respecting the cumulative model, item Q5 was answered at this level with 'perceived sometimes' (a3). Thus, there is a tendency for an overall improvement of responses already at this level of the scale.

At level 50 (high perception of IMS impacts), the answers 'always perceive' (a5) in items Q1, Q2, Q3, Q10, Q20, Q22, Q23 and Q24 appear; and answers in the other items are 'perceive often' (a4). In other words, at this level of the scale the workers already perceive the impacts of the IMS on the three systems evaluated.

At level 60 (maximum perception of the impacts of the IMS) all items are now answered as 'always perceive' (a5). However, items Q4, Q5, Q6, Q7, Q8, Q9, Q11, Q12 and Q13 associated with the QMS; items Q14, Q15, Q16, Q17, Q18 and Q19 associated with the EMS; and items Q21 and Q24 associated with the OHSMS are only fully perceived at this level of the scale, something that demonstrates the difficulty of having workers at this level. Only stakeholders who have been with the company longer or are from top management are here.

In summary, 74% of the sample have a moderate to high perception of the impacts of IMS (Table 8). The closer the sample population is to level 60, the greater their perception of these impacts. It can be considered then that the company's performance with regard to IMS impacts is effective for most workers.

It is noteworthy that the application of IRT in this study was relevant to validate the measurement instrument, since it has enabled the appreciation of the item quality and the development of a measurement scale with the recognition of anchor levels for the perception of the impacts of the

IMS in organizational performance. It also made it possible to obtain more information from the workers' answers, since it considers the probability of the employee marking a certain alternative and his or her answer pattern.

It was concluded that the Instrument devised by this article is able to measure the perception of employees regarding the impact of IMS, being composed of items from QMS, EMS and OHSMS. Therefore, the perception of IMS proved to be a "multifaceted" phenomenon as it involves the contribution of three management systems. The 25 items of the instrument showed satisfactory psychometric properties, as good ability to discriminate employees with different levels of perception and with increasing difficulty according to the response alternative that demanded more perception (or latent trait).

Through IRT parameters a six-level scale was generated evaluating the latent trait from 'minimal perception of IMS impact' to 'maximum perception of IMS impact'. At minimum perception (level 10) employees rarely perceive organizational commitment to quality improvement and cost reduction. At moderate perception (level 40) the aspects associated with quality, environmental management and health and safety are much more visible to employees. In the maximum perception (level 60) all aspects associated with IMS are widely perceived, resulting in relevant positive impacts for the organization.

The scale can contribute to future research associated with measuring the impact of other companies' IMS, even if items are removed from or added to the Instrument, as long as common items are kept. This phenomenon is possible because in IRT methods the important thing is not the totality of the instruments, but the items themselves.

Helping companies understand the elements that form their perception of IMS is important, as it assists companies in developing strategies that seek to improve the impact of management systems on the organization as a whole. Therefore, improving employees' perception of IM and its positive impacts is not only important, but also necessary.

4 ARTICLE III – INTEGRATED MANAGEMENT SYSTEMS AND ORGANIZATIONAL PERFORMANCE: A MULTIDIMENSIONAL PERSPECTIVE

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4.1 INTRODUCTION

The Integrated Management System (IMS) is an important management mechanism for companies today, being responsible for the integration of processes, sectors of the organization and management systems, such as: Quality Management System (QMS), according to ISO 9001; Environmental Management System (EMS), according to ISO 14001; and Occupational Health and Safety Management System (OHSMS), according to ISO 45001 / BS OSHAS 18001; between others (Hamidi et al., 2012; Majerník et al., 2017).

These management models (ISO 9001, ISO 14001 and OHSAS 18001) requires organizations to develop policies, establish roles and responsibilities, designate management representatives and manage processes (Von Ahsen & Funck, 2001). To meet these premises, each management system needs a large amount of documentation, written procedures, checking, control forms and other documents.(Karapetrovic & Jonker, 2003).

In this sense and realizing the complexity of coordinating the 3 main management systems (QMS, EMS and OHSMS) individually and in parallel to meet the requirements of ISO standards and align them with the organizational strategy, several companies are adopting the integrated systems management method that has the role of unifying the quality, environmental management and occupational health and safety processes making the implementation of policies, objectives, procedures and practices more efficient than through individual management systems for each process of the organization (Zeng et al., 2007).

Through research by Poltronieri, Gerolamo and Carpinetti (2017), Muthusamy, Palanisamy and Mohanraj (2018) it was realized that the studies deal with the advantages, the levels and the maturity of the integration of the management systems in a qualitative way. However, no models were found to measure, simultaneously and quantitatively, through a statistical model of multivariate

analysis, the impacts stimulated by the integration of the 3 management systems, the theme of this study, through the multidimensional perspective of the perception of its employees.

Part of what was located, as shown by research by Abisourour et al. (2020), by Trierweiller et al. (2016), by Poltronieri et al. (2018) and by Tepaskoualos and Chountalas (2017), point out, respectively, the benefits and difficulties of integration, as well as their maturity and levels of integration. And in this case of the levels of integration, the result found boils down to verifying whether or not the systems are, partially or completely, integrated.

In a long and continuous way, the implementation of IMS is a proposal that presents several types of problems and prior knowledge of these possible problems (such as the duplication of efforts in terms of documentation, forms and control procedures and the difficulty of guaranteeing the alignment of the strategy in all the different systems) can be extremely important to adopt preventive actions or even to define more appropriate procedures. It's expensive and prolonged due to the complexity of the company's processes and operations, its size and the project to be implemented (Holdsworth, 2003; Ionescu et al., 2018).

Therefore, observing the research gap, a hypothesis to measure the impacts on the organizational performance of a large company, stimulated by the implementation of management systems, when practiced in a simultaneous and integrated way, is the adoption of a statistical methodology of Multivariate Analysis.

Starting also from the perception of the gap, the main objective of this article was to measure the impacts of the management systems (QMS, EMS and OHSMS) when practiced synchronously and integrated in the organizational performance of a large company through the perception of its workers to validate a theoretical model.

4.2 METHODOLOGICAL PROCEDURE

All stages of this study were previously approved by the research ethics committee of the Federal University of Paraíba under the number CAAE: 37320620.8.0000.5185. In order to present a methodology that measures the level of impacts that each of the management systems (QMS, EMS and OHSMS), a survey was carried out by conducting a questionnaire to verify the multidimensional perception of employees in relation to the impacts provided by the integration of these systems and, finally, to validate a model that explains how the relationship between the perception of management systems and the IMS occurs.

4.2.1 Construction of the Research Instrument

The data collection instrument was developed through a consistent Systematic Literature Review (SLR) carried out by Barbosa et al. (2021) (Table 1), which aimed to diagnose the aspects and parameters that sensitize the perception of workers on the impacts on the organizational performance of a large company promoted by the simultaneous and integrated management of the QMS, EMS and OHSMS systems, resulting in a research tool with 25 items with five answer alternatives.

In this way, we sought to formulate items that capture the perception of workers about basic elements of the QMS, such as, for example, the company's image, the quality of goods and services, the stakeholder satisfaction, organizational competitiveness, operational performance, organizational costs, business risk control, training optimization, labor qualification, bureaucracy, redundant activities, management standardization, optimization time, strategic planning, decision making, audit optimization, communication and optimization of the organizational structure; basic elements of the EMS, such as the company's culture, social responsibility, sustainable development, organizational policy, environmental protection and waste reduction; and basic elements of the OHSMS, such as, for example, the reduction of the risk of accidents at work, the work environment and employee satisfaction.

The instrument for collecting the information was structured in an electronic form called Google Form, which was of obvious value in the appreciation of the research components, since it made it impossible to fill out the wrong answer or the absence of answers.

Table 1 - Summary of the findings of the systematic literature review.

System	Positive impacts identified	Idealized items	References
QMS	Improve the company's image	1. In your perception, is there an organization's commitment to improving the quality of products, services and processes visible in daily work, valuing the company's image?	(Bernardo et al., 2015; Blasco-Torregrosa et al., 2019; Nunhes et al., 2017; M. Rebelo et al., 2014; Salomone, 2008; Sampaio et al., 2012; G. Santos et al., 2011; G. Santos & Carvalho, 2019)
	Improve the quality of goods and services		(Bernardo et al., 2015; Bevilacqua et al., 2016; Drożyner, 2020; Fresner & Engelhardt, 2004; López-Fresno, 2010; Majerník et al., 2017; Manzanera et al., 2014; Moumen & El Aoufir, 2017; Nunhes et al., 2017; M. F. Rebelo et al., 2014; Sampaio et al., 2012; G. Santos & Carvalho, 2019)
	Improve stakeholder satisfaction	2. In your perception, is there a quality awareness process developed by the organization known to all involved, satisfying the interested parties?	(Algheriani et al., 2019; Alvarado Rueda & Perez Gomez, 2016; Asif et al., 2009; L. C. F. M. Barbosa et al., 2018; Bernardo et al., 2015; F. Carvalho et al., 2019; Casadesús et al., 2011; Dahlin & Isaksson, 2017; Dragomir et al., 2017; Drożyner, 2020; Fresner & Engelhardt, 2004; Holdsworth, 2003; Muhammad Ikram et al., 2020; Ionescu et al., 2018; Jaroenroy & Chompunth, 2019; Jørgensen et al., 2006; Karapetrovic & Jonker, 2003; Kruse et al., 2019; López-Fresno, 2010; Manzanera et al., 2014; Marinkovic et al., 2016; M. Rebelo et al., 2014, 2015; M. F. Rebelo et al., 2016; Siva et al., 2016; Zeng et al., 2006, 2007)
	Increase organizational competitiveness	3. In your perception, does the organization use procedures to correct possible problems in goods, services and / or work processes, improving operational performance and increasing the company's competitiveness?	(Alvarado Rueda & Perez Gomez, 2016; Bernardo et al., 2015; Chan et al., 1998; De Oliveira, 2013; Escorcia et al., 2018; Jørgensen et al., 2006; Majerník et al., 2017; Manzanera et al., 2014; Muthusamy et al., 2018; M. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Zeng et al., 2011)
	Improve operational performance		(Jesús Abad et al., 2013; Abisourour et al., 2020; Algheriani et al., 2019; Alvarado Rueda & Perez Gomez, 2016; Bąk & Nowak, 2019; L. C. F. M. Barbosa et al., 2018; Beckmerhagen et al., 2003; Bernardo et al., 2009, 2012, 2015; Biniecka et al., 2005; Casadesús et al., 2011; Chaudhuri & Jayaram, 2019; Ćwiklicki et al., 2019; Dahlin & Isaksson, 2017; De Oliveira, 2013; Hamidi et al., 2012; Hernandez-Vivanco et al., 2019; M. Ikram et al., 2019; Muhammad Ikram et al., 2020; Jaroenroy & Chompunth, 2019; Jørgensen et al., 2006; Karapetrovic & Casadesús, 2009; Llonch et al., 2018; Majerník et al., 2017; Moumen & Elaoufir, 2018; Muthusamy et al., 2018; Nunhes et al., 2017, 2019; Ramos et al., 2020; M. Rebelo et al., 2015; M. F. Rebelo et al., 2014, 2016; Savino & Shafiq, 2018; Simon, Karapetrovic, & Casadess, 2012; Simon & Douglas, 2013; Sui et al., 2018; Vulanovic et al., 2020; Walker & McAleer, 2014; Yazdani & Wells, 2012; Zeng et al., 2011)
	Reduction of organizational costs	4. In your opinion, is there a policy of reducing organizational costs in the company?	(Abisourour et al., 2020; Asif et al., 2009; Bąk & Nowak, 2019; Beckmerhagen et al., 2003; Bernardo et al., 2015; Biniecka et al., 2005; Casadesús et al., 2011; Dahlin & Isaksson, 2017; J. P. T. Domingues et al., 2015; Escorcia et al., 2018; Fresner & Engelhardt, 2004; Llonch et al., 2018; López-Fresno, 2010; Milliman et al., 2005; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Muthu Samy et al., 2015; Muthusamy et al., 2018; Nadae et al., 2019; Ofori et al., 2002; Pheng & Kwang, 2005; Camila Fabricio Poltronieri et al., 2018; M. Rebelo et al., 2014; Ribeiro et al., 2017; Salomone, 2008; G. Santos et al., 2011; Simon et al., 2013; Souza & Alves, 2018; Tepaskoualos & Chountalas, 2017; Wright, 2000; York & Miree, 2004; Zaloga et al., 2019; Zeng et al., 2011)
	Business risk control	5. In your perception, in order to make decisions, does the organization seek all available information so as not to make a mistake, controlling business risks?	(Algheriani et al., 2019; Azadeh et al., 2012; Blasco-Torregrosa et al., 2019; Holdsworth, 2003; Muhammad Ikram et al., 2020; Labodová, 2004; Masuin & Latief, 2019; Milliman et al., 2005; Ramos et al., 2020; M. Rebelo et al., 2015; M. F. Rebelo et al., 2014; Sampaio et al., 2012; Simon, Karapetrovic, & Casadesus, 2012)
	Training optimization	6. In your perception, does the organization optimize training courses, adapting them to the needs of employees in order to qualify the workforce?	(Abouettahir et al., 2013b; Berezyuk et al., 2017; P. Domingues et al., 2017; Labodová, 2004; Nunhes et al., 2017; G. Santos et al., 2011; G. Santos & Carvalho, 2019; Yazdani & Wells, 2012; Zeng et al., 2007)

	Qualification of labor		(Blasco-Torregrosa et al., 2019; Karapetrovic & Jonker, 2003; Manzanera et al., 2014; Sampaio et al., 2012; G. Santos & Carvalho, 2019; Zeng et al., 2006, 2007)
	Reduction of bureaucracy	7. In your perception, is there a standardized management in the organization, aiming at reducing redundant activities and bureaucracy?	(Beckmerhagen et al., 2003; Bernardo et al., 2009, 2015; del Prado Martínez & Navarro, 2016; Holdsworth, 2003; Muhammad Ikram et al., 2020; Mora-Contreras, 2019; Muthu Samy et al., 2015; Nunhes et al., 2017; Ribeiro et al., 2017; Simon, Karapetrovic, & Casadesus, 2012; Souza & Alves, 2018; Vulanovic et al., 2020; Zeng et al., 2011)
	Reduction of redundant activities		(Bąk & Nowak, 2019; J. P. T. Domingues et al., 2015; Muhammad Ikram et al., 2020; Camila Fabrício Poltronieri et al., 2017; G. Santos & Carvalho, 2019; Souza & Alves, 2018; Trierweiller et al., 2016)
	Management standardization		(Muhammad Ikram et al., 2020; Nunhes et al., 2019; Ribeiro et al., 2017; G. Santos & Carvalho, 2019; Simon & Douglas, 2013)
	Time optimization	8. In your perception, is there an optimization of time to guarantee the quality of the goods / services offered?	(Bernardo et al., 2015; Blasco-Torregrosa et al., 2019; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; Sampaio et al., 2012; Simon et al., 2013)
	Improve strategic planning	9. In your perception, is there a strategic planning in the organization?	(Jesus Abad et al., 2016; Algheriani et al., 2019; Blasco-Torregrosa et al., 2019; Holdsworth, 2003; Luo et al., 2015; Nunhes et al., 2019; Sampaio et al., 2012; G. Santos & Carvalho, 2019; Trierweiller et al., 2016)
	Improve decision making	10. In your perception, does your organization's management (directors, managers, supervisors and other senior management positions) demonstrate a commitment to quality in its decisions?	(Azadeh et al., 2012; Blasco-Torregrosa et al., 2019; Gapp et al., 2008; Muhammad Ikram et al., 2020; Nunhes et al., 2017; Camila Fabrício Poltronieri et al., 2017; M. Rebelo et al., 2015; G. Santos & Carvalho, 2019; Zaloga et al., 2019; Zeng et al., 2011)
	Audit optimization	11. In your perception, are there audits (internal or external) in the organization?	(Beckmerhagen et al., 2003; Blasco-Torregrosa et al., 2019; J. P. T. Domingues et al., 2015; Dragomir et al., 2017; Jaroenroy & Chompunth, 2019; Laal et al., 2019; Nunhes et al., 2017; M. F. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Savino & Mazza, 2014; Simon et al., 2011; Simon, Karapetrovic, & Casadesus, 2012; Wright, 2000; Zeng et al., 2011)
	Improve communication	12. In your perception, is there good communication within the organization?	(Jesus Abad et al., 2016; Asif et al., 2013; Blasco-Torregrosa et al., 2019; F. Carvalho et al., 2020; del Prado Martínez & Navarro, 2016; J. P. T. Domingues et al., 2015; Dragomir et al., 2017; El Yacoubi El Idrissi et al., 2014; López-Fresno, 2010; Nunhes et al., 2017; M. Rebelo et al., 2014; G. Santos & Carvalho, 2019; Simon, Karapetrovic, & Casadesus, 2012)
	Optimization of the organizational structure	13. In your perception, is there an optimization of the organization's physical structure?	(Alvarado Rueda & Perez Gomez, 2016; Chountalas & Tepaskoualos, 2019; Gapp et al., 2008; Kruse et al., 2019; Pheng & Kwang, 2005; G. Santos et al., 2011; G. Santos & Carvalho, 2019; Souza & Alves, 2018; Sui et al., 2018; Zeng et al., 2007, 2006)
EMS	Changing the culture of the company	14. In your perception, is there a culture of sustainable development formally inserted in the organization's strategy?	(Alvarado Rueda & Perez Gomez, 2016; Biniecka et al., 2005; Gianni & Gotzamani, 2015; Holdsworth, 2003; Holm et al., 2015; Jørgensen et al., 2006; Ramos et al., 2020; Taylor, 2002; Wright, 2000; Zeng et al., 2007, 2006)
	Improving social responsibility	15. In your perception, is there an organization's commitment to social responsibility?	(Asif et al., 2013; Bevilacqua et al., 2016; Botta et al., 2013; F. Carvalho et al., 2020; Fresner & Engelhardt, 2004; M. Ikram et al., 2019; Ionescu et al., 2018; Karapetrovic & Jonker, 2003; Mežinska et al., 2015; Camila Fabricio Poltronieri et al., 2018; M. Rebelo et al., 2014; von Ahsen, 2014)
	Sustainable development	16. In your perception, is there a structured organizational policy for environmental education?	(Abouettahir et al., 2013a, 2013b; Bernardo et al., 2015; F. Carvalho et al., 2020; Chaudhuri & Jayaram, 2019; de Nadae & de Carvalho, 2019; De Oliveira, 2013; Drożyner, 2020; Fonseca & Carvalho, 2019; Fresner & Engelhardt, 2004; Holm et al., 2015; M. Ikram et al., 2019; Jørgensen et al., 2006; Mežinska et al., 2015; Muhamad Khair et al., 2018; Muthu Samy et al., 2015; Muthusamy et al., 2018; Nadae et al., 2019; Ofori et al., 2002; Camila Fabricio Poltronieri et al., 2018; Camila Fabrício Poltronieri et al., 2017; M. Rebelo et al., 2014,

			2015; M. F. Rebelo et al., 2014, 2016; Savino & Shafiq, 2018; Simon, Karapetrovic, & Casadess, 2012; Siva et al., 2016; Souza & Alves, 2018; Zeng et al., 2011)
	Organizational Policy	17. In your perception, does the organization proactively contribute to environmental protection and improvement of the work environment?	(Abisourour et al., 2020; P. Domingues et al., 2017; El Yacoubi El Idrissi et al., 2014; Muhamad Khair et al., 2018; Ofori et al., 2002; Pheng & Pong, 2003; G. Santos & Carvalho, 2019)
	Environmental Protection	18. In your perception, does the organization consider adapting to climate change in the design of its ventures, processes, products and services?	(Bąk & Nowak, 2019; Berezyuk et al., 2017; Blasco-Torregrosa et al., 2019; Botta et al., 2013; Gangolells et al., 2013; Jaroenroy & Chompunth, 2019; Kruse et al., 2019; Labodová, 2004; Mariouryad et al., 2015; Milliman et al., 2005; Pheng & Kwang, 2005; G. Santos & Carvalho, 2019; von Ahsen, 2014)
	Waste reduction	19. In your perception, is the organization concerned with reducing the amount of solid waste generated?	(Biniecka et al., 2005; Fresner & Engelhardt, 2004; Ramos et al., 2020; M. F. Rebelo et al., 2014; G. Santos & Carvalho, 2019)
OHSMS	Reducing the risk of accidents at work	20. In your perception, does the organization care about your health and safety? 22. In your perception, does the organization offer preventive measures to prevent accidents at work?	(Jesús Abad et al., 2013; Abouettahir et al., 2013a; Al-Darrab et al., 2013; Bąk & Nowak, 2019; Bevilacqua et al., 2016; Fresner & Engelhardt, 2004; Gangolells et al., 2013; Hamidi et al., 2012; Jain A., Aswar N., Kale K., 2016; Jaroenroy & Chompunth, 2019; Kruse et al., 2019; Laal et al., 2019; Labodová, 2004; Mariouryad et al., 2015; Milliman et al., 2005; Pheng & Kwang, 2005; Ramos et al., 2020; Yazdani & Wells, 2012)
	Improve the work environment	23. In your perception, is the working environment in your organization healthy? 24. In your perception, is there a quality of life in the work environment?	(Bevilacqua et al., 2016; Biniecka et al., 2005; Casadesús et al., 2011; Jain A., Aswar N., Kale K., 2016; Labodová, 2004; Marinkovic et al., 2016; Moumen & El Aoufir, 2017; Moumen & Elaoufir, 2018; G. Santos & Carvalho, 2019; A. L. I. F. Silva et al., 2020; Siva et al., 2016; Zeng et al., 2006, 2007)
	Improve employee satisfaction	21. In your perception, does the organization provide quality of life in the work environment, increasing employee satisfaction? 25. In your perception, are you satisfied with your workday?	(Bernardo et al., 2015; Fresner & Engelhardt, 2004; M. Ikram et al., 2019; Ionescu et al., 2018; López-Fresno, 2010; Manzanera et al., 2014; Moumen & El Aoufir, 2017; Muthu Samy et al., 2015; Muthusamy et al., 2018; Ramos et al., 2020; M. Rebelo et al., 2014)

Source: Barbosa et al. (2021).

4.2.2. Content analysis

After the composition of the questionnaire's observable variables, a content analysis was implemented to interpret its relevance and representativeness with regard to the design of the research instrument. The theoretical analysis included a semantic verification carried out by the researchers and a specialized investigation carried out by qualified professionals.

The semantic analysis investigated the adequate understanding of the items for the individuals, generating indications of the effectiveness of the questionnaire content. The experts 'assessment was carried out by 3 qualified managers, responsible for each of the management systems (QMS, EMS, OHSMS), who investigated whether the observable variables were relevant and representative, instigating the employees' perception. The methodology used was the Hernandez-Nieto (2002) Content Validity Coefficient (CVC) technique, which found the clarity, coherence and relevance of the observable variables of the data collection instrument. Also in this phase, the distribution of the responses of the Instrument items and their adjustment to the one-dimensional model was analyzed using the Factor Analysis technique.

4.2.3 Pilot study

The next procedure was to conduct a pilot test with the expectation of estimating the consistency and reliability of the research tool. To this end, a random sample of 106 employees was assigned, out of 850 workers in the company, which corresponds to 12.47%, to answer the pilot questionnaire. *Cronbach's Alpha* coefficient was the test used to verify the reliability of the data collected through the Research Instrument.

4.2.4 Sample surveyed

The instrument was answered by 485 workers, which accounts for 57.06% of the organization's total employees. The internal consistency and reliability of the data was verified using *Cronbach's Alpha* and *McDonald's Omega* coefficients. In addition, the characterization of the sample was carried out, in which information about sex, age, time in the company, state of the federation in which it works, sector of the company, position held, level of education and workload were collected.

4.2.5 Assessment of the Dimensionality of the Instrument

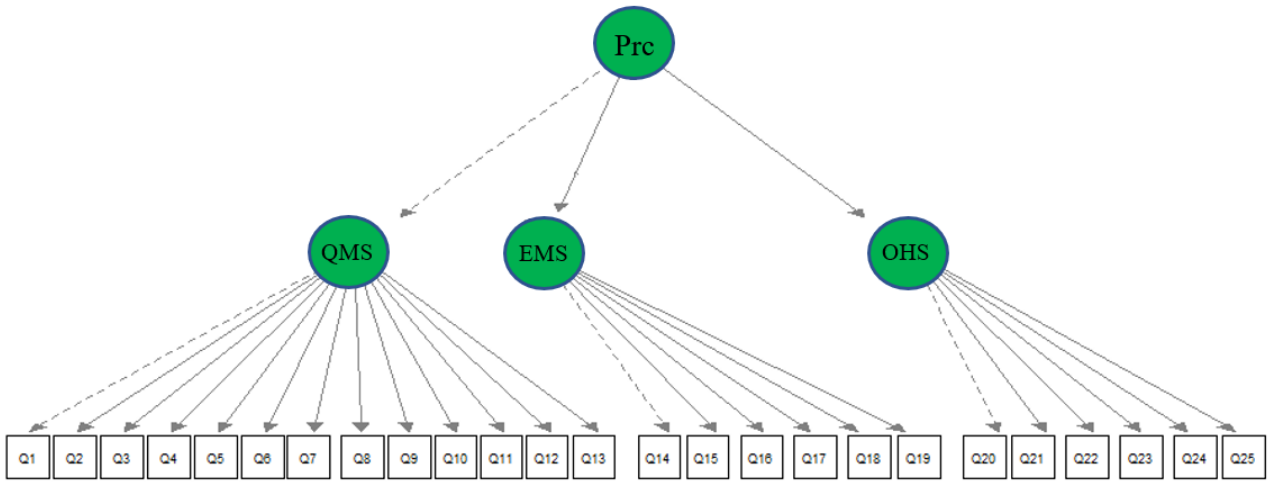
Cluster Analysis methods (CA), Factorial Analysis (FA) of Full Information and Parallel Analysis (PA) were used to search for indications of the instrument's dimensionality. The CA method was applied using the "*Ward*" connection method, with a "*Correlation*" spacing measure and specification of the final partition in "*3 clusters*". The number of clusters is based on the most usual number of systems that make up the IMS. The dendrogram sought to verify the positioning of the items in the clusters.

Bartlett and Kaiser-Meyer-Olkin (KMO) sphericity test, on the other hand, preceded FA. After ensuring the assumptions for the use of PA, we sought to extract from it the value of the Factor Loads (F) and Communality (h2) associated with the items. For a better understanding of how the information of the items of the Instrument is distributed, the PA graph was constructed in which it was verified how much information there is in each eigenvalue associated with the probable dimensions of the Instrument.

4.2.6 Construction of the Theoretical Model of the Integrated Management System

Based on literature findings (Table 1) the following second order Structural Equation Model (SEM) was theorized (Figure 1). The composition of the items that form the QMS, EMS and OHSMS dimensions or the theoretical basis that supports the positioning of each item has already been presented in topic 2.1 of this article. It is theorized, therefore, that the perception of workers is intrinsically associated with the perception of other systems (QMS, EMS, OHSMS), being a latent trait of second order, according to reviews by authors such as Barbosa et al.(2021). The results of multivariate statistical analyzes, such as Cluster Analysis, Factor Analysis and the Parallel Analysis graph were used to generate support for the theoretical model.

Figure 1 - Theoretical model for the perception of IMS by workers.



Caption: Prc is the workers' perception of the IMS; and OHS refers to OHSMS.

Source: Author himself.

To validate the SEM, the relationship between the chi-square value and the degrees of freedom of the model (χ^2/df), the comparative fit index (CFI), the Tucker-Lewis index (TLI), the square root mean of the approximation error (RMSEA) and the standardized residual mean square root (SRMR).

4.3 RESULTS

4.3.1 Findings of content analysis

Table 2 presents the results of the content analysis, in which it is possible to observe that the parameters presented satisfactory values in terms of clarity, coherence and relevance. The response alternatives 'always' and 'almost always' were the most pointed out by the workers, regardless of the evaluated system, indicating that the company seems to contribute so that the workers perceive the impact of the IMS. In all systems, *Cronbach's Alpha* value was greater than 0.900, a very good result. It is also possible to observe the good fit of the items in a single dimension, with high Factor Loads (F) and Communalities (h2) values, suggesting evidence of unidimensionality for the Instrument.

4.3.2 Considerations for the pilot study

The pilot study, in its majority, was formed by workers male, aged between 26 and 30 years, with length of service and current position between 1 and 4 years and with average technical and higher education levels. The internal consistency of the data collected in the pilot study was ensured by the value of *Cronbach's Alpha* which was equal to 0.977.

4.3.3 Research findings

Most of the respondents are male, aged between 22 and 25 years, with a length of service and current position between 1 and 4 years and with an average level of technical instruction. Values of internal consistency and reliability were calculated in which a value of *Cronbach's Alpha* equal to 0.964 and *McDonald's Omega* equal to 0.970 was observed.

Table 2: Preliminary statistical results.

Item	Discrimination	Content Validation (ε = 0.04)			IMS	Answers (%)					*Cronbach*'α (0.964)	Questionnaire Validation (one-dimensional)	
		Clarity (0.94)	Coherence (0.94)	Relevance (0.95)		Never	few times	sometimes	oftentimes	ever		F	h2
Q1	In your perception, is there an organization's commitment to improving the quality of products, services and processes visible in daily work, valuing the company's image?	1.00	1.00	1.00		0.2	1.9	7.0	28.4	62.5		0.795	0.631
Q2	In your perception, is there a quality awareness process developed by the organization known to all involved, satisfying the interested parties?	1.00	1.00	1.00		0.8	2.7	10.1	35.9	50.5		0.792	0.628
Q3	In your perception, does the organization use procedures to correct possible problems in goods, services and / or work processes, improving operational performance and increasing the company's competitiveness?	1.00	1.00	1.00		0.4	2.5	12.0	34.0	51.1		0.814	0.663
Q4	In your opinion, is there a policy of reducing organizational costs in the company?	1.00	1.00	1.00		0.8	1.9	18.6	41.8	36.9		0.551	0.303
Q5	In your perception, in order to make decisions, does the organization seek all available information so as not to commit mistakes, controlling business risks?	1.00	1.00	1.00		1.0	3.5	16.1	34.0	45.4		0.793	0.628
Q6	In your perception, does the organization optimize training courses, adapting them to the needs of employees in order to qualify the workforce?	1.00	1.00	1.00	**QMS**	2.9	7.8	14.6	36.1	38.6	**0.935**	0.806	0.649
Q7	In your perception, is there a standardized management in the organization, aiming at the reduction of redundant activities and bureaucracy?	0.93	1.00	0.87		2.1	8.0	19.6	40.2	30.1		0.820	0.672
Q8	In your perception, is there an optimization of time to guarantee the quality of the goods / services offered?	1.00	0.80	1.00		0.8	4.9	14.6	39.9	39.8		0.841	0.708
Q9	In your perception, is there a strategic planning in the organization?	1.00	1.00	1.00		1.4	3.5	15.3	38.6	41.2		0.843	0.710
Q10	In your perception, does your organization's management (directors, managers, supervisors and other senior management positions) demonstrate a commitment to quality in its decisions?	1.00	1.00	1.00		0.8	3.3	5.6	29.3	61.0		0.832	0.692
Q11	In your perception, are there audits (internal or external) in the organization?	1.00	1.00	1.00		4.9	7.8	24.3	34.8	28.2		0.746	0.556
Q12	In your perception, is there good communication within the organization?	1.00	1.00	1.00		1.6	6.0	16.3	36.7	39.4		0.785	0.616
Q13	In your perception, is there an optimization of the organization's physical structure?	1.00	1.00	0.80		1.9	4.1	17.7	41.7	34.6		0.805	0.648

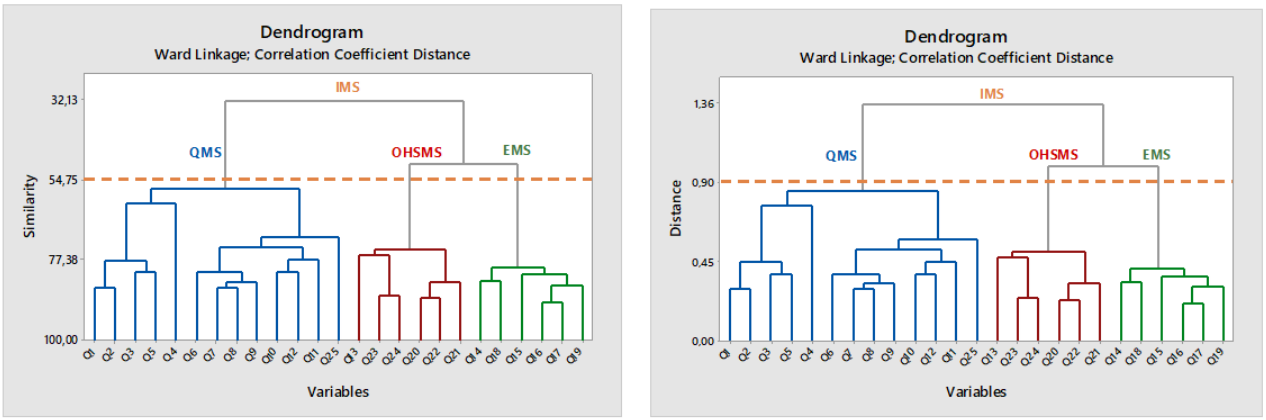
Q14	In your perception, is there a culture of sustainable development formally inserted in the organization's strategy?	0.93	0.93	1.00		1.0	3.7	18.1	40.7	36.5		0.812	0.660
Q15	In your perception, is there an organization's commitment to social responsibility?	1.00	1.00	1.00		0.8	3.9	12.0	37.1	46.2		0.823	0.677
Q16	In your perception, is there a structured organizational policy for environmental education?	1.00	1.00	1.00		0.8	4.5	15.1	37.5	42.1		0.791	0.626
Q17	In your perception, does the organization proactively contribute to environmental protection and improvement of the work environment?	1.00	1.00	1.00	**EMS**	1.2	3.7	14.0	36.9	44.2	**0.924**	0.840	0.705
Q18	In your perception, does the organization consider adapting to climate change in the design of its ventures, processes, products and services?	0.93	0.87	1.00		1.6	3.9	20.4	42.8	31.3		0.827	0.684
Q19	In your perception, is the organization concerned with reducing the amount of solid waste generated?	1.00	1.00	1.00		2.3	3.7	14.0	37.9	42.1		0.780	0.608
Q20	In your perception, does the organization care about your health and safety?	1.00	1.00	1.00		0.8	2.9	7.4	28.7	60.2		0.862	0.744
Q21	In your perception, does the organization provide quality of life in the work environment, increasing employee satisfaction?	1.00	1.00	1.00		1.4	5.6	14.6	30.4	48.0		0.860	0.740
Q22	In your perception, does the organization offer preventive measures to prevent accidents at work?	1.00	1.00	1.00	**OHSMS**	0.4	2.1	6.0	29.2	62.3	**0.906**	0.872	0.761
Q23	In your perception, is the working environment in your organization healthy (healthy)?	1.00	1.00	1.00		1.9	2.5	9.9	30.1	55.6		0.818	0.669
Q24	In your perception, is there quality of life in the work environment?	1.00	1.00	1.00		1.6	3.3	11.8	36.1	47.2		0.869	0.755
Q25	In your perception, are you satisfied with your workday?	1.00	1.00	1.00		1.4	3.7	11.8	29.5	53.6		0.712	0.507

Source: Author himself.

4.3.4 Dimensionality of the research instrument

Figure 2 shows the dendrogram resulting from the Cluster Analysis, in which (a) and (b) identify the results both for the similarity of the vectors and for the proximity between them. It is possible to observe the formation of 3 clusters. The first is formed by questions Q1 to Q12, and Q25, which are related to the QMS; the second consists of questions Q13, and Q20 to Q24 present in the OHSMS dimension; and the third consists of questions Q14 to Q19 associated with the EMS.

Figure 2: Dendrograms by similarity (a) and by distance (b).



(a) (b)

Source: Author himself.

Thus, it appears that the groups constituted by the CA statistical method reflect the composition of the impacts listed by each of the management systems analyzed in this study. The only exceptions were for variables Q13 (*In your perception, is there an optimization of the organization's physical structure?*) and Q25 *(In your perception, are you satisfied with your workday*?) which according to the proposed questionnaire belong to the Quality Management Systems (Q13) and Occupational Health and Safety (Q25), respectively, which can interpreted and linked for both systems. Such similarity and proximity between these 2 variables are easily perceived in the dendrograms in Figure 2.

We then proceeded with Factor Analysis considering three dimensions a priori. The chi-square of Bartlett's sphericity test showed a value equal to 212.61 (p-value equal to 2.2×10^{-16}), as well as the KMO test was equal to 0.970 guaranteeing the assumptions for the use of PA (Table 3).

Table 3: Factor loads per variable (multidimensional).

Dimensions (mm)	Variable	Factorial Loads (F)			Communality (h2)	Cumulative
		Vector 1	Vector 2	Vector 3		
QMS	Q1	**0.856**	-0.120	-0.083	0.710	73%
	Q2	0.703	0.028	-0.107	0.651	
	Q3	0.827	0.041	0.010	0.718	
	Q4	0.470	0.326	0.202	0.341	
	Q5	**0.856**	0.064	0.084	0.702	
	Q6	0.761	0.065	-0.027	0.684	
	Q7	0.796	0.150	0.069	0.723	
	Q8	0.782	0.019	-0.091	0.750	
	Q9	0.781	-0.037	-0.145	0.758	
	Q10	0.594	-0.065	-0.354	0.718	
	Q11	0.527	0.230	-0.047	0.548	
	Q12	0.520	0.026	-0.293	0.616	
	Q13	0.359	0.261	-0.262	0.624	
EMS	Q14	0.316	0.668	0.071	0.737	
	Q15	0.166	0.638	-0.126	0.732	
	Q16	-0.006	**0.895**	-0.032	0.832	
	Q17	-0.084	0.879	-0.182	0.905	
	Q18	0.191	0.661	-0.082	0.745	
	Q19	0.022	0.862	-0.016	0.789	
OHSMS	Q20	0.037	0.268	-0.650	0.778	
	Q21	0.136	0.153	-0.660	0.776	
	Q22	0.022	0.312	-0.638	0.801	
	Q23	0.020	0.040	**-0.834**	0.767	
	Q24	0.092	0.047	-0.816	0.846	
	Q25	0.192	-0.103	-0.677	0.582	

Source: Author himself.

It is possible to observe a grouping of three dimensions (items associated with the QMS, EMS and OHSMS) similar to that found in cluster analysis. All items in at least one dimension had F greater than 0.500 (in module) and h2 greater than 0.300, indicating a good fit of the items to the multidimensional model with three dimensions.

It is observed that the most impacting factors in organizational performance, resulting from the QMS, are the variables Q1 (*In your perception, is there an organization's commitment to improving the quality of products, services and processes visible in daily work, valuing the company's image?*) and Q5 (*In your perception, in order to make decisions, the organization seeks all available information so as not to make mistakes, controlling business risks?*) which have statistically the same vector intensities.

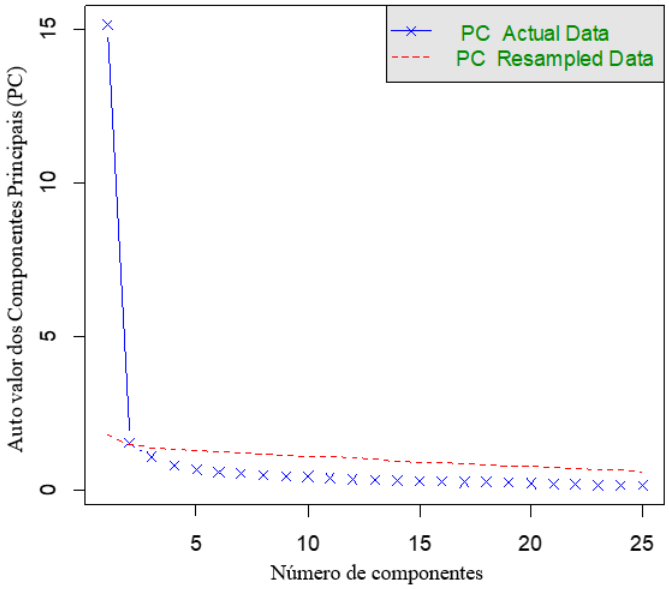
The most impacting factors from the EMS and OHSMS are the variables Q16 (*In your perception, is there a structured organizational policy for environmental education?*) and Q23 (*In your perception, is the working environment in your organization healthy?*), respectively.

Regarding the analysis of the positive (+) and negative (-) signs of the factors of each vector, it can be interpreted that the greater the impacts on the management of quality and occupational health

and safety, the greater the results on organizational performance, and conversely, the lower the impacts (degradation) on the work environment, the greater the benefits to the company's performance. Ensure that also that the vectors explain the latent traits in 73%.

The Parallel Analysis graph (Figure 3) shows strong indications of unidimensionality for the Instrument, given that a single dimension concentrates most of the item information. However, for this case, information that seems conflicting may, in fact, be providing information that it is a second order model.

Figure 3: Parallel Analysis Graph.



Source: Author himself.

4.3.5 Theoretical model for the perceived Integrated Management System

In view of the results of the Cluster Analysis, Factor Analysis and Parallel Analysis theorized a model that expresses the IMS perceived by the workers as a second order dimension, derived from the values of the dimensions QMS, EMS and OHSMS (Figure 1). The values of the relationships between the items and the dimensions of the first order, and between these and the dimension of the second order were tested using a Structural Equation Model (Table 4), in which all estimates presented significant values (p-value < 0.05). Table 5 shows the R2 that represents the explanatory power of the variables by the adjusted model. With the exception of Q4, all values were greater than 0.500. The model's adjustment parameters are shown in Table 6, in which the $\chi 2/df$ values < 2,000; the CFI and TLI > 0.900; and RMSEA and SRMR < 0.05, so that the second-order theoretical model that measures workers' perception of the Integrated Management System can be considered valid. Figure 4 shows the SEM with the values of the estimates.

Table 4 - SEM result for IMS perception

Dimension	Latent Variables	Estimate	Std.Err	z-value	p-value
QMS	Q1	1,000	-	-	-
	Q2	0.974	0.027	36,335	0.000
	Q3	0.995	0.025	39,915	0.000
	Q4	0.650	0.041	15,758	0.000
	Q5	0.970	0.027	36,485	0.000
	Q6	0.989	0.028	34,813	0.000
	Q7	1.001	0.029	34,813	0.000
	Q8	1,031	0.026	39,096	0.000
	Q9	1,033	0.026	39,100	0.000
	Q10	1,024	0.027	38,409	0.000
	Q11	0.910	0.030	29,894	0.000
	Q12	0.965	0.029	32,839	0.000
	Q13	0.962	0.032	29,881	0.000
EMS	Q14	1,000	-	-	-
	Q15	1,014	0.026	39,252	0.000
	Q16	1,017	0.022	45,259	0.000
	Q17	1,078	0.023	47,873	0.000
	Q18	1,017	0.022	45,748	0.000
	Q19	0.984	0.025	39,983	0.000
OHSMS	Q20	1,000	-	-	-
	Q21	0.982	0.020	48,649	0.000
	Q22	1.009	0.021	47,212	0.000
	Q23	0.951	0.023	42,079	0.000
	Q24	1,012	0.022	46,902	0.000
	Q25	0.804	0.033	24,484	0.000
IMS	QMS	1,000	-	-	-
	EMS	0.983	0.034	28,891	0.000
	OHSMS	1.108	0.038	29,434	0.000
Variances	Q1	0.320	-	-	-
	Q2	0.355	-	-	-
	Q3	0.327	-	-	-
	Q4	0.713	-	-	-
	Q5	0.360	-	-	-
	Q6	0.335	-	-	-
	Q7	0.319	-	-	-
	Q8	0.278	-	-	-
	Q9	0.274	-	-	-
	Q10	0.287	-	-	-
	Q11	0.437	-	-	-
	Q12	0.368	-	-	-
	Q13	0.371	-	-	-
	Q14	0.265	-	-	-
	Q15	0.245	-	-	-
	Q16	0.240	-	-	-
	Q17	0.146	-	-	-
	Q18	0.240	-	-	-
	Q19	0.288	-	-	-
	Q20	0.198	-	-	-
	Q21	0.226	-	-	-
	Q22	0.183	-	-	-
	Q23	0.274	-	-	-
	Q24	0.179	-	-	-
	Q25	0.481	-	-	-
	QMS	0.100	0.016	6.115	0.000
	EMS	0.174	0.019	8,961	0.000
	OHSMS	0.090	0.017	5.157	0.000
	IMS	0.580	0.037	15,753	0.000

Source: Author himself.

Table 5 - Relationship between R2 and model variables

Variables	R2 Estimate
Q1	0.680
Q2	0.645
Q3	0.673
Q4	0.287
Q5	0.640
Q6	0.665
Q7	0.681
Q8	0.722
Q9	0.726
Q10	0.713
Q11	0.563
Q12	0.632
Q13	0.629
Q14	0.735
Q15	0.755
Q16	0.760
Q17	0.854
Q18	0.760
Q19	0.712
Q20	0.802
Q21	0.774
Q22	0.817
Q23	0.726
Q24	0.821
Q25	0.519
QMS	0.853
EMS	0.763
OHSMS	0.888

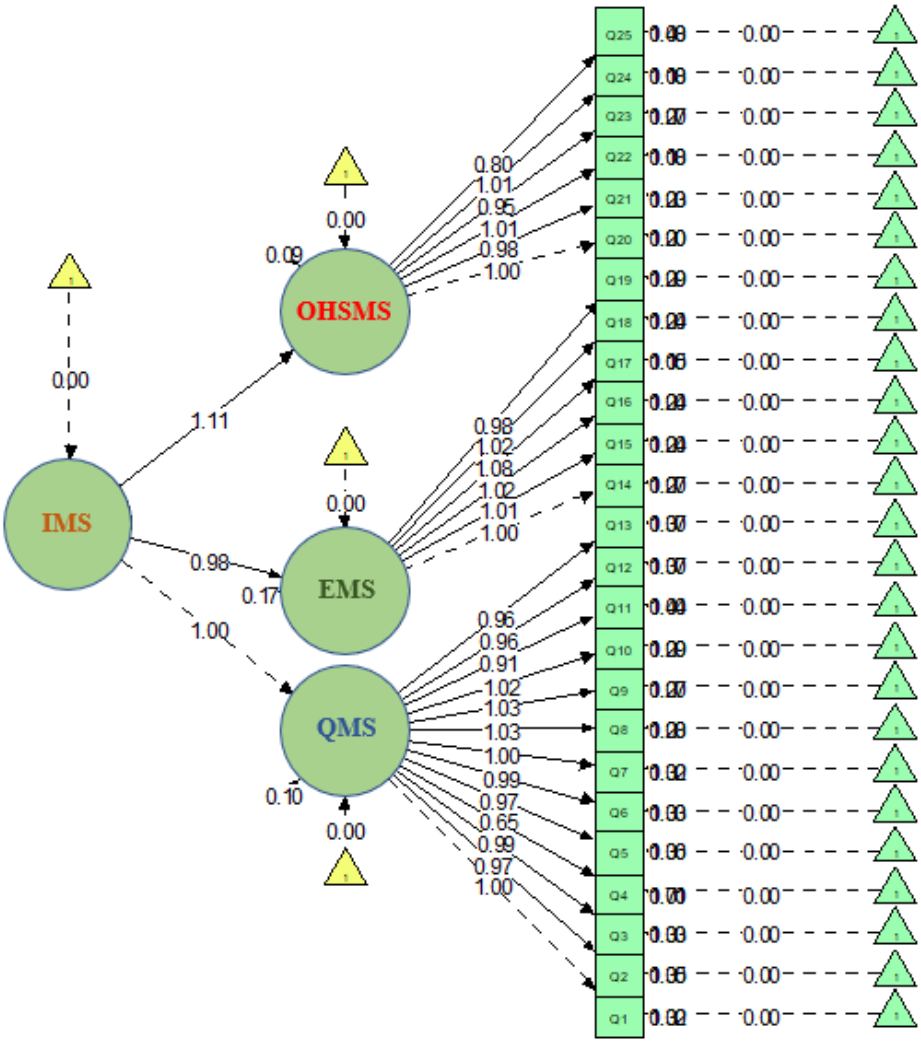
Source: Author himself.

Table 6: Adequacy Ratios (Adjustment) of the SEM.

Parameters	Standardized	Robust
χ2/df	1.602	1.567
CFI	0.998	0.990
TLI	0.998	0.992
RMSEA	0.035 (0.030-0.040)	0.034 (0.029-0.039)
SRMR	0.044	0.044

Source: Author himself.

Figure 4: Structural Equation Model.



Source: Author himself.

4.4 DISCUSSION

The search for a model that explains a certain phenomenon is almost never trivial, since the decomposition of a latent trait in simple elements is something complex (Morim, 2020). In addition, it is in this direction that the findings of this article indicate that the Integrated Management System perceived by employees is a latent trait of the second order and that it is supported by their perceptions about the 3 management systems (QMS, EMS and OHSMS).

However, the validation of a theoretical model depends on reliable data. From the content analysis stage, the values of *Conbrach's Alpha* were greater than 0.900, indicating a significant internal consistency (CRONBACH, 1951). Another reliability test applied to the largest sample group, the *McDonald's Omega*, also showed a value greater than 0.900, being even greater than the value of *Conbrach's Alpha*, something expected for reliable data (ZINBARG et al., 2005).

In addition to the findings in the literature that point to the direct relationship between the QMS, EMS and OHSMS and the workers' perception of the IMS (Barbosa et al., 2021), the use of multivariate statistical methods such as Cluster Analysis, Factor Analysis and the Parallel Analysis graph contributed to the idealization of the theoretical model. The CA method and the FA indicated the presence of 3 clusters and 3 dimensions, respectively. The Factor Analysis showed factor loads (F) and communalities (h2) with values greater than 0.300 and 0.200, that is, the items concentrate information and are quality items (Tezza et al., 2011).

On the other hand, the PA indicated a dimension that stood out for concentrating a large volume of information, something that for Silva et al. (2020) indicates the presence of a one-dimensional model. Therefore, when taking into account the information from the literature and from the multivariate statistical tests, a second order model was conceived, with the first multidimensional order and the second unidimensional order.

The theoretical model was tested using the SEM, obtaining satisfactory adjustment indexes. The relationship between chi-square and degree of freedom (χ^2/df) presented a good adjustment with a value less than 2 (Schermelleh-Engel et al., 2003); CFI and TLI were greater than 0.900 with RMSEA < 0.05 (Brown, 2015), in addition to SRMR < 0.08 (Hu; BENTLER, 1999). Therefore, it is perfectly plausible that the model is statistically valid and, as it is based on the literature, it explains the workers 'perception about the impact of the organizations' IMS.

Based on the Structural Equation Model, it can be observed that the OHSMS dimension, even composed of only 6 items, has an explanatory capacity 11% higher (approximately) in relation to the other dimensions, and it is the dimension that is most influenced (equal factor load to 1.11) due to the integration of management systems, followed by the QMS (factorial load equal to 1) and later by the EMS (factorial load equal to 0.98). Therefore, it is a dimension that deserves some attention, mainly because it is the one that deals directly with people and the working conditions that they experience

4.5 Conclusion

The second-order theoretical model proved to be valid to explain how Workers' perception of the Integrated Management System is formed. It became evident that for a total understanding of the IMS by the stakeholders, it is necessary that the Quality Management Systems, Environmental Management System and Occupational Health and Safety Management System are aligned with the organization's strategy. Therefore, the IMS is a latent trait that is not only multifactorial, but also complex because it depends directly on the perception of three other systems.

The impact of OHSMS dimension in organizational performance gained greater weight according to the perception of employees (explanatory capacity 11% higher, approximately), since it is a dimension closely linked to the working conditions of individuals.

The combination of the literature review findings with multivariate statistical methods contributed to the idealization of the second order model. The results of the Cluster Analysis, Factor Analysis and Parallel Analysis indicated that the evaluated systems formed a layer of latent features of a multifactorial order, more specifically of three dimensions (QMS, EMS and OHSMS), preceded by a second order formed by a unidimensional latent trace (IMS). The adjustment indexes of the Structural Equation Modeling built were satisfactory, providing significant evidence that validated the theoretical structure of the idealized model.

Although other management systems, in addition to those studied by this article, can be implemented in organizations, it was evidenced that the correct zeal and attention to the Quality Management System, the Environmental Management System and the Occupational Health and Safety Management System are already sufficient to ensure success in the implementation of the Integrated Management System. And likewise, when the perception of workers is not positive about these 3 systems, little success can be expected with regard to the impact of the Integrated Management System.

Therefore, knowing the impacts on organizational performance promoted by the integration of management systems (QMS, EMS and OHSMS) experienced by the corporation, future research could focus on identifying the relationship between these integration impacts and measures of financial performance. It would also be interesting to study the evolution of the perception of companies in relation to the difficulties and benefits of integrating management systems over time. Finally, it is worth noting that the contribution of this study is in the aspect of guiding the organization to know how to invest in IMS, because through this information the company will be able to better evaluate and plan which direction to follow.

5 CONCLUSÕES

Pôde-se obter algumas conclusões importantes relacionadas aos Sistemas de Gestão Integrados (SGI).

Observou-se que muitas organizações, independente da nacionalidade, seguem as diretrizes de integração dos sistemas de gerenciamento e tal procedimento agrega diversos ganhos as empresas, tais como: Melhora a imagem da organização para as partes interessadas; Aumenta a competitividade da corporação; Promove o desenvolvimento sustentável; Melhora a salubridade do local de trabalho; Melhora a qualidade de vida laboral, entre outros.

Com base em diversas referências bibliográficas, a Figura 6 (seção 3, Capítulo 2) sintetizou alguns dos principais benefícios elencados que as empresas podem almejar posteriormente a implementação de um processo de integração dos sistemas de gestão. Os ganhos podem ser de natureza interna ou externa. As vantagens internas são aquelas que podem melhorar o desempenho e reduzir os custos organizacionais, como também, melhorar o ambiente de trabalho e a satisfação das partes interessadas. Enquanto as vantagens externas melhoram a interação entre a empresa e as entidades (governo, concorrentes, sociedade).

O desenvolvimento de métricas para quantificar e avaliar o sistema de gestão integrado das empresas tem se mostrado um tema relevante (Mariouryad et al., 2015). Contudo, a escassez de estudos que busquem medir os impactos dos diferentes sistemas de gestão com base na percepção das partes interessadas acaba por dificultar decisões por parte dos gestores das organizações.

Do conhecimento do autor deste estudo, este é o primeiro a propor e validar um instrumento de medida para avaliar, mediante uma escala gerada por métodos psicométricos robustos, a percepção multidimensional dos trabalhadores em relação aos impactos promovidos por sistemas de gerenciamento (SGQ, SGA e SGSSO) no desempenho organizacional, quando conduzidos de forma simultânea e integrada.

Isto posto, com o auxílio do método da Teoria de Resposta ao Item (TRI) foi possível validar um Instrumento, ao mesmo tempo que se determinou o nível de discriminação dos itens e o grau de dificuldade de cada alternativa de resposta da escala de *Likert*. Portanto, a TRI adicionou informações relativas aos aspectos de cada variável, distinguindo as que melhor discriminam os níveis de percepção dos colaboradores no tocante aos impactos no desempenho organizacional. O reconhecimento dos parâmetros de dificuldade viabilizou situar cada alternativa de resposta de um item em uma escala com um modelo interpretativo que demonstra o quanto de percepção que um trabalhador deve ter para assinalar uma dada alternativa de resposta, dado que o traço latente (θ) e o nível de dificuldade da alternativa de resposta k do item i (b_{ik}) estão numa mesma unidade de medida e por isso são comparáveis facilmente.

Já com o auxílio de um modelo teórico de equações estruturais de segunda ordem foi possível explicar como é formada a percepção dos trabalhadores sobre o SGI. Ficou evidenciado que para uma total compreensão por parte das partes interessadas é preciso que os SGQ, SGA e SGSSO estejam alinhados a estratégia da organização. Portanto, o SGI é um traço latente não apenas multifatorial, mas também complexo por depender diretamente da percepção de outros três sistemas.

O impacto da dimensão SGSSO no desempenho organizacional obteve maior peso segundo a percepção dos colaboradores (capacidade explicativa 11% superior, aproximadamente), haja vista ser uma dimensão intimamente ligada às condições de trabalho dos indivíduos.

A combinação dos achados da revisão da literatura com métodos de estatística multivariada contribuiu para a idealização do modelo de segunda ordem. Os resultados da Análise de Agrupamento, Análise Fatorial e Análise Paralela indicaram que os sistemas avaliados formavam uma camada de traços latentes de ordem multifatorial, mais especificamente de três dimensões (SGQ, SGA e SGSSO), precedida de uma segunda ordem formado por um traço latente unidimensional (SGI). Os índices de ajustes da Modelagem de Equações Estruturais construída foram satisfatórios, fornecendo indícios significativos que validaram a estrutura teórica do modelo idealizado.

Ainda que outros sistemas de gerenciamentos, além dos estudados por este artigo, possam ser implementados nas organizações, ficou evidenciado que o correto zelo e atenção ao Sistema de Gestão da Qualidade, ao Sistema de Gestão Ambiental e ao Sistema de Gestão da Saúde e Segurança Ocupacional já sejam suficientes para garantir sucesso na implementação do Sistema de Gestão Integrado. E do mesmo modo, quando a percepção dos trabalhadores não for positiva sobre tais 3 sistemas, pouco sucesso pode ser esperado no que se refere ao impacto do SGI.

Portanto, conhecendo-se os impactos no desempenho organizacional promovidos pela integração dos sistemas de gerenciamento (SGQ, SGA e SGSSO) experimentados pela corporação, pesquisas futuras poderiam se concentrar em identificar a relação entre esses impactos de integração e as medidas de desempenho financeiro. Também seria interessante estudar a evolução da percepção das empresas em relação às dificuldades e benefícios de integração dos sistemas de gestão ao longo do tempo.

Os resultados fornecem evidências substanciais para provar a importância da adoção de Sistemas de Gestão Integrados, a qual mostra-se uma ferramenta viável para as empresas fortalecerem os negócios e aumentarem a sustentabilidade corporativa.

Por fim, vale destacar que as contribuições deste estudo estão no aspecto de propor uma ferramenta de pesquisa (questionário), de como realizar uma análise robusta de uma *survey*, de nortear um passo a passo didático da metodologia estatística aplicada e de como orientar a organização a saber como investir em SGI, pois através dessas informações a empresa poderá avaliar e planejar melhor que direção seguir.

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Apêndice I

Questionário Aplicado

Impactos de Sistemas de Gestão Integrados no Desempenho Organizacional em uma Percepção Multidimensional

Por favor, tenha em mente seus valores, aspirações e preocupações. Você deve circular o número que melhor corresponde a sua percepção, relembrando, pensando apenas nos últimos 12 (meses) meses. Exemplo:

Na sua percepção, a organização se preocupa com a gestão dos sistemas integrados?				
nunca	**poucas vezes**	**algumas vezes**	**muitas vezes**	**sempre**
1	2	3	4	⑤

Por favor, após o preenchimento dos dados de reconhecimento, leia com atenção as questões e escolha o número que lhe parecer a melhor resposta.

Dados de Reconhecimento	
Setor:	
Cargo inicial:	**Cargo atual:**
Tempo de empresa: ( ) menos de 1 ano ( ) de 1 a 4 anos ( ) de 5 a 9 anos ( ) mais de 10 anos	
Tempo no cargo atual: ( ) menos de 1 ano ( ) de 1 a 4 anos ( ) de 5 a 9 anos ( ) mais de 10 anos	
Nível de instrução inicial:	
Nível de instrução atual:	
Carga horária de trabalho (exceto horas extras):	
Idade:	**Sexo: ( ) masculino ( ) feminino**

1. Na sua percepção, há um compromisso da organização com a melhoria da qualidade dos produtos, serviços e processos visível no trabalho diário, valorizando a imagem da empresa?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

2. Na sua percepção, há um processo de conscientização para a qualidade desenvolvido pela organização conhecido por todos os envolvidos, satisfazendo as partes interessadas?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

3. Na sua percepção, a organização utiliza procedimentos para corrigir possíveis problemas nos bens, nos serviços e/ou nos processos de trabalho, melhorando o desempenho operacional e aumentando a competitividade da empresa?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

4. Na sua percepção, há uma política de redução dos custos organizacionais na empresa?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

5. Na sua percepção, para tomar decisões, a organização busca todas as informações disponíveis para não cometer falha, controlando os riscos de negócio?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

6. Na sua percepção, a organização otimiza os treinamentos adequando-os as necessidades dos colaboradores para qualificar a mão de obra?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

7. Na sua percepção, há uma gestão padronizada na organização, visando a redução de atividades redundantes e da burocracia?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

8. Na sua percepção, há uma otimização do tempo para garantir a qualidade dos bens/serviços oferecidos?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

9. Na sua percepção, há um planejamento estratégico na organização?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

10. Na sua percepção, a administração da sua organização (diretores, gerentes, supervisores e outros cargos de chefia) demonstra compromisso com a qualidade em suas decisões?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

11. Na sua percepção, há auditorias (internas ou externas) na organização?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

12. Na sua percepção, há uma boa comunicação dentro da organização?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

13. Na sua percepção, há uma otimização da estrutura física da organização?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

14. Na sua percepção, há uma cultura de desenvolvimento sustentável formalmente inserido na estratégia da organização?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

15. Na sua percepção, há um compromisso da organização com a responsabilidade social?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

16. Na sua percepção, há uma política organizacional estruturada de educação ambiental?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

17. Na sua percepção, a organização contribui, de forma proativa, para a proteção ambiental e a melhoria do ambiente laboral?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

18. Na sua percepção, a organização considera a adaptação às mudanças climáticas na concepção de seus empreendimentos, processos, produtos e serviços?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

19. Na sua percepção, a organização se preocupa com a redução da quantidade de resíduos sólidos gerados?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

20. Na sua percepção, a organização se preocupa com sua saúde e segurança?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

21. Na sua percepção, a organização proporciona qualidade de vida no ambiente laboral, aumentando a satisfação do colaborador?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

22. Na sua percepção, a organização oferece medidas preventivas para evitar acidentes do trabalho?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

23. Na sua percepção, o ambiente laboral na sua organização é salubre (saudável)?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

24. Na sua percepção, há qualidade de vida no ambiente de trabalho?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

25. Na sua percepção, você está satisfeito com sua jornada de trabalho?

nunca	poucas vezes	algumas vezes	muitas vezes	sempre
1	2	3	4	5

Apêndice II

TERMO DE ANUÊNCIA

Solicitação de Autorização Institucional

Prezado Senhor, Nome.

Solicito sua autorização para realização do projeto de pesquisa intitulado **"IMPACTOS DE SISTEMAS DE GESTÃO INTEGRADOS NO DESEMPENHO ORGANIZACIONAL EM UMA PERCEPÇÃO MULTIDIMENSIONAL",** de minha autoria, **Anrafel de Souza Barbosa**, aluno do mestrado do Programa de Pós-graduação em Engenharia de Produção e Sistemas - PPGEPS, da Universidade Federal da Paraíba - UFPB. A pesquisa visa analisar os impactos estimulados pela integração dos sistemas de gerenciamento (sistemas de gestão da qualidade, ambiental e da saúde e segurança ocupacional) no desempenho organizacional da ENGESELT - Engenharia e Serviços (que atua não somente no estado da Paraíba como em outros estados do Brasil), através da percepção de seus colaboradores, fazendo uso da metodologia estatística de análise multivariada. Neste caso estarei disponível para todas as dúvidas possíveis sobre a pesquisa e para maiores informações através do e-mail: anrafel.barbosa@academico.ufpb.br, telefone: (83) 9**** **46. A qualquer momento, o senhor(a) poderá solicitar esclarecimentos sobre o trabalho que será realizado e, sem qualquer tipo de cobrança, poderá retirar sua autorização. Estarei apto a esclarecer estes pontos e, em caso de necessidade, darei indicações para contornar qualquer mal-estar que possa surgir em decorrência da pesquisa. Os dados obtidos nesta pesquisa serão utilizados unicamente e exclusivamente para fins acadêmicos através de publicação de artigo científico. Contudo, assumimos a total responsabilidade de não publicar qualquer dado que comprometa o sigilo da participação dos integrantes de sua organização. Nomes, endereços e outras indicações pessoais não serão publicadas em hipótese alguma. Os dados gerados pela pesquisa só serão disponibilizados sem estes itens. Caso a pesquisa traga qualquer tipo de dano aos participantes, comprometo-me a reparar este dano, ou prover meios para a reparação. A participação será voluntária, não forneceremos por ela qualquer tipo de pagamento.

Eu, Nome, Sócio-Gerente da ENGESELT, autorizo a pesquisa solicitada neste documento.

Nome
Sócio-Gerente da ENGESELT

Anrafel de Souza Barbosa
Pesquisador responsável

Apêndice III

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título do Projeto: **IMPACTOS DE SISTEMAS DE GESTÃO INTEGRADOS NO DESEMPENHO ORGANIZACIONAL EM UMA PERCEPÇÃO MULTIDIMENSIONAL.**
Pesquisador responsável: ANRAFEL DE SOUZA BARBOSA.
Eu_____ residente na rua_____ fui informado(a) que este projeto tem o objetivo de analisar os impactos estimulados pela integração dos sistemas de gerenciamento (sistemas de gestão da qualidade, ambiental e da saúde e segurança ocupacional) no desempenho organizacional da ENGESELT - Engenharia e Serviços (que atua não somente no estado da Paraíba como em outros estados do Brasil), através da percepção de seus colaboradores, fazendo uso da metodologia estatística de análise multivariada. Depois disso o pesquisador responsável afirmou que iria analisar os dados e discutir sobre esse tema e ainda me informou que esses dados serão utilizados em um trabalho de pesquisa, bem como em artigos e estudos científicos que poderão ser divulgados através de revistas, congressos, etc.

Após ler e receber explicações sobre o estudo, tive assegurado os meus direitos de obter resposta a qualquer pergunta e esclarecimento sobre os procedimentos, riscos, benefícios e outros relacionados à pesquisa. Tive assegurado também o direito de retirar o meu consentimento e deixar (desistir) de participar do estudo a qualquer momento, bem como, de não ser identificado e de ser mantido o caráter confidencial das informações relacionadas à minha privacidade e a meu anonimato.

Fiquei ciente dos riscos originados pelo desenvolvimento da pesquisa e de como minimizá-los, que podem ser: constrangimento e represália, por parte do empregador, em detrimento da exposição das minhas opiniões sobre as condições de trabalho na empresa; para minimizá-los foi garantido o sigilo total da minha identificação, foi assegurada a opção de responder os questionários em um local diferente do ambiente de trabalho, por exemplo, em minha residências, pois o questionário será disponibilizado em formulário eletrônico acessível em qualquer dispositivo eletrônico com internet, e não haverá necessidade de assinatura do mesmo.

Foi informado também que neste estudo, serão respeitados os aspectos éticos e legais da Resolução Nº 510/2016, do Conselho Nacional de Saúde, que expressa os direitos dos indivíduos participantes em pesquisa, assegurando o direito à privacidade, anonimato, entre outros.

Esta pesquisa foi analisada e aprovada pelo Comitê de Ética em Pesquisa do IFPB (CEP-IFPB), o qual tem o objetivo de garantir a proteção dos participantes de pesquisas submetidas a este Comitê. Portanto, se o senhor(a) desejar maiores esclarecimentos sobre seus direitos como participante da pesquisa, ou ainda formular alguma reclamação ou denúncia sobre procedimentos inadequados dos pesquisadores, pode entrar em contato com o CEP-IFPB. COMITÊ DE ÉTICA EM PESQUISA DO IFPB. Av. João da Mata, 256 – Jaguaribe – João Pessoa – PB. Telefone: (83) 3612-9725 - e-mail: eticaempesquisa@ifpb.edu.br

Após obter as informações necessárias sobre o projeto de pesquisa, declaro estar ciente do conteúdo deste termo e desejo participar da pesquisa.

João Pessoa - PB, _____de_____ de _____.

Nome do pesquisado ou do responsável:_____

Assinatura: _____

Testemunhas (não ligadas à equipe de pesquisa):

Testemunha:_____

Assinatura: _____

_____

Assinatura do pesquisador responsável.