UNIVERSIDADE FEDERAL DE SÃO CARLOS
CENTRO DE CIÊNCIAS EXATAS E DE TECNOLOGIA
DEPARTAMENTO DE ENGENHARIA DE PRODUÇÃO
PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA DE PRODUÇÃO

IGOR ROBERTO AMANCIO

# SERVITIZAÇÃO TERRITORIAL: OS IMPACTOS DA CONCENTRAÇÃO DE KIBS NA PRODUTIVIDADE DE EMPRESAS DE MANUFATURA

SÃO CARLOS -SP

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Dissertação apresentada ao Programa de Pós-Graduação em Engenharia de Produção da Universidade Federal de São Carlos (UFSCar), como parte dos requisitos para obtenção do título de mestre em Engenharia de Produção.

Área de concentração: Gestão da Produção

Orientador: Prof. Dr. Glauco Henrique de Sousa Mendes

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2021

**UNIVERSIDADE FEDERAL DE SÃO CARLOS**

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### Comissão Julgadora:

Prof. Dr. Glauco Henrique de Sousa Mendes (UFSCar)

Prof. Dr. Herick Fernando Moralles (UFSCar)

Prof. Dr. Bruno Brandão Fischer (UNICAMP)

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## RESUMO

As empresas de serviços empresariais de conhecimento intensivo (knowledge-intensive business services - KIBS) desempenham um importante papel na geração e transferência do conhecimento. Além disso, as KIBS têm apoiado a implantação de modelos de negócios orientados aos serviços nas empresas de manufatura. Deste modo, essas empresas se beneficiam das conexões com as KIBS ao passo em que usam estes serviços para complementarem suas capacidades e se tornarem mais competitivas. As conexões entre empresas de manufatura e KIBS são também capazes de contribuir para o desenvolvimento econômico regional por meio da geração de novos empregos e novos negócios. As relações simbióticas entre KIBS e empresas de manufatura e seus efeitos para essas empresas e para a região na qual estão inseridas têm recebido o nome de servitização territorial. Esta dissertação tem como objetivo avaliar os impactos da concentração de KIBS na produtividade (Total Fator Productivity – TFP) das empresas de manufatura brasileiras e determinar o papel moderador da capacidade de absorção nesta relação. Para atingir o objetivo, o método de pesquisa foi estruturado em duas etapas. A primeira correspondeu a um estudo de escopo com a finalidade de obter uma melhor compreensão das conexões entre KIBS e empresas de manufatura. A segunda etapa correspondeu ao desenvolvimento de um modelo econométrico com variáveis de concentração de KIBS e produtividade de empresas de manufatura. Os resultados evidenciam que somente a concentração de KIBS não é capaz de gerar efeitos positivos na produtividade das empresas de manufatura. Estas empresas devem possuir capacidade de absorção suficiente para transformar o conhecimento disponível em ganhos de produtividade. Esta dissertação contribui para o avanço da literatura sobre servitização territorial ao fornecer uma análise temática referente à convergência da literatura entre KIBS e empresas de manufatura. Também aponta que os benefícios da servitização territorial dependem, além da concentração de KIBS, que as empresas de manufatura tenham capacidade de explorar os conhecimentos das KIBS. Implicações teóricas e gerenciais são apresentadas na dissertação.



**Palavras-chave:** Servitização. Serviços empresariais de conhecimento intensivo. KIBS. Empresas de manufatura. Produtividade. Servitização territorial.

## ABSTRACT

Knowledge-intensive business services (KIBS) companies play an important role in knowledge generation and transfer. In addition, KIBS has supported the implementation of service-oriented business models in manufacturing companies. In this way, these companies benefit from connections with KIBS as they use these services to complement their capabilities and become more competitive. The connections between manufacturing companies and KIBS are also able to contribute to regional economic development through the generation of new jobs and new businesses. The symbiotic connections between KIBS and manufacturing companies and their effects on these companies and on the region in which they are located have been called territorial servitization. This dissertation aims to evaluate the impacts of KIBS concentration on productivity (Total Factor Productivity – TFP) of Brazilian manufacturing companies and determine the moderating role of absorptive capacity in this relationship. To achieve the objective, the research method was structured in two stages. The first was a scoping study in order to gain a better understanding of the connections between KIBS and manufacturing companies. The second stage corresponded to the development of an econometric model with variables of concentration of KIBS and productivity of manufacturing companies. The results show that only the concentration of KIBS is not capable of generating positive effects on the productivity of manufacturing companies. These companies must have sufficient absorptive capacity to transform the available knowledge into productivity gains. This dissertation contributes to the advancement of the literature on territorial servitization by providing a thematic analysis regarding the convergence of the literature between KIBS and manufacturing companies. It also points out that the benefits of territorial servitization depend, in addition to the concentration of KIBS, that manufacturing companies are able to exploit the knowledge of KIBS. Theoretical and managerial implications are presented in the dissertation.



**Keywords:** Servitization. Knowledge-intensive business services. KIBS. Manufacturing companies. Productivity. Territorial servitization.

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# 1 INTRODUÇÃO

Este capítulo tem como objetivo apresentar o tema Servitização Territorial, assim como apresentar o problema de pesquisa, os objetivos desta dissertação, uma síntese dos métodos de pesquisa empregados e a estrutura do trabalho.

## 1.1 CONTEXTUALIZAÇÃO E JUSTIFICATIVA

O termo servitização surgiu com o estudo de Vandermerwe e Rada (1988) referindo-se à incorporação de serviços nas proposições de valor baseadas em produtos. Apesar de surgido na década de oitenta, a servitização continua a ser um tema de interesse para as comunidades de pesquisa e empresas (BAINES *et al.* 2020). Atualmente, seu entendimento tem um escopo maior, referindo-se ao processo de transformação que empresas de manufatura passam ao alterar seus modelos de negócios centrados em produtos para modelos de negócios centrados em serviços (BAINES *et al.*, 2017; DÍAZ-GARRIDO *et al.*, 2018; ZHANG e BANERJI, 2017).

A servitização tem o potencial de gerar benefícios financeiros, estratégicos e de marketing, contudo, são muitos os desafios decorrentes da sua adoção (BAINES *et al.*, 2017; ZHANG e BANERJI, 2017). A implementação da servitização pode demandar novos recursos e capacidades (por exemplo, capacidades de inovação em serviços), os quais podem ser desenvolvidos internamente (RADDATS *et al.*, 2019) ou adquiridos por meio de parcerias colaborativas com provedores de serviços especializados (BUSTINZA *et al.*, 2015, 2019a; DE PROPIS e STORAI; 2019; LIU *et al.*, 2019). Quanto à colaboração externa, estudos (VENDRELL-HERRERO e WILSON, 2017; KAMP e ALCALDE, 2014; BELLANDI e SANTINI, 2018) destacam a importância das interações das empresas de manufatura com as empresas de serviços empresariais de conhecimento intensivo, conhecidas na literatura como KIBS (do inglês: *knowledge-intensive business services*). Este termo será usado na dissertação.

As KIBS são empresas que oferecem serviços empresariais de conhecimento intensivo (MILES, 1995). Elas estão relacionadas à oferta de serviços de pesquisa e desenvolvimento (P&D), consultoria de gestão e serviços de tecnologia da informação (TI) (MILES, 1995; STRAMBACH, 2001). Em virtude dos tipos de serviços especializados que prestam, as KIBS ocupam uma posição importante nos sistemas de inovação e difusão do conhecimento, apoiando o crescimento interno das organizações e o desenvolvimento econômico em níveis regional e nacional (BUSTINZA *et al.*, 2019a; MULLER e ZENKER, 2001). Destaca-se também, o

envolvimento com as pequenas e médias empresas (PME) de manufatura, já que elas não detêm os mesmos recursos e as capacidades de investimentos das grandes empresas (KAMP e ALCALDE, 2014; VENDRELL-HERRERO e WILSON, 2017; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017).

As conexões entre empresas de manufatura e KIBS têm sido investigadas em diferentes temas de pesquisa. Alguns deles, concentram-se nas colaborações e processos de cocriação dos serviços (BETTENCOURT *et al.*, 2002). Há também tópicos que focam os resultados das interações para as empresas envolvidas, tais como os estudos que discutem as oportunidades para obtenção de lucros por meio da oferta serviços com o suporte das KIBS (BUSTINZA *et al.*,2019a; HU e LIN; CHANG, 2013; KOHTAMÄKI e PARTANEN, 2016). Ainda, estudos que abordam seus efeitos para os territórios aonde estas empresas se localizam, como é o caso da servitização territorial (LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017).

A servitização territorial é definida como as conexões entre empresas de manufatura e KIBS (BELLANDI e SANTINI, 2019; GEBAUER e BINZ, 2019; GOMES *et al.*, 2019; HORVÁTH e RABETINO, 2019; LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017; LIU *et al.*, 2019). Este tema tem sua origem ligada à própria servitização, porém, pesquisadores observaram que as conexões colaborativas (potenciais e reais) entre esses dois tipos de empresas têm condições de gerar, além, dos resultados individuais (tanto para KIBS como para empresas de manufatura), também podem produzir resultados em níveis regionais (BELLANDI e SANTINI, 2019; GEBAUER e BINZ, 2019). Assim, a servitização territorial ultrapassa os limites organizacionais e integra efeitos associados ao desenvolvimento econômico e aumento de empregos, podendo também contribuir para a competitividade da indústria local (LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017; SFORZI e BOIX; 2019).

Na servitização territorial, as KIBS assumem um papel crítico como parceiras das empresas de manufatura e como catalizadoras do desenvolvimento regional (LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017; LIU *et al.*, 2019). Por exemplo, Gomes *et al.* (2019) constataram que o aumento de KIBS em uma determinada região eleva os níveis de servitização das empresas de manufatura, retomando a ideia do papel das KIBS como provedores de valor e soluções hibridas (produtos e serviços). Gebauer e Binz (2019) destacam a importância das KIBS para a alocação de tecnologias inovadoras em empresas de manufatura. Seclen-Luna e Moya-Fernandez (2020) reconhecem que a proximidade com as KIBS aumenta a possibilidade de inovação de produto em empresas de manufatura. Liu *et al.* (2019) afirmam que a presença simultânea de KIBS e empresas de manufatura provoca efeitos de

transbordamento (*spillover*) de conhecimento entre os setores. Deste modo, a servitização territorial pode ser vista como um catalizador de benefícios para as empresas de manufatura (BELLANDI e SANTINI, 2019).

Apesar dos estudos citados, a Servitização Territorial enquanto tema de pesquisa ainda é incipiente (VENDRELL-HERRERO; LAFUENTE; VAILLANT, 2020). Já a literatura sobre servitização prioriza exemplos sobre o sucesso das empresas de manufatura na oferta de serviços, mas não aborda diretamente como as regiões podem capitalizar o potencial da conexão entre as empresas de manufatura e as KIBS (LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017). Como consequência, mais estudos são necessários para compreender, por exemplo, as características da dinâmica entre os setores de manufatura e as KIBS (DÍAZ-GARRIDO *et al.*, 2018; VENDRELL-HERRERO; WILSON, 2017), bem como aprofundar o conhecimento dos impactos da servitização territorial no desempenho tanto dos atores envolvidos como na competitividade regional (GOMES *et al.*, 2019; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017).

Dentre as oportunidades de pesquisa acima, a maioria dos estudos em Servitização Territorial têm se dedicado em compreender os efeitos regionais da servitização territorial (e.g. BELLANDI e SANTINI, 2019; GEBAUER e BINZ, 2019; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017), enquanto que os impactos nos desempenhos das empresas de manufatura e das KIBS (e.g., produtividade) têm sido investigados por poucos estudos (DE PROPRIS e STORAI, 2019; GOMES *et al.*, 2019; LIU *et al.*, 2019; SFORZI e BOIX, 2019). Portanto, esta dissertação aborda esta lacuna de pesquisa ao explorar os efeitos da concentração de KIBS na produtividade de empresas de manufatura no contexto da servitização territorial.

Os estudos referentes a servitização territorial foram realizados em diversos países, tais como Espanha (GOMES *et al.*, 2019; KAMP e RUIZ DE APODACA, 2017; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017), Itália (BELLANDI e SANTINI, 2019), Alemanha (GOMES *et al.*, 2019; LIU *et al.*, 2019; WYRWICH, 2019) e Reino Unido (DE PROPRIS e STORAI, 2019). Seclen-Luna e Moya-Fernandez (2020) desenvolveram um estudo relacionado à servitização territorial na América Latina, contudo, tais autores não incluíram o Brasil na lista de países. Neste sentido, é evidente a necessidade de mais estudos que explorem a servitização territorial em países emergentes (GEBAUER e BINZ, 2019; KAMP e RUIZ DE APODACA, 2017; LIU et al, 2019), como é o caso do Brasil. Esta é outra oportunidade para a realização desta pesquisa.

## 1.2 PROBLEMA DE PESQUISA E OBJETIVOS

As conexões entre KIBS e empresas de manufatura resultam em benefícios regionais (LAFUENTE; VAILLANT; VENDRELL-HERRRO, 2017) e para as próprias empresas de manufaturas, tais como: elevar os níveis de servitização (GOMES *et al.*, 2019; OPAZO-BASÁEZ; CANTÍN; CAMPOS 2020), disponibilização de novas tecnologias (GEBAUER e BINZ, 2019), inovação em produto (SECLEN-LUNA e MOYA-FERNANDEZ, 2020) e apoio à adoção da economia circular (PEREIRA e VINCE, 2021). Elas também promovem os chamados *spillovers* de conhecimento (LIU *et al.*, 2019). Logo, esses benefícios são gerados através das colaborações feitas diretamente com as KIBS por meio do uso desses serviços em suas cadeias de valor (BUSTINZA *et al.*, 2019b) ou a partir da própria proximidade espacial, como é o caso dos *spillovers* de conhecimento (LIU *et al*., 2019).

Os *spillovers* de conhecimento são resultados da geração, transferência e absorção de conhecimento e tecnologias que podem acontecer dentro de uma indústria ou entre indústrias, por meio de ligações com fornecedores locais e/ou clientes (MARIOTTI *et al*., 2015; CAPELLO e FAGGIAN, 2005, LIU *et al*., 2019). Neste sentido, as interações de proximidade entre empresas de manufatura e as KIBS facilitam os fluxos de conhecimento e a criação de sistemas inovadores de produto-serviço, melhorando a competitividade da empresa e da cadeia de valor local, e consequentemente promovendo o desenvolvimento regional (BUSTINZA; OPAZO-BASÁEZ; TARBA, 2021; GOMES *et al*., 2019; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017). Assim, a presença de empresas KIBS com capacidades em serviços especializados permite que as empresas de manufatura colocalizadas acessem, projetem e incorporem competências de serviços e produtos em suas operações (DE PROPRIS e STORAI, 2019).

Deste modo, presume-se que a proximidade espacial entre KIBS e empresas de manufatura pode oferecer *spillovers* de conhecimento (LIU *et al.*, 2019) e que eles podem aumentar a produtividade na medida em que as empresas de manufatura, foco desta dissertação, incorporam os conhecimentos obtidos externamente e agrega-os em suas funções de produtividade (AUDRETSCH e BELITSKI, 2020; GEBAUER e BINZ, 2019). Entretanto, a incorporação desses benefícios pode depender da capacidade das empresas de manufatura em identificar, assimilar e explorar o conhecimento externo para melhorar suas vantagens competitivas (COHEN e LEVINTHAL, 1990; DAGHFOUS; ASHILL; ROD, 2013). Assim, a os potenciais benefícios dos spillovers de conhecimento dependeriam da capacidade de

absorção das empresas envolvidas (VENDRELL-HERRERO; DARKO; GHAURI, 2020; ZAHRA e GEORGE, 2002).

Mediante o exposto, este trabalho concentra-se na análise dos efeitos das interações entre a concentração de KIBS e as empresas de manufatura, bem como na relevância da capacidade de absorção neste contexto. Sendo assim, esta dissertação visa responder a seguinte questão de pesquisa:

*Como a concentração de KIBS, no contexto da servitização territorial, impacta no desempenho da produtividade de empresas de manufatura brasileiras?*

Deste modo, esta dissertação tem como objetivo geral avaliar os impactos da concentração de KIBS na produtividade (*Total Fator Productivitiy* – TFP) das empresas de manufatura brasileiras. Tal objetivo será desdobrado nos seguintes objetivos específicos:

OP1: Identificar os principais temas dispostos na literatura sobre as interações entre empresas de manufatura e as KIBS;

OP2: Destacar novas oportunidades para pesquisas futuras no campo de pesquisa sobre as conexões entre KIBS e empresas de manufatura;

OP3: Destacar os efeitos da concentração de KIBS na produtividade de empresas de manufatura e determinar o papel moderador da capacidade de absorção nesta relação.

## 1.3 MÉTODO

O desenvolvimento da dissertação deu-se em duas etapas cujos resultados são apresentados em dois artigos, que formam o corpo geral da dissertação. Ao combinar o conteúdo desses dois artigos, entende-se, que o objetivo geral da dissertação fora alcançado. Os métodos de pesquisa dos artigos estão alinhados aos objetivos das duas etapas: revisão de escopo (*scoping review*) (ARKSEY e O'MALLEY, 2005; LEVAC; COLQUHOUN; O'BRIEN, 2010) e a modelagem econométrica (GUJARATI; PORTER, 2011). Logo, entende-se que esta dissertação segue, no geral, uma abordagem metodológica multimétodos. Vale destacar que esta seção traz apenas uma síntese dos métodos adotados nesta dissertação, pois o detalhamento desses métodos estará presente nas seções referentes a cada artigo.

A estrutura da dissertação por artigos é apresentada no Quadro 1 com uma descrição dos artigos quanto aos seus objetivos e métodos.

Quadro 1.1 - Estrutura da dissertação por artigos

| | Questão de pesquisa do artigo | Objetivo de pesquisa | Bases teóricas | Método |
|---|---|---|---|---|
| **Artigo 1** | Quais são os principais temas da literatura convergente sobre a interação entre KIBS e fabricantes? | (i) identificar os principais temas dispostos na literatura sobre as conexões entre empresas de manufatura e as KIBS, e (ii) destacar novas oportunidades para pesquisas futuras no campo de pesquisa sobre as conexões entre KIBS e empresas de manufatura | As conexões entre KIBS e empresas de manufatura resultam em benefícios organizacionais e regionais | Estudo de escopo |
| **Artigo 2** | Como a concentração de KIBS, no contexto da servitização territorial, impacta no desempenho da produtividade de empresas de manufatura brasileiras? | Destacar os efeitos da concentração de KIBS na produtividade de empresas de manufatura e determinar se esses efeitos dependem de um nível mínimo da capacidade de absorção | A presença de KIBS e empresas de manufatura geram *spillovers* de conhecimento que podem resultar ganhos em produtividade | Modelo de regressão de limiar |

Fonte: Elaborada pelo autor

**O Artigo 1** – "*The interplay between KIBS and manufacturers: a scoping review of major key themes and research opportunities".* Para a consecução da Etapa 1 foi proposto a realização de uma revisão de escopo para atingir a consecução dos objetivos OP1 e OP2. Este método permite a apresentação das evidências da literatura em um aspecto mais narrativo, mapeando e articulando os principais conceitos-chaves do campo de pesquisa derivados de uma vasta fonte de dados (PETERSON *et al.* 2017). O estudo de escopo é recomendado para identificar e mapear tópicos da literatura de uma forma ampla (análise temática), permitindo evidenciar o campo de interesse e suas principais lacunas e bem como o direcionamento de pesquisas futuras (ARKSEY e O'MALLEY, 2005), sendo uma alternativa mais flexível quando comparado à revisão sistemática (PETERSON *et al.* 2017). Na Etapa 1, o estudo de escopo contou com uma amostra de 76 artigos e concentrou-se nos principais temas de pesquisas vinculados às conexões entre KIBS e empresas de manufatura, sendo estes divididos em três grandes categorias: os mecanismos envolvidos nestas conexões, os resultados intraorganizacionais destas conexões e os efeitos regionais. Além disso, foram levantados os principais pontos para o desenvolvimento de novas pesquisas na área.

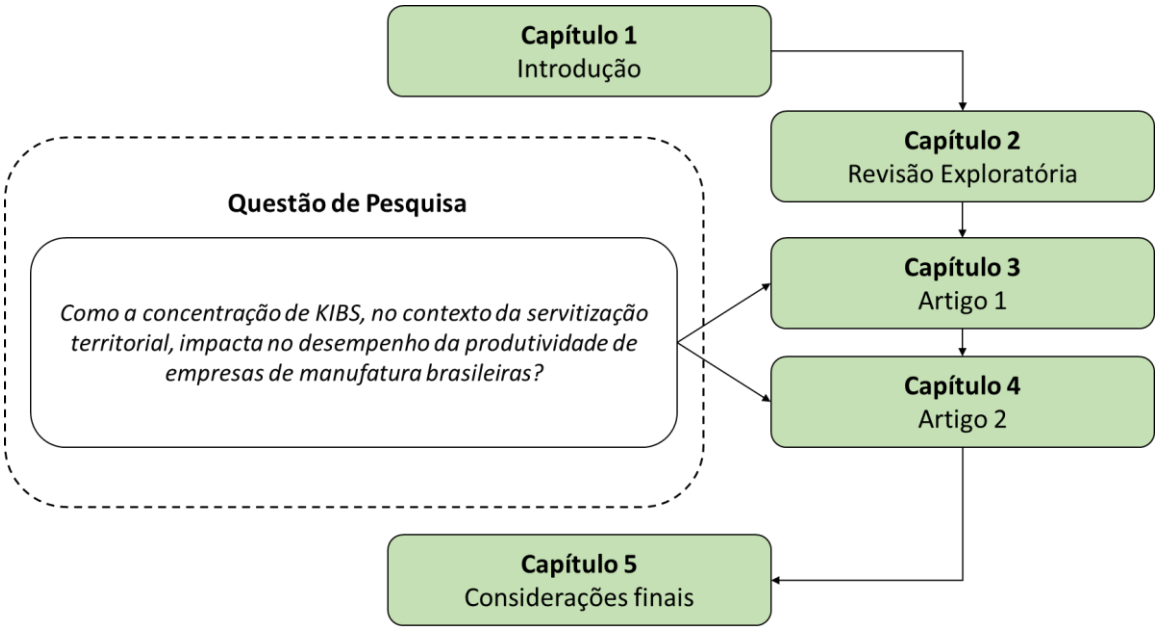
O **Artigo 2** – "*Knowledge-intensive business services and territorial servitization: the moderating role of absorptive capabilities".* Para atender à questão de pesquisa e o objetivo OP3 foi empregado o método da modelagem econométrica (GUJARATI e PORTER, 2011). Deste modo, foi realizada uma análise econométrica usando um modelo de regressão de limiar

de dados regionais e financeiros de 125 empresas de manufatura brasileiras coletados durante o período de 2010 a 2017. O uso de tal método permitiu a avaliação quantitativa dos impactos da concentração de KIBS na produtividade de empresas de manufatura, bem como determinar a importância da capacidade de absorção neste relacionamento.

## 1.4 ESTRUTURA DA DISSERTAÇÃO

Esta dissertação está organizada em cinco capítulos. O primeiro capítulo corresponde à apresentação da contextualização do tema, justificativa, problema de pesquisa e objetivos. O segundo capítulo, a Revisão Exploratória, está organizado em três seções. Na primeira seção apresenta-se servitização, na segunda é abordada a servitização territorial, na terceira e última seção tem-se as KIBS. O terceiro capítulo expõe o Artigo 1, que corresponde a uma revisão de escopo sobre os principais temas dispostos na literatura sobre as conexões entre KIBS e empresas de manufatura. O quarto capítulo expõe o Artigo 2, que avalia os principais efeitos da concentração de KIBS na produtividade de empresas de manufatura e determina níveis mínimos de capacidade de absorção. O quinto capítulo expõe as considerações finais. A Figura 1.1 sintetiza a estrutura completa desta dissertação.

Figura 1.1 - Estrutura da dissertação




Fonte: Elaborada pelo autor

# 2 REVISÃO EXPLORATÓRIA

Este capítulo tem como objetivo apresentar os fundamentos teóricos da dissertação. Portanto, ele está dividido em três seções: servitização, KIBS e servitização territorial.

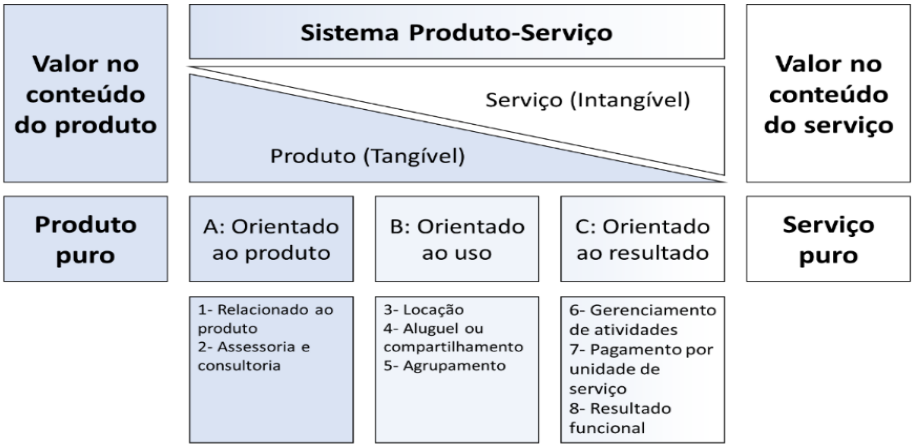
## 2.1 SERVITIZAÇÃO

Schmenner (2009) afirma que desde a segunda metade do século XIX, os fabricantes buscavam expandir suas operações com a oferta de serviços na intenção de diminuir a dependência de fornecedores e fortalecer o relacionamento com seus clientes. Porém, a partir do trabalho seminal de Vandermerwe e Rada (1988), a oferta de serviços por empresas de manufatura se torna mais estratégica. Os autores foram os primeiros a usar o termo servitização, que foi inicialmente definido como o processo de agregação de valor por meio da adoção de serviços aos produtos (VANDERMERWE e RADA, 1988).

Dado ao crescente interesse pelo tema, diversas comunidades de pesquisa, entre elas o marketing de serviços e a gestão e operações de serviços, passaram a se dedicar na investigação da oferta de serviços em empresas de manufatura (BIGDELI *et al.*, 2017; KOWALKOWSKI *et al.*, 2017). Logo, este fenômeno passou a ser associado a diferentes termos, tais como: transição de serviços (*Service Transition*) (KOWALKOWSKI *et al.*, 2015), infusão de serviços (*Service Infusion*) (KOWALKOWSKI *et al.*, 2012), ofertas hibridas (*Hybrid Offering*) (RAPACCINI; VISINTIN, 2015), solução integrada (*Integrated Solution*) (BRAX; JONSSON, 2009), e sistema produto-serviço (SPS) (*Product-Service System* – PSS) (BAINES *et al.*, 2007; TUKKER, 2004). Entre esses, dois conceitos se destacam. O primeiro é o PSS e o segundo é a servitização. Enquanto o primeiro refere-se à oferta integrada de produtos e serviços aos clientes (TUKER, 2004; 2015), o segundo passou a designar o processo de transformação ou transição que uma empresa de manufatura faz rumo a modelos de negócios mais orientados aos serviços (BAINES *et al.*, 2020).

Tukker (2004) propõe um modelo com oito tipos de PSS, divididos em três categorias: orientado ao produto, orientado ao uso e orientado ao resultado. Conforme ilustra a Figura 2.1, à medida em que se avança da primeira até a última categoria, a importância do valor no produto diminui. Simultaneamente, as necessidades dos clientes se tornam mais abstratas, ao passo que as ofertas priorizam o valor no serviço que é intangível, dificultando o fornecimento das soluções por parte dos provedores.

Figura 2.1 - Principais categorias e subcategorias de PSS




Fonte: Tukker (2004)

No PSS orientado ao produto, o modelo de negócio gira em torno dos produtos, com adição de alguns serviços extras somente durante a fase de uso, estando inclusos os PSS: 1) serviços relacionados aos produtos (exemplo: contrato de manutenção e serviços de reparo), 2) serviços de assessoria e consultoria para tornar o uso do produto mais eficiente (exemplo: treinamento sobre como usar os bens) (TUKKER, 2004, 2015).

No PSS orientado ao uso, a empresa passa a explorar a função básica do produto por meio da transformação do produto em serviço. Nesta categoria, a posse do produto e as atividades de manutenção e reparo são do provedor e, deste modo, ele é motivado a prolongar o ciclo de vida do produto por meio do uso de melhores materiais. Pode-se incluir os seguintes PSS: 3) locação (*leasing*), onde o cliente paga um valor referente ao uso ilimitado do produto por um tempo determinado; 4) aluguel/ compartilhamento (*renting/ sharing*), é da mesma natureza da locação, com a diferença de que o produto muitas vezes é compartilhado com mais usuários e o seu uso geralmente não é ilimitado; e 5) agrupamento (*pooling*), que é o mesmo que a locação, só que neste caso há o uso simultâneo do produto (TUKKER, 2004, 2015).

No PSS orientado ao resultado, provedores e usuários determinam o resultado da solução, mas os meios (por exemplo, produtos e serviços) envolvidos para alcançá-lo não são preestabelecidos. Nesta categoria, a posse do produto e atividades de manutenção e reparo também são do provedor e ele entrega somente a solução ao usuário. Estão inclusos os PSS: 6) gerenciamento de atividade, que é quando alguma atividade da empresa é terceirizada (exemplo: serviços de limpeza), e como boa parte destes serviços terceirizados possuem indicadores de desempenho, eles estão classificados nesta categoria; 7) pagamento por unidade

de serviço, um PSS que ainda tem o produto como base, porém o usuário não compra o produto mas sim as unidades de saída do mesmo (exemplo: número de cópias em contratos de impressão); 8) resultado funcional, provedores e usuários entram em acordo para a entrega de uma funcionalidade, mas o provedor é totalmente livre de como esta entrega será feita (exemplo: fornecimento de um "clima agradável" ao invés de ar condicionado ou aquecedor) (TUKKER, 2004, 2015).

Enquanto o conceito de PSS representa a oferta integrada de produto e serviços e abordado, principalmente, pelas áreas de engenharia e sustentabilidade; a servitização passou a ter um novo entendimento, que corresponde ao processo de transformação que as empresas de manufatura passam para que possam ofertar produtos e serviços (BAINES *et al*., 2020; FLIES e LEXUTT, 2019). Kowalkowski *et al.* (2017) definem servitização como o processo de transformação de um modelo de negócios centrado no produto para uma abordagem com foco no serviço. A servitização substitui a tradicional lógica focada nos produtos (*Product-dominant logic* – PDL) para a lógica focada em serviços (*Service-Dominant Logic* -SDL), ou seja, na SDL, os produtos são mecanismos para que a prestação de serviços ocorra, tendo o relacionamento com o cliente e a entrega da solução como prioridade do negócio (VARGO e LUSCH, 2004, 2008).

Nesta transição, as empresas de manufatura passam por mudanças nas estratégias, na estrutura organizacional, nos processos, nos recursos e nas capacidades (BAINES *et al*., 2020; FLIES e LEXUTT, 2019; ZHANG e BANERJI, 2017). As mudanças estratégicas referem-se às decisões estratégicas que as empresas de manufatura tomam para ao adotarem negócios orientados à serviços, por exemplo o compromisso estratégico com os serviços (BAINES *et al*., 2020; FLIES e LEXUTT, 2019; ZHANG e BANERJI, 2017). As mudanças organizacionais estão relacionadas às reconfigurações organizacionais, ou seja, as empresas de manufatura precisam adaptar sua arquitetura organizacional para atenderem as novas estratégias voltadas aos serviços, como por exemplo a adoção de uma cultura orientada a serviços (BAINES *et al.*, 2020; FLIES e LEXUTT, 2019). As mudanças nos processos são necessárias pois agora as empresas de manufatura deverão pensar em uma oferta de produto-serviço, o que afeta por exemplo os processos de desenvolvimento de produtos e a comercialização dos produtos e serviços (BAINES *et al.,* 2020; FLIES e LEXUTT, 2019; ZHANG e BANERJI, 2017). As mudanças nos recursos estão relacionadas à criação de uma infraestrutura que apoie a oferta de serviços, já as mudanças nas capacidades são relacionadas as novas habilidades desenvolvidas

para atender as necessidades dos clientes, por exemplo a capacidade de inovação em serviços (QUEIROZ, 2018; BAINES *et al*., 2020; FLIES e LEXUTT, 2019).

Muitas empresas de manufatura adquirem e/ou expandem suas competências em servitização por meio de parcerias colaborativa com as KIBS (BELLAND e SANTINI, 2019; BUSTINZA *et al.*, 2019). O aumento do nível de servitização das empresas de manufatura por meio de colaborações com as KIBS diminui os riscos da implantação de serviços internamente e permite que as empresas de manufatura adquiram conhecimentos para iniciarem suas operações de serviços (KOHTAMÄKI e PARTANEN, 2016; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017; LIU *et al.*, 2019). Como resultado, a servitização pode trazer benefícios para as empresas de manufatura como a entrada em mercados anteriormente inexplorados (GEBAUER e BINZ, 2019), melhorando seu posicionamento competitivo (LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017).

## 2.2 SERVITIZAÇÃO TERRITORIAL

Na literatura sobre servitização, Lafuente, Vaillant e Vendrell-Herrero (2017) expandiram os estudos relacionados a este tópico para além dos limites organizacionais. Tais autores definiram o conceito de servitização territorial como os resultados econômicos regionais (e.g. geração de empregos e novos negócios) que as associações mutuamente dependentes entre empresas de manufatura e as KIBS desenvolvem dentro de um determinado território. A origem do termo está relacionada a um território com uma base de manufatura resiliente, que estimula o consumo de serviços prestados pelas KIBS nas cadeias de valor, garantindo a expansão dos negócios (DE PROPIS e STORAI, 2019; LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017). Consequentemente, este estímulo atrai e colabora com a criação de novas empresas de manufatura, intensificando a competitividade local e contribuindo para geração novos empregos (LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017; LIU *et al.*, 2019).

Uma das preocupações dos artigos é com a conceituação/definição da servitização territorial. O Quadro 2.1 apresenta as principais definições para servitização territorial.

A análise dessas definições permite destacar alguns pontos, como: a i) coexistência simbiótica de KIBS e empresas de manufatura em um determinado território; ii) o importante papel das KIBS na transferência de conhecimento, aumento do nível de servitização e disponibilização de tecnologias às empresas de manufatura; iii) os efeitos regionais da

servitização territorial, como a geração de novos empregos e negócios, e o fortalecimento da competitividade econômica local.

Quadro 2.1 - Definições de servitização territorial

| **Referência** | **Definição** |
|---|---|
| Lafuente, Vaillant e Vendrell-Herrero (2017) | Sevitização territorial corresponde aos resultados econômicos regionais que as associações mutuamente dependentes entre empresas de manufatura e KIBS desenvolvem dentro de um determinado território. |
| Bellandi e Santini (2019) | Interação entre KIBS e empresas de manufatura, impulsionada por uma intensificação contínua de produções servitizadas e produtos inteligentes. |
| De Propis e Storai (2019) | Acoplamento simbiótico entre KIBS e empresas de manufatura em um determinado território, onde as empresas de manufatura expandem suas funções de negócios por meio da servitização através da complementaridade de conhecimento das KIBS. |
| Figueroa-Armijos (2019) | O desenvolvimento de setores de serviços direcionados que apoiam uma indústria de base como a manufatura, também chamada de servitização, pode gerar um impacto territorial generalizado. |
| Horváth e Rabetino (2019) | Servitização territorial refere-se aos processos de criação de valor territorial resultantes do aumento das interações entre fabricantes e KIBS. |
| Horváth e Berbegal-Mirabent (2020) | As KIBS podem contribuir para o desenvolvimento regional através da criação e transferência de conhecimento para empresas de manufatura regionais, conceito referido como servitização territorial. |
| Gebauer e Binz (2019) | A extensão dos serviços em empresas de manufatura e indústrias leva a competências de serviço, que fortalecem a produção e o emprego em um território específico. |
| Gomes *et al.* (2019) | A coexistência local interconectada de empresas de manufatura e KIBS é o fundamento da servitização territorial. |
| Liu *et al.* (2019) | Relação simbiótica entre os serviços empresariais intensivos em conhecimento (KIBS) e as empresas de manufatura tradicionais, podendo contribuir para a competitividade econômica local através da criação de novas oportunidades de manufatura e negócios locais. |
| Sforzi e Boix (2019) | Envolve uma interdependência entre empresas de manufatura e KIBS em um determinado território. |

Fonte: Elaborado pelo autor

A partir do estudo de Lafuente, Vendrell-Herrero e Vaillant (2017) outros pesquisadores passaram a investigar este fenômeno sob diferentes perspectivas. Por exemplo, Horváth e Rabetino (2019) identificaram que para que a servitização possa trazer benefícios regionais não basta apenas uma base de manufatura resiliente, é necessário que o ecossistema na qual estas empresas estão inseridas tenha uma característica empreendedora, ou seja, um ambiente institucional que apoie o empreendedorismo. Gomes *et al.* (2019) constataram que regiões com maior taxa de concentração KIBS, ou seja, a porcentagem de KIBS sobre o número de negócios totais, possuem maiores níveis de servitização territorial. Outros fatores interferem neste nível, como por exemplo, a exposição ao comércio (medida pelo número de fretes) e o conhecimento acumulado (medido pelo número de patentes). Por fim, Figueroa-Armijos (2019) descrevem a importância de políticas governamentais (como por exemplo financiamento público) que

apoiem o desenvolvimento dos setores de manufatura e KIBS, visto que estes são a base para desenvolvimento da servitização territorial.

Na servitização territorial, as KIBS assumem importante papel nos processos de transformação para a servitização das empresas de manufatura, além de potencializam o desenvolvimento regional (LAFUENTE; VAILLANT; VENDREL-HERRERO, 2017; LIU *et al.*, 2019). A presença de KIBS nas regiões colabora para que as empresas de manufatura sejam provedoras de soluções produto-serviço, ou seja, se tornem servitizadas (GOMES *et al.*, 2019) além de aumentarem a probabilidade de as empresas de manufatura promoverem inovações em produtos e serviços (GEBAUER e BINZ, 2019). Ademais, as conexões entre KIBS e empresas de manufatura estimula a criação de novas empresas, e consequentemente, a geração de empregos (LAFUENTE; VAILLANT; VENDRELL-HERRERO, 2017).

## 2.3 *KNOWLEDGE-INTENSIVE BUSINESS SERVICES*

As KIBS são empresas que fornecem serviços empresariais que exigem conhecimentos técnicos, científicos e/ou profissionais para que estes sejam desenvolvidos (GUIMARÃES e MEIRELLES, 2014; MILES *et al.*, 1995). Alguns aspectos caracterizam as KIBS. Primeiro, o principal produto da sua relação com seus clientes é o conhecimento, considerado seu fator de produção mais importante; o segundo aspecto é o relacionamento com seus clientes, caracterizado pela intensa comunicação e interação com seus usuários; e por último, sua atividade de solução de problemas através da adaptação de suas experiências às necessidades dos clientes (MILES *et al.*, 1995; MULLER e ZENKER, 2001; STRAMBACH, 2001).

Miles (2012) classifica as KIBS em três categorias: *Professional*-KIBS (P-KIBS), *Technological*-KIBS (T-KIBS) e *Creative*-KIBS (C-KIBS). As P-KIBS são serviços profissionais tradicionais que dependem do conhecimento especializado de vários tipos, como por exemplo: contabilidade e serviços jurídicos (MILES, 2012). As T-KIBS referem-se aos serviços especializados que requerem conhecimento técnico e científico, como os serviços relacionados a tecnologia da informação (TI) e serviços de engenharia (MILES, 2012). As C-KIBS estão ligadas aos serviços relacionados à indústria criativa, como os serviços de design e arquitetura (DOROSHENKO; MILES; VINOGRADOV, 2014; MILES, 2012). O Quadro 2.2 apresenta as categorias de KIBS e exemplifica alguns tipos de serviços em cada uma delas.

As KIBS desempenham importante papel na geração e transferência do conhecimento (STRAMBACH, 2001; MULLER e ZENKER, 2001; GEBAUER e BINZ, 2019), os quais são

conhecidos por serem bidirecionais, ou seja, ao mesmo tempo em que as KIBS transmitem conhecimento para empresas clientes, as empresas clientes também transmitem seu conhecimento para as KIBS, fortalecendo a competitividade de ambas as empresas (ASLESEN e ISAKSEN, 2007; CORRECHER e CUSMANO, 2014; KAMP e RUIZ DE APODACA, 2017).

Quadro 2.2 - Tipologia KIBS

| P-KIBS | T-KIBS | C-KIBS |
|---|---|---|
| Treinamento | Desenvolvimento de Software | Design |
| Serviços financeiros (por exemplo, títulos e atividades relacionadas ao mercado de ações) | Treinamento em novas tecnologias | Marketing |
| | Design envolvendo novas tecnologias | Publicidade |
| | Redes de computadores | Arquitetura |
| Serviços de escritório | Consultoria envolvendo novas tecnologias | |
| Consultoria de Gestão | Engenharia | |
| Contabilidade | Pesquisa e Desenvolvimento (P&D) | |
| Serviços jurídicos | Consultoria em P&D | |
| | Telecomunicações (especialmente novos serviços empresariais) | |

Fonte: Miles (2012); Miles *et al.* (1995)

As principais empresas de manufatura que colaboram com as KIBS são as Pequenas e Médias Empresas (PME) (KAMP e ALCADE, 2014). As PME que interagem com KIBS têm maiores propensões à inovação, visto que as KIBS são conhecidas por apoiarem os processos de inovação nas empresas de manufatura (DOLOREUX e MATTSON, 2008; CAINELLI; DE MARCHI; GRANDINETTI, 2019). Outra razão pela qual as PME buscam as KIBS são para elevarem os níveis de servitização, pois estas empresas não contam com recursos e capacidades necessárias para desenvolver e ofertar serviços, então, elas buscam as KIBS para complementarem suas competências (VENDRELL-HERRERO e WILSON, 2017).

Neste sentido, a aproximação geográfica entre KIBS e empresas de manufatura é interessante e deve ser buscada (BUSTINZA *et al.*, 2019a; KOCH e STAHLECKER, 2006. Afinal, os custos de transação são inferiores quando as empresas se aglomeram geograficamente (ANTONIETTI e CAINELLI, 2008; ASLESEN e ISAKSEN, 2007), o que acaba incentivando o uso de KIBS e facilitando atividades inovadoras nas PME (HU; LIN; CHANG, 2013). Neste sentido, os formuladores de políticas regionais devem propor medidas que incentivem a interação entre as KIBS e as empresa de manufatura (ANTONIETTI e CAINELLI, 2008; CIRIACI e PALMA, 2016; GOMES *et al.*, 2019; HE; WONG, 2009; LIU *et al.*, 2019), pois as KIBS são consideradas uma fonte de desenvolvimento econômico baseado

em conhecimento (WYRWICH, 2019), sendo um importante aliado ao desenvolvimento econômico de indústrias (ASLESEN e ISAKSEN, 2007; BRENNER *et al.*, 2018), regiões (BUSTINZA *et al.*, 2019a; CORROCHER e CUSMANO, 2014; MULLER e ZENKER, 2001) e países (BUSTINZA *et al.*, 2019a).

# 3 ARTIGO 1 - THE INTERPLAY BETWEEN KIBS AND MANUFACTURERS: A SCOPING REVIEW OF MAJOR KEY THEMES AND RESEARCH OPPORTUNITIES

ABSTRACT

Knowledge-intensive business services (KIBS) collaborate with manufacturers to increase their knowledge, stimulate innovation, and support the implementation of service-oriented business models. In addition, KIBS firms are also known to stimulate regional economic development. Hence, this study aims to identify the key research themes and future opportunities in the convergent literature addressing the interplay between KIBS and manufacturers. A scoping review was adopted to map key themes in the KIBS and manufacturing literature. A sample of 76 focal articles was analyzed using descriptive and thematic analyses. Results of the scoping review are presented consolidating three categories of analysis: (i) mechanisms of connections between KIBS and manufacturers, such as value co-creation, knowledge transfer, innovation, and servitization, (ii) results at firm-level, such as competitiveness, organizational and financial performance (iii) results at regional-level, such as economic development, KIBS agglomeration, and public policies. An agenda for future research is proposed.

KEYWORDS: Knowledge-Intensive Business Services; KIBS; Manufacturers; Territorial Servitization; Servitization

## 3.1 INTRODUCTION

Knowledge-intensive business services (KIBS) are central actors in knowledge-based economies considering their role as pivotal agents of knowledge transformation and innovation development (da Silva et al., 2007; Horváth and Rabetino, 2019; Miles, 2011). Furthermore, KIBS firms are sources of competitive capabilities - mainly for manufacturers (Muller and Zenker, 2001; Strambach, 2008). In this sense, Miles (2011) presents three types of KIBS based on the services they offer: (i) P-KIBS provide professional services (e.g., accounting, consulting, and legal assistance services); (ii) T-KIBS offer specialized services related to technology (e.g., technology providers, software developers) and (iii) C-KIBS provide design and creative services (e.g., design companies and industrial architecture).

Collaborations between KIBS and manufacturers have long attracted the interest of researchers and practitioners (Muller and Zenker, 2001; Liu et al., 2019). They have been investigated under three main perspectives. The first one deals with the changes in the internal processes and the achievement of new competitive advantages resulted in manufacturers due to the collaboration with KIBS (e.g., Rajala et al., 2008; Shearmur and Doloreux, 2013). The second one emphasizes how these collaborations with KIBS firms play an important role in

developing and revitalizing regional competitiveness (Lafuente et al., 2017). Another more recent perspective found that collaborating with KIBS may offer opportunities to manufacturers to create bundles of products and services without the need for large in-house investments (Bustinza et al., 2019a).

Servitization strategy refers to the transformational process by which manufacturers implement service-oriented business models (Raddats et al., 2019). This strategy calls for an ecosystem approach and, hence, expands the organization´s boundaries to include a multi-actor perspective (Sklyar et al., 2019). For instance, manufacturers rely on external partners (e.g., KIBS) to develop new service capabilities or to provide services (Tronvoll et al., 2020). In the literature, the symbiotic relationship between KIBS and manufacturers in the servitization context is termed territorial servitization and can generate multiple benefits for both the involved firm as well as can create regional development (Horváth and Rabetino, 2019; Lafuente et al., 2017). In particular, the collaborative partnerships between KIBS firms and manufacturers contribute to regional development through job creation, territorial resilience, manufacturing renaissance and, enhancement of aggregate competitiveness levels in regions (Gebauer and Binz, 2019; Lafuente et al., 2017).

Despite the importance of the collaborations between KIBS firms and manufacturers, the academic coverage on this theme is still fragmented. Moreover, there is a lack of understanding on which are the mechanisms that stimulate the collaboration between KIBS and manufacturers, as well as the firm-level and regional-level effects of this interplay (Vendrell-Herrero et al., 2020a; Vendrell-Herrero and Wilson, 2017; Liu et al., 2019). Therefore, this article aims at examining the convergent literature on this theme based on a scoping review of the literature. In particular, two specific goals are addressed: (i) identify the themes covered in this convergent literature and (ii), highlight new opportunities for future research. For these purposes, a sample of articles (76 articles) was analyzed considering descriptive and thematic analyses. Content analysis techniques were used to access the content of the articles to identify four categories of analysis: (i) mechanisms of connections between KIBS and manufacturers, (ii) results at firm-level, (iii) results at regional-level, and (iv) research opportunities.

By incorporating the territorial servitization stream into collaborative partnership literature, this paper generates useful theoretical underpinnings to shed light on the nuanced interactions between KIBS and manufacturers. In particular, this study contributes in three ways. First, it uncovers the mechanisms (e.g., value co-creation, knowledge transfer, innovation support, and servitization implementation) around key research themes discussed in the

convergent literature between KIBS and manufacturers. Second, it contributes to clarifying the firm-level and regional-level effects from this interplay, thus reinforcing the systemic effects. Third, it presents future research directions, that is, research opportunities related to the research involving the interplay between KIBS and manufacturers. These opportunities represent potential research gaps that emerged from the analyzed focal articles.

## 3.2 RESEARCH METHOD

Our research method followed scoping study procedures proposed by Arksey and O'Malley (2005) comprising five steps: (i) identify the research question, (ii) identify relevant studies, (iii) select the studies, (iv) map the data, and (v) present the results.

### 3.2.1 Identifying the research question

A research question should guide the steps followed in a Scoping Review. More important, it defines the literature that will be under investigation (Arksey and O'Malley, 2005). In this study, the adopted research question was: *What are the main themes by the convergent literature concerning the interplay between KIBS and manufacturers?*

### 3.2.2 Identifying relevant studies

The search keywords were chosen based on several studies (e.g., D'Antone and Santos, 2016; Vivas and Barge-Gil, 2015). The search string included the intersection (AND) between the first two keywords sets: knowledge-intensive business service ("knowledge-intensive business service*" OR KIBS) and manufacturers (produc* OR manufactur* OR industr*). Documents were selected in May 2020 considering two databases: Scopus and ISI Web of Science. These two databases were included because they are comprehensive databases that have been the primary sources of information in many literature reviews. In addition, these databases are recognized for their quality standards and impact indicators (Pranckutė, 2021). The initial search returned 457 documents from Scopus and 401 documents from ISI Web of Science. The inclusion criteria selected were English articles and published in peer-reviewed journals. Non-English language articles are usually excluded in reviews because of the cost and time involved in translating the material (Arksey and O'Malley, 2005). Also, this is a common

feature of reviews (e.g., Raddats et al., 2019). After applying these filters and discarding duplicates (243 articles), 395 articles were analyzed.

### 3.2.3 Selecting the Studies

Eligibility criteria were applied to ensure the relevance of the final sample. To be included in the sample, the articles had to (i) present evidence about the connections between KIBS and manufacturers, and (ii) access to the full content of the article. Two members of the research team were involved in reading the titles, abstracts, and keywords following procedures defined by Levac et al. (2010). When a consensus was not reached, a third author was involved. Articles were excluded when they did not meet the eligibility criteria. Thus, 309 articles were discarded based on the first criterium, and 10 articles were discarded based on the second. Based on these procedures, 76 focal articles comprise our final sample, as displayed in Figure 1.

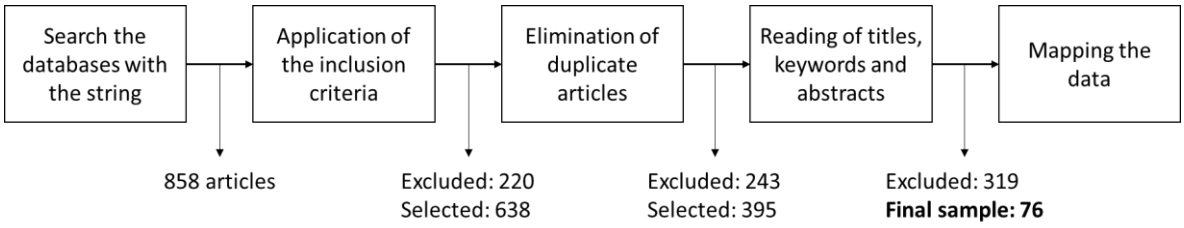



Figure 3.1 - Literature search process

### 3.2.4 Mapping the data and reports on the results

We analyzed the focal articles as suggested by Arksey and O'Malley (2005) in two ways: descriptive and thematic. In the descriptive analysis, we extracted the articles' basic information such as the frequency of publications, journals, author´s countries, and most cited articles. In the thematic analysis, content analysis was performed with the support of NVivo 11 Plus software for coding processes, results comparison, and crossing information. We explored both the manifest and latent contents of the focal articles based on Erlingsson and Brysiewicz (2017), and Tronvoll et al. (2020). The codification of text fragments concentrated on the following article' sections: introduction, results, and conclusions.

The coding process was iterative, and it involved discussions among the research team. Figure 2 shows the final coding structure developed during the content analysis. The first-order codes emerged from the classification of the extracted text fragments (614 fragments), and they referred to (i) mechanisms, (ii) firm-level results, (iii) the regional-level effects. Next, the first-order codes were grouped into three main themes (second-order codes). Finally, we aggregated the second-order codes into a high-level category. The same process was employed for the identification of research opportunities.

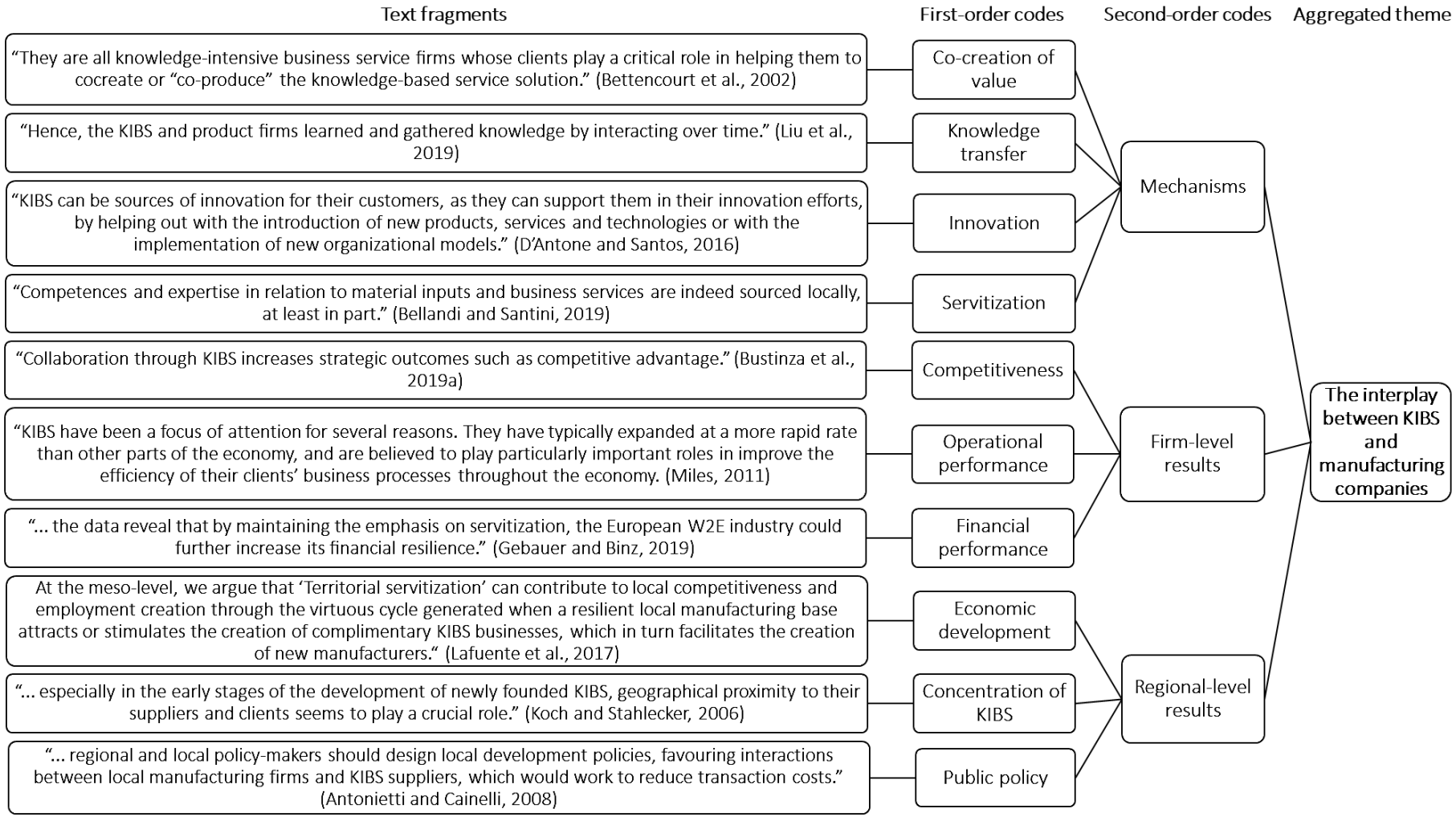



Figure 3.2 - Coding structure

3.3 RESULTS

### 3.3.1 Descriptive Analysis

Figure 3 displays the descriptive numerical summary of the focal articles. The first publication was in 1994 (Strambach, 1994). Between 2007 and 2019 there was an increase in the number of publications, peaking in 2019 due to a special issue of the Regional Studies Journal (number 53, 2019) oriented to the topic "Territorial Servitization, manufacturing renaissance, and KIBS". Articles from 2020 were included until the search date (May 2020). The most prolific journals and countries with the most author´s affiliations are also shown in Figure 3. Finally, the articles were classified based on their main research objectives. The majority of the articles (58%) address mechanisms involving in the connections between KIBS and manufacturers (e.g., Bettencourt et al., 2002), 20% out of the sample focused on the firm-level results (e.g., Vivas and Barge-Gil, 2015), and 22% out of the articles discuss regional-level effects (e.g., Lafuente et al., 2017). For more details about this general classification, see Figure 1A in Appendix I.

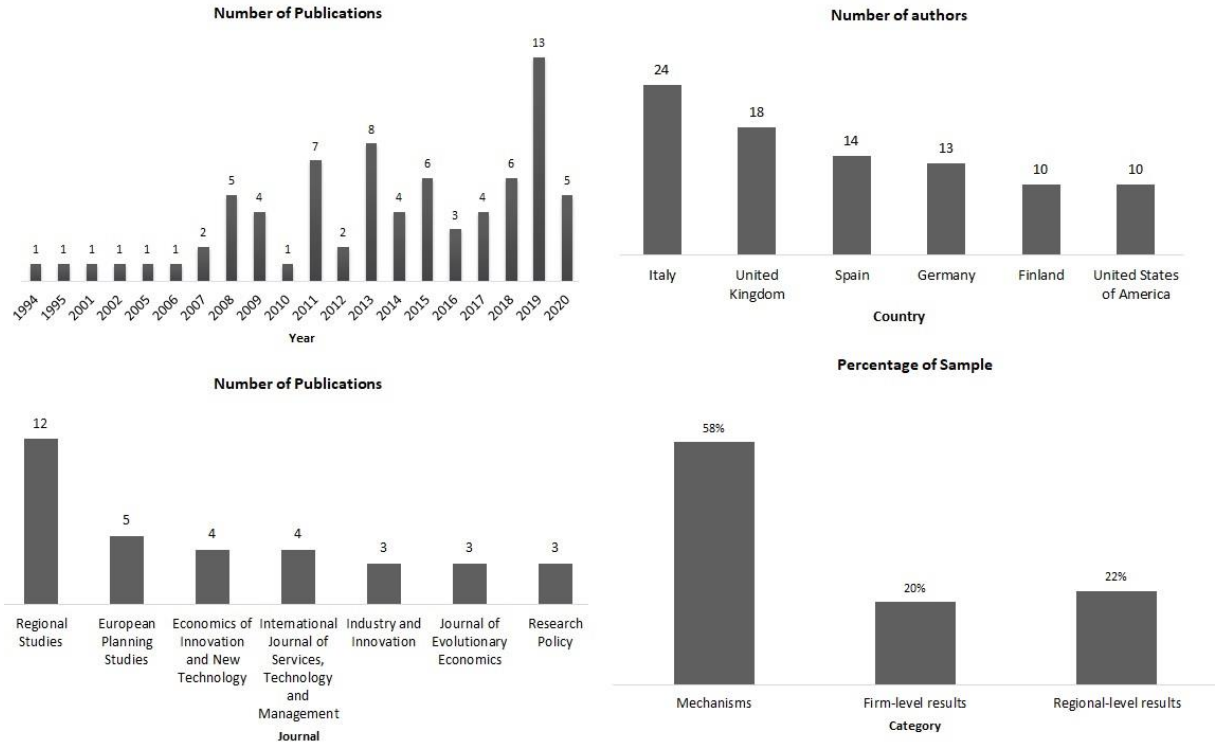



Figure 3.3 - A quantitative summary of the descriptive analysis of the articles

Figure 3.4 presents the 10 most influential articles based on their average citations per year. Bustinza et al. (2019b) demonstrate how manufacturers can benefit from collaborations with KIBS companies when implementing the servitization strategy. Muller and Zenker (2001) emphasize the role and function of KIBS companies in innovation systems and their knowledge production, transformation, and diffusion activities. Yam et al. (2011) highlight that KIBS can serve as a link between manufacturers and the innovation systems. Bettencourt et al. (2002) emphasize the importance of co-creation processes between KIBS and manufacturers. The other articles deal with several themes such as territorial servitization (Lafuente et al., 2017; Vendrell-Herrero et al., 2018; Gomes et al., 2019), knowledge transfer (Strambach, 2008; Kohtamäki and Partanen, 2016) and modularity in services (Miozzo and Grimshaw, 2005).

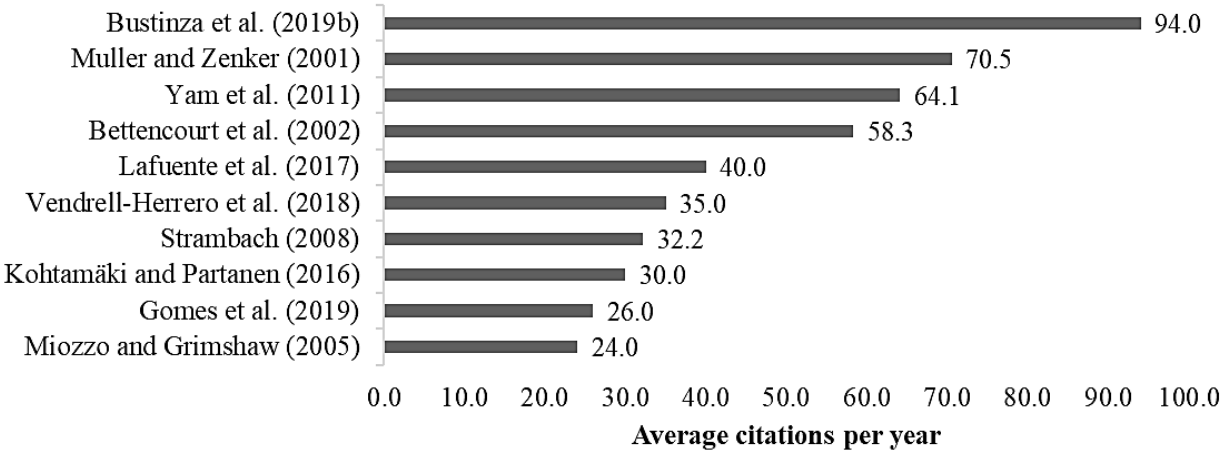



Figure 3.4 - Most influential articles

Source: Google Scholar, accessed in May 2020.

### 3.3.2 Thematic Analysis

A thematic approach was adopted to identify research themes covered by the focal articles. As shown in Figure 2. The first category encompasses the mechanisms that lead to the collaborations between KIBS and manufacturers such as co-creation, knowledge transfer, innovation, and servitization. A second category encompasses firm-level results such as operational performance, financial performance, and competitiveness increase. The third category deals with the impacts of the connections in a territorial (regional-level) perspective such as economic development, KIBS agglomeration and, public policy development.

#### 3.3.2.1 Mechanisms

*Value co-creation.* Co-creation is a central theme in many articles in our sample (e.g., Bettencourt et al., 2002; Kohtamäki and Partanen, 2016), revealing that this is one of the most important connection processes between KIBS and manufacturers. Co-creation refers to the joint creation of value by KIBS and manufacturers to solve specific challenges, generate new knowledge or develop a new product. Indeed, it is the desired outcome in a KIBS-manufacturing company interaction (Bettencourt et al., 2002; Cainelli et al., 2019). There is a general assumption that the more KIBS companies co-create with manufacturers, the more they collect valuable information and exchange knowledge that are relevant to their development (Bolisani and Scarso, 2009; Sole and Carlucci, 2010). In this sense, KIBS companies acquire knowledge from customers' businesses, learn customer skills, and improve their services based on customer needs (Bettencourt et al., 2002; Doroshenko et al., 2014). Conversely, the services provided by KIBS are highly complex and customized, benefiting manufacturers by increasing their capabilities (Cainelli et al., 2019; Doroshenko et al., 2014). Therefore, co-creation can form a virtuous cycle between these two types of organizations.

The process of co-creation is facilitated by processes of communication, transparency, and trust between the involved parties (Cabigiosu and Campagnolo, 2019; Zieba and Kończyński, 2020). The value co-creation also is dependable on the intensity of the relationship between KIBS and manufacturers and the positive results of previous interactions (Bettenbourt et al., 2002; Zieba and Kończyński, 2020). Learning and relational capabilities for co-creating services are also highlighted in the literature (Kohtamäki and Partanen, 2016). Consequently, negative previous experiences and the lack of trust, access, dialogue, and transparency affect the willingness to collaborate and the benefits of co-creation (Doroshenko et al., 2014). In short, KIBS and manufacturers should emphasize the co-creation processes based on trust, commitment, reciprocity, and power structure to develop a win-win relationship that is sustainable and positive for the organizations involved in the collaborations.

*Knowledge Transfer.* Knowledge transfer is another important research theme in the literature covering the interplay between KIBS and manufacturers (Sole and Carlucci, 2010; Yam et al., 2011). KIBS companies are facilitators of knowledge transfer and diffusion in innovation systems (Bettiol et al., 2013b; He and Wong, 2009). For example, T-KIBS and C-KIBS transfer new methods and technologies for manufacturers (Seclen and Barrutia, 2018; She and Nagahira, 2012), while P-KIBS offer services related to innovation, intelligence

strategies and, productivity improvements (Miles, 2011; Zhou et al., 2017). In other words, T-KIBS companies contribute more to knowledge accession and knowledge utilization, whereas P-KIBS act as knowledge bridges contributing to knowledge identification and knowledge accession (Zhou et al., 2017). Thus, the type of knowledge transfer differs concerning the type of KIBS companies.

The knowledge transferred by KIBS companies to their clients aims at allowing them to develop new competencies, innovations, and technologies (Doloreux and Shearmur, 2013; Paiola et al., 2013). Haakonsson et al. (2020) discuss the transmission mechanisms for knowledge transfer: (i) parceled transmission (a one-way knowledge transaction involving the provision of access to proprietary embodied knowledge); (ii) co-located transmission (unidirectional transmission of tacit knowledge: involving a degree of 'socialization' or face-to-face engagement) and, (iii) interactive transmission (bidirectional transfer and creation of tacit knowledge due to co-creation of knowledge produced by KIBS and client in intensive collaborations). The evidence confirms that the reciprocal and bi-directional interactions are most effective in fueling the knowledge generation process (Antonelli and Gehringer, 2015). In this sense, KIBS companies also benefit from knowledge transfer (Antonelli and Gehringer, 2015; Grandinetti, 2011). For instance, KIBS companies can increase their capacity to offer services and enhance their knowledge base (Muller and Zenker, 2001).

The integration of competencies between KIBS and manufacturers is the most effective driver to support the generation and transfer of new knowledge (Antonelli and Gehringer, 2015). However, clients need to have the absorptive capabilities to incorporate this new knowledge (Huggins, 2011; Doroshenko et al., 2014). In the same vein, KIBS companies also need absorptive capabilities to enhance their stock of knowledge (Daghfous et al., 2013; Grandinetti, 2011). In general, studies have emphasized that small and medium enterprises (SMEs) face more difficulties to absorb knowledge due to their relative lack of capabilities, costs involved, and time in the knowledge transfer processes (Aslesen and Isaksen, 2007; Vivas and Barge-Gil, 2015). Furthermore, SMEs have problems in identifying which knowledge and which technologies are necessary for their business, although they depend on partnerships with KIBS to complement their competitive assets (Bolisani and Scarso, 2009). In this sense, the absorptive capacity of the companies involved in the processes of knowledge transfer and generation can be seen as a key factor for successful and productive collaborations.

*Innovation support.* Innovation is another research theme in the literature between KIBS and manufacturers (e.g., Shearmur and Doloreux, 2013; Wu et al., 2014). There is a connection between innovation and other previously discussed mechanisms. However, in this section we focus on the roles performed by KIBS companies when supporting the innovation development in manufacturers such as (i) provision of ideas and services related to new products, services, and processes (Santos, 2020; Shearmur and Doloreux, 2015); (ii) intermediation in innovation processes by establishing connections between technology suppliers and users (Bettiol et al., 2013a; Corrocher et al., 2009); (iii) organization of operational innovation processes (Doroshenko et al., 2014; He and Wong, 2009); and (iv) optimization of innovation processes making them more efficient (Mas-Verdú et al., 2011).

Concerning innovation outcomes, it is well-known the use of KIBS in manufacturing innovation processes has a strong positive effect (Audretsch and Belitski, 2019; Doloreux and Shearmur, 2013; Rodriguez, 2013). KIBS companies contribute more to radical innovations rather than to incremental innovations in manufacturers (Koch and Strotmann, 2008; Cao et al., 2011). More cooperative companies tend to achieve better innovation outcomes than non-cooperative firms, which is consistent for KIBS and manufacturers (Doloreux and Mattson, 2008). Notwithstanding, Cabigiosu and Campagnolo (2019) discuss that highly innovative KIBS focuses more on growth rather than on collaborations. This means that, in the KIBS domain, innovation might have controversial results depending on the type of innovations and the timing of entry. Therefore, the complex relationships between innovation and growth in KIBS remain ambiguous.

*Servitization implementation.* A recent theme in the convergent literature between KIBS and manufacturers is servitization and, mainly, the Territorial Servitization (Lafuente et al., 2017). In the servitization strategy, manufacturers provide services to their clients which can be developed internally or outsourced (Liu et al., 2019; Vendrell-Herrero et al., 2020b). Local KIBS provide manufacturers with a vast stock of knowledge and help them develop and supply value-adding services (Lafuente et al., 2017). Several studies (e.g., Gebauer and Binz, 2019; Liu et al., 2019) describe how collaborations with KIBS allow manufacturers to achieve better results with the offer of services.

KIBS companies can contribute to the servitization in several ways. First, outsourcing services aim to reduce the risks related to the servitization since the manufacturers can acquire external knowledge, innovation capabilities, and resources for providing services (Bustinza et

al., 2019a; Doloreux and Shearmur, 2012). Second, offering service packages to the manufacturers' clients (Lafuente et al., 2017; Liu et al., 2019). Third, allowing manufacturers to concentrate on their essential activities (Bengtsson and Dabhilkar, 2009; Rajala et al., 2008). Thus, KIBS companies support the manufacturers in the servitization implementation (Bellandi and Santini, 2019; Bustinza et al., 2019a). In this sense, Gomes et al. (2019) provide empirical evidence showing that in regions where there is a high concentration of KIBS, the level of servitized manufacturers is also higher. Therefore, KIBS firms enable the implementation of servitization strategies by manufacturers.

Many manufacturers have implemented servitization and digitalization, a phenomenon called digital servitization (Bustinza et al., 2019a; Gebauer and Binz, 2019; Haakonsson et al., 2020). Digital technologies such as the Internet of Things (IoT), sensors, and big data have the potential to amplify and optimize the provision of advanced services to clients (Bustinza et al., 2019a). In this sense, KIBS companies are important agents for digital servitization. One example of services provided by KIBS is the management of large samples of digital information, namely big data (Lafuente et al., 2017). Moreover, KIBS companies can act as innovation bridges that interplay with other agents to develop digital infrastructures and other forms of innovation linked to digital servitization and the development of platform ecosystems. Thus, the intensified use of smart products and smart services should contribute to connections between KIBS and manufacturers (Bellandi and Santini, 2019).

#### 3.3.2.2 Firm-level results

*Competitiveness.* Several studies (e.g., Kamp and Ruiz de Apodaca, 2017; Shearmur et al., 2015) show that the collaboration with KIBS improves the competitive advantage of manufacturers. For instance, Gomes et al. (2019) argue that collaboration between SMEs and KIBS companies develops economies of scale. KIBS companies also increase their competitive advantage due to the development of new services and competencies (Seclen and Barrutia, 2018; Zhou et al., 2017). In summary, the collaborations with KIBS are essential for the development of new skills, capabilities, and resources that enhance the competitiveness of manufacturers, since they allow the development of new business trends such as digital transformation, technological innovation, and servitization.

*Organizational performance.* Several studies present improvements in the organizational performance of manufacturers such as productivity (Antonelli and Gehringer, 2015; Broersma and Van Ark, 2007), operational efficiency (Gebauer and Binz, 2019; Zhou et al., 2017), quality of services (Bengtsson and Dabhilkar, 2009; O'Farrell and Moffat, 1995), quality (Bengtsson and Dabhilkar, 2009; Gebauer and Binz, 2019), flexibility and differentiation (Bustinza et al., 2019b; Hu et al., 2013), competencies in product optimization (Gebauer and Binz, 2019) and lead-time reduction (Miozzo and Grimshaw, 2005). Besides operational and technological improvements, collaborations between KIBS and manufacturing have an impact on both companies´ mindsets changing their organizational values as well (Sole and Carlucci, 2010; Yam et al., 2011).

*Financial performance.* The financial returns resulted from the interplay between KIBS and manufacturers is a research topic that has received less attention from researchers. Some indirect evidence shows that KIBS companies contribute to positive effects on sales of manufacturers and new business opportunities (Kamp and Ruiz de Apodaca, 2017; Kite, 2018; Vivas and Barge-Gil, 2015). Gebauer and Binz (2019) state that not only KIBS but also servitization in manufacturers enhance the competitiveness of an industry in a certain territory, while at the same time competitiveness boosts servitization, facilitating the growth and resilience of the manufacturing industry.

#### 3.3.2.3 Regional-level results

*Economic development.* KIBS companies are considered as agents of development (e.g., gatekeepers and connectors) in the innovation systems (Hu, 2017; Muller and Zenker, 2001; Wyrwich, 2019). Thus, they can contribute to both company and regional long-term economic growth (Brenner et al., 2018). In regions where KIBS growth is higher, the rate of job creation at manufacturers also increases, making these regions more resilient to technological or market turbulences, strengthening economic indicators, and generating more jobs (Bellandi and Santini, 2019; de Propris and Storai, 2019). Therefore, the connections between KIBS and manufacturers are essential for revitalizing local manufacturing sectors by developing new competencies and providing innovative services and technologies (e.g., Gebauer and Binz 2019; Lafuente et al., 2017; Liu et al., 2019).

*KIBS agglomeration.* Traditionally, authors have focused on the agglomeration of firms in the same place (Belso-Martínez et al., 2011). In this context, geographical proximity and a strong feeling of belonging enhance collaborations, trust and, reciprocity (Aslesen and Isaksen, 2007; Doloreux and Mattson, 2008). They also favor the exchange of high-quality information and tacit knowledge. In other words, agglomeration of KIBS and manufacturers result in knowledge spillovers, learning by proximity (Hu et al., 2013; Liu et al., 2019), and transaction cost reductions (Antonietti and Cainelli, 2008; Aslesen and Isaksen, 2007). Therefore, agglomeration economies and knowledge spillover effects are important in developing internal resources and capabilities for both KIBS and manufacturers (Bustinza et al., 2019b; Koch and Stahlecker, 2006). Moreover, they should be understood as drivers of regional growth (D'Antone and Santos, 2016).

Certain urban areas contain higher concentrations of KIBS for several reasons. First, they supply qualified professionals to KIBS companies (Aslesen and Isaksen, 2007; di Giacinto et al., 2020). Second, these areas favor new business creation (Jacobs et al., 2014), which attracts new KIBS companies. Lastly, there are more manufacturers in these areas (di Giacinto et al., 2020; Hsieh et al., 2015), which guarantees more opportunities for collaboration (Corrocher and Cusmano, 2014; Horváth and Rabetino, 2019; Wyrwich, 2019). In conclusion, there are positive effects from the agglomeration between KIBS and manufacturers. However, it is necessary to pay attention to externalities to leverage these effects. These externalities are external concerning the individual firm but internal to spatial agglomerations (Belso-Martínez et al., 2011).

*Public policy development.* Many studies agree that support from governments via public policy is essential for developing collaborations between KIBS and manufacturers (Figueroa-Armijos, 2019; Liu et al., 2019). Thus, public agents should propose policies to forming complex and extensive cooperative networks and active cooperation between KIBS and manufacturers. In special, policymakers should stimulate digital infrastructures that facilitate data management and sharing (Lafuente et al., 2017), multi-sectoral platforms to reduce transaction costs (Bellandi and Santini, 2019; Ciriaci and Palma, 2016), and channels to promote and increase the visibility of the services provided by local KIBS companies (Antonietti and Cainelli, 2008; Kamp and Ruiz de Apodaca, 2017). Other measures might be the creation of incubators and accelerators (de Propris and Storai, 2019), and the development of institutional training and learning (Doroshenko et al., 2014; Gomes et al., 2019). At the

macro-level, the literature reinforces how governmental policies have a role to achieve the firm-level and regional-level effects of the interplay between KIBS and manufacturers.

## 3.4 CONCEPTUAL FRAMEWORK

We developed a conceptual framework (Figure 5) to highlight the main mechanisms concerning the interplay between KIBS and manufacturers as well as their potential results. In addition, we present research propositions that emerge from the discussions made in the previous sections.

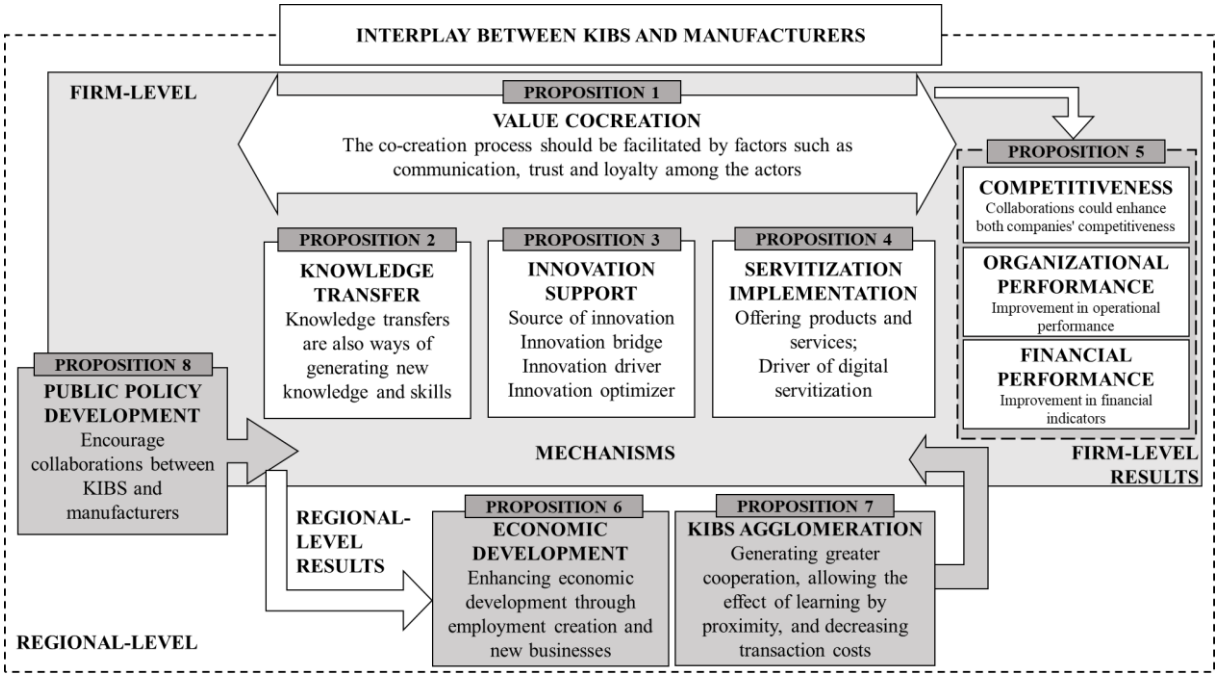



Figure 3.5 - Conceptual Framework of the Interplay between KIBS and Manufacturing firms

First, several factors such as commitment, dialog, transparency, and reciprocity are essential for the effective collaboration between manufacturers and KIBS firms (Doroshenko et al., 2014; Zieba and Kończyński, 2020). Indeed, in the exchange of value, both companies act as value co-creators. Moreover, the co-creation process is an umbrella mechanism that supports the development of value-based knowledge networks based in the ecosystem approach. This leads to the following research proposition 1:

*Proposition 1: A value co-creation perspective is essential to support the interplay between KIBS and manufacturers*

Second, KIBS provide specialized knowledge to manufacturers through real collaborations (e.g., cocreation) or by the advantages of spatial proximity (e.g., knowledge spillovers) (Ciriaci et al., 2015; Liu et al., 2019). However, the knowledge transfer will only be beneficial and productive if manufacturers maintain sufficient capabilities to incorporate this new knowledge and apply it in their operations. This leads to the following research proposition:

*Proposition 2: Information and knowledge exchange towards value cocreation based on the interplay between KIBS and manufactures remains as a critical mechanism for the expansion of technological capabilities and the development of solutions.*

Third, KIBS firms have been recognized for supporting manufacturers' innovation processes (Muller and Zenker, 2001; Wyrwich, 2019). Mainly in innovation ecosystems, manufacturers should engage in open innovation processes with KIBS to obtain complementary expertise for their development of innovations. This leads to the following research proposition:

*Proposition 3: Innovation support is another mechanism to cocreate value between KIBS and manufactures. Thus, both types of companies should enhance innovation processes by social interactions where they can jointly address the required technological capabilities to cocreate new solutions.*

Fourth, KIBS firms have been recently associated with manufacturers´ servitization strategies, supporting the manufacturers´ transition towards more service-oriented business models (Bustinza et al., 2019a; Bustinza et al., 2019b). In particular, manufacturers can use the value-adding services provided by KIBS to complement their capabilities for the development, provision, and delivery of advanced product-service systems (Bellandi and Santini, 2019, Liu et al., 2019). Moreover, the aggregated outcome of the mutually dependent association between KIBS and manufacturers within a focal territory can generate positive benefits for both companies (firm-level) and regions (meso-level) (Gebauer and Binz, 2019; Lafuente et al., 2017). This leads to the following research proposition:

*Proposition 4: The territorial symbiotic interactions between KIBS and manufacturers facilitate knowledge flows, provision of specialized services and the creation of innovative smart product-service systems. Thus, servitization appears as another mechanism to stimulate the interplay between KIBS and manufactures.*

Fifth, interactions with KIBS enhance the competitiveness of both companies while they acquire new knowledge, technologies, and capabilities to face new business trends such as

digital transformation, Industry 4.0 and, digital servitization (Bustinza et al., 2021; Vaillant et al., 2021). In this context, these connections are capable of boosting the operational and financial performance of manufacturing and KIBS as well. This leads to the following research proposition:

*Proposition 5: The interplay between KIBS and manufacturers contributes to enhancing the performance of both companies.*

Sixth, the knowledge flows and the positive effects on input-output markets resulting from the interplay between KIBS and manufacturers are capable of generating a virtuous cycle that promotes employment creation, entrepreneurial activity, local industry competitiveness, and other economic and social growth outputs. This leads to the following research proposition:

*Proposition 6: The interplay between KIBS and manufacturers contributes to enhancing the positive benefits of the territorial servitization at the regional-level, thus supporting regional development.*

Seventh, KIBS concentration has the potential to enhance collaborations with manufacturers as well as to generate positive results (Gebauer and Binz, 2019; Lafuente et al., 2017). In particular, the development of co-creation spaces supported by a high number of KIBS (e.g., startup incubators and innovation HUBs) strengthens the development of innovation ecosystems as well as improve the innovation performance of the ecosystem. Indeed, strengthening the local industrial base may induce KIBS regional concentration, which in turn configure an important channel for knowledge-based regional development (Wyrwich, 2019). This leads to the following research proposition:

*Proposition 7: The interplay between KIBS and manufacturers promote value co-creation, thus enhancing aggregate levels of development and performance in localized innovation ecosystems.*

Lastly, policymakers should promote laws and regulations that facilitate and encourage co-creation processes between KIBS and manufacturers. These sectors have been exchanging technological capabilities and they need the development of policies that can help them to adapt to the business trends in a digital economy context. This leads to the following research proposition:

*Proposition 8: Policymakers should develop initiatives to develop and support the main mechanisms involved in the interplay between KIBS and manufactures to foster improved firm-level and regional-level outcomes.*

## 3.5 FUTURE RESEARCH AGENDA

Table 3.1 shows future opportunities that are promising for advancing the research concerning the interplay between KIBS and manufacturers. We also deploy the future directions into potential research questions and present key references that inspired the proposal of these research opportunities.

*Mechanisms of connections.* As pointed out in Proposition 1, value co-creation is a fundamental and essential process for the development of KIBS solutions. Thus, it is necessary to advance in studies that understand the main success factors of the co-creation of services and identify which of these factors are crucial (Zieba and Kończyński, 2020). In the same vein, value co-creation process between KIBS and manufacturers seems to be fundamental in developed ecosystems (Horváth and Rabetino, 2019). Thus, it is important to assess whether the co-creation processes between KIBS in manufacturers are capable of enhancing the results of innovation within localized ecosystems.

In addition, as illustrated by Proposition 2, the knowledge transfer via KIBS is also an important process for connections with manufacturers. However, more studies should be conducted to obtain a better understanding of how these knowledge exchanges affect the development of manufacturers (Vendrell-Herrero et al., 2020b). Additionally, some previous organizational attributes of manufactures (e.g., absorptive capacity) seem to be important for these companies to take advantage from external sources of knowledge, highlighting an emerging line of research for future studies. Furthermore, we need to investigate how the intensity of contact during the transfer of knowledge process occurs across different geographical levels (Audretsch and Belitski, 2019; Bellandi and Santini, 2019).

Based on Proposition 3, future studies should address how open innovation processes facilitate interactions between KIBS and manufacturers may contribute to positive results in innovation. Also, it would be interesting to know how these interactions can affect all the forms of manufacturers' innovation performance, such as product innovation, process innovation, and management innovation (Audretsch and Belitski, 2019; Cabigiosu and Campagnolo, 2019). Also, studies need to be expanded to address the impacts of KIBS on innovation at manufacturers in other countries, specifically in developing markets (Brenner et al., 2018; Cabigiosu and Campagnolo, 2019; Cainelli et al., 2019).

Table 3.1 - Opportunities for future research

| Category | Related proposition | Potential research questions | Key references |
|---|---|---|---|
| Mechanisms of connections | 1 | What are the main success critical factors of the value co-creation process?<br>Could value co-creation within KIBS and manufacturers interactions be considered a driver for better ecosystem performance? | Zieba and Kończyński (2020) |
| | 2 | How does the exchange of information among KIBS affect the development of manufacturers?<br>What are the main boundaries conditions to achieve better performance by using knowledge external sources?<br>What is the difference between the intensity of contact of the processes of transfer of knowledge with KIBS across different geographical proximities? | Audretsch and Belitski (2019); Vendrell-Herrero et al. (2020b) |
| | 3 | Does open innovation a driver for interactions between KIBS and manufactures happen to?<br>How are the connections with KIBS affected by innovation processes at manufacturers in developing countries? | Audretsch and Belitski (2019); Cabigiosu and Campagnolo (2019) |
| | 4 | What are the drivers and support mechanisms in the process of territorial servitization?<br>What are the conditional attributes for the manufactures to obtain positive results from interactions with KIBS in Territorial Servitization context?<br>How KIBS can improve the delivering of smart product-service system?<br>Digital technologies from KIBS can contribute to the success of digital servitization implementation by manufacturers? | Bellandi and Santini (2019); Bustinza et al. (2019a); Gebauer and Binz (2019); Lafuente et al. (2017). |
| Firm-level results | 5 | What are the financial impacts of the interplay between KIBS and manufacturers in the short and long-run?<br>Which moderating and controlling variables interfere with this relationship? | Bustinza et al. (2019b); Vivas and Barge-Gil (2015) |
| Regional-level results | 6 | How does Territorial Servitization work in a developing economy/region context?<br>What are the impacts of Territorial Servitization on developing regions? | Bellandi and Santini (2019); Brenner et al. (2018); Cainelli et al. (2019) |
| | 7 | What are the industry factors that stimulate the creation and concentration of new KIBS companies?<br>What are the impacts of each type of KIBS on the local economy?<br>What is the impact of multi-sectoral clusters compared to traditional single-sector clusters?<br>The co-creation spaces with KIBS can stimulate the interactions with manufactures and promote positive resulting on innovation process? | Bustinza et al. (2019b); Gomes et al. (2019); Horváth and Rabetino (2019); Wyrwich (2019) |
| | 8 | What are the systemic effects of public policies regarding the interplay between KIBS and manufacturers? | Feser and Proeger (2018); Figueroa-Armijos (2019) |

Lastly, as suggested in Proposition 4, servitization strategy appear as new mechanisms for the connections between KIBS and manufacturers. Thus, future research should focus on the drivers for territorial servitization at regional and firm levels (de Propris and Storai, 2019; Gomes et al., 2019), especially regarding the conditional attributes for the manufactures to

obtain positive results from interactions with KIBS. Furthermore, more studies are needed to provide evidence regarding the impacts of territorial servitization on the firm and regional performance (Figueroa-Armijos, 2019; Gebauer and Binz, 2019; Kamp and Ruiz de Apodaca, 2017; Liu et al., 2019). Likewise, the technological and digital services makes KIBS an important driver of digital servitization on manufacturers. So, a promising research avenue involves using qualitative methods to consider the role of KIBS as a source of smart product-service systems. Equally important, future works should examine the impacts of digital technologies delivered by KIBS in the success of digital servitization implementations by manufacturers.

*Firm-level results.* Proposition 5 identified that interactions with KIBS are capable of increasing the competitiveness of manufacturers. Furthermore, these interactions generate positive effects on performance indicators, such as productivity and operational efficiency (Gebauer and Binz, 2019; Zhou et al., 2017). However, our results showed the lack of empirical evidence concerning the financial impact of the interplay between KIBS and manufacturers. Consequently, new studies addressing this topic would advance the literature on this topic (Bustinza et al., 2019b; Vivas and Barge-Gil, 2015). Studies should also focus on moderating and controlling factors (e.g., size of companies, types of KIBS companies, type of collaboration, etc). Lastly, quantitative studies based on sophisticated financial measures (e.g., EBIT Margin and Tobin's Q) and longitudinal datasets would also contribute to clarifying short-term and long-run effects.

*Regional-level results.* Proposition 6 highlighted the aggregated regional effects of the symbiotic relationship and interaction process between manufacturers and KIBS firms (Lafuente et al., 2017). Nonetheless, studies regarding the effects of territorial servitization were carried out mainly in European countries (e.g., Bellandi and Santini, 2019; Liu et al., 2019). Moreover, studies should consider different regional contexts for territorial servitization such as developing economies (Gebauer and Binz, 2019; Kamp and Ruiz de Apodaca, 2017; Liu et al., 2019).

Preposition 7 pointed out the concentration of KIBS, as these companies are important agents for industrial and regional development. Future research should evaluate the specific manufacturing sectors that stimulate the creation and concentration of new KIBS companies in

certain regions. Moreover, it seems to be relevant to investigate how different types of KIBS impact their use by manufacturers and regional economic development (Cabigiosu and Campagnolo, 2019; Heikka et al., 2018; Horváth and Rabetino, 2019). Another opportunity is to validate the assumption that regions with more KIBS companies effectively attract new manufacturers (Gomes et al., 2019). Researchers should strive to understand the location patterns for KIBS and manufacturing sectors (Wywirch, 2019). Another issue is to investigate if multi-sectoral clusters create more advantages than traditional single sector clusters (Bustinza et al., 2019b). In the same line, the spatial proximity between manufacturers and KIBS co-creation centers of innovation could be important to increase interactions. Hence, the development of future case studies should consider manufactures that are located close to innovation centers and understand the main benefits of this proximity.

Lastly, regarding proposition 8, understanding how public policies contribute to the attraction of incumbents into an emerging industry and the potential systemic effects of such policies represent promising areas for future research (Feser and Proeger, 2018; Gebauer and Binz, 2019; Lafuente et al., 2017).

## 3.6 CONCLUSIONS

This research examined the main research themes in the literature between KIBS and manufacturers based on a scoping review of the literature. In doing this, we present the mechanisms, firm and regional level results. Furthermore, we identified research gaps and proposed future research directions advancing the extant literature.

### 3.6.1 Theoretical and managerial implications

The theoretical contribution of the study is the thematic account of the literature and the identification of ten themes to which all papers can be assigned. Since the knowledge on the interplay between KIBS and manufacturers congregates in several research fields, this review aims to organize and integrate the body of knowledge on this topic. They reveal the importance of a systemic-level approach for addressing the connections between KIBS and manufacturers. Thus, at first theoretical contribution, we discuss the mechanisms around key research themes discussed in the convergent literature. Such mechanisms are driven by the collaborations of manufacturers with KIBS. Second, the main firm and regional levels results are clarified, stressing the importance of the systemic effects. Consequently, the review enables an

assessment of where new studies can contribute to the field, addressing uncharted research gaps. Hence, the third contribution is the identification of the research opportunities that can guide future researchers. In this regard, the review can also stimulate interdisciplinary research (e.g., innovation ecosystem and regional development) due to the developments of studies concerning digital transformation and the regional effects of servitization on regional competitiveness.

This study has important implications for managers. First, managers can use results to better understand how connections between KIBS and manufacturers possibly influence their companies' performance, since these collaborations could help them to develop business trends such as innovation ecosystem, Industry 4.0, and servitization. Second, managers must be aware of the requirements for a fruitful collaboration with external knowledge providers such as KIBS, in addition to better understand the regional consequences of these collaborations, which can result in regional competitiveness. Third, this study also has implications for policymakers by demonstrating the importance of supporting the interaction between KIBS companies and the manufacturing sectors since it can increase the aggregated effects on economic development. In this sense, this study can add a macro-level in approaching this topic, which concerns the national or regional policies, programs, and legislation to incentivize the interplay between KIBS and manufacturers.

### 3.6.2 Limitations

This study presents some limitations. First, the decisions for the used search terms and, eligibility criteria may have affected our results. For instance, non-English articles were excluded from the sample, which could introduce some biases in our findings. Second, although the Scoping review is a rigorous approach to map a research field, limitations associated with the quality of selected documents may occur (Arksey and O'Malley, 2005). Third, the suggested future research opportunities were identified through the research team's judgment. Thus, the research team's interests and backgrounds may have influenced our decisions and other future opportunities can emerge from this literature. Still, our assessment offers organized guidance to further explore this promising research topic.

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## Appendix I

**Mechanisms**

**VALUE CO-CREATION**
Bettencourt et al. (2002); Cabigiosu and Campagnolo (2019); Zieba and Kończyński (2020)

**KNOWLEDGE TRANSFER**
Antonelli and Gehringer (2015); Bettiol et al. (2013b); Bolisani and Scarso (2009); Daghfous et al. (2013); Feser and Proeger (2018); Hsieh et al. (2015); Hu (2017); Miles (2011); Paiola et al. (2013); She and Nagahira (2012); Sole and Carlucci (2010); Strambach (1994); Strambach (2008); Vendrell-Herrero et al. (2020b)

**INNOVATION SUPPORT**
Aslesen and Isaksen (2007); Audretsch and Belitski (2019); Belso-Martínez et al. (2011); Bettiol et al. (2013a); Cainelli et al. (2019); Corrocher et al. (2009); D'Antone and Santos (2016); Doloreux and Mattson (2008); Doloreux and Shearmur (2012); Doloreux and Shearmur (2013); Doroshenko et al. (2014); Haakonsson et al. (2020); He and Wong (2009); Hu et al. (2013); Huggins (2011); Koch and Strotmann (2008); Mas-Verdú et al. (2011); Miozzo and Grimshaw (2005); Rodriguez (2013); Santos (2020); Shearmur and Doloreux (2013); Shearmur and Doloreux (2015); Wu et al. (2014); Yam et al. (2011)

**SERVITIZATION IMPLEMENTATION**
Bustinza et al. (2019b); Heikka et al. (2018); Vendrell-Herrero et al. (2018)

**Firm-level Results**

**COMPETITIVINESS**
Kamp e Ruiz de Apodaca (2017); Shearmur et al. (2015)

**ORGANIZATIONAL PERFORMANCE**
Bengtsson and Dabhilkar (2009); Broersma and Van Ark (2007); Bustinza et al. (2019a); Cao et al. (2011); Ciriaci and Palma (2016); Ciriaci et al. (2015); Kohtamäki and Partanen (2016); O'Farrell and Moffat (1995); Rajala et al. (2008); Seclen and Barrutia (2018); Vivas and Barge-Gil (2015); Zhou et al. (2017)

**FINANCIAL PERFORMANCE**
Kite (2018)

**Regional-level Results**

**ECONOMIC DEVELOPMENT**
Brenner et al. (2018); Gebauer and Binz (2019); Lafuente et al. (2017); Muller and Zenker (2001)

**KIBS AGGLOMERATION**
Antonietti and Cainelli (2008); Bellandi and Santini (2019); Corrocher and Cusmano (2014); de Propris and Storai (2019); di Giacinto et al. (2020); Gomes et al. (2019); Grandinetti (2011); Horváth and Rabetino (2019); Jacobs et al. (2014); Koch and Stahlecker (2006); Liu et al. (2019); Wyrwich (2019)

**PUBLIC POLICY DEVELOPMENT**
Figueroa-Armijos (2019)

Figure 1A. Sample of articles and respective thematic classification

# 4 ARTIGO 2: KNOWLEDGE-INTENSIVE BUSINESS SERVICES AND TERRITORIAL SERVITIZATION: THE MODERATING ROLE OF ABSORPTIVE CAPACITY

ABSTRACT

Knowledge-intensive business services (KIBS) are service providers that collaborate with manufacturers to increase their knowledge, stimulate innovation, and support the implementation of service-oriented business models. In addition, KIBS firms are also known for stimulating regional economic development. The outcomes that result from the mutually dependent associations between manufacturers and KIBS firms is called Territorial Servitization. This article aims to explore whether the effect of regional KIBS deepening on productivity growth is dependent on minimum levels of manufacturers' absorptive capacity. An econometric analysis using a threshold regression model of regional and financial data from 125 Brazilian manufacturers collected during the timeframe of 2010 to 2017 was carried out. Results indicate that KIBS deepening on its own does not bring productivity benefits. Manufacturers may collect positive gains if they are endowed with high levels of absorptive capacity. Important implications for research, firms and policymakers are discussed.

Keywords: territorial servitization, knowledge-intensive business services, manufacturing, absorptive capacity, threshold regression

## 4.1 INTRODUCTION

Knowledge-intensive business service (KIBS) firms attract the attention of governments, companies, and academia due to their roles in knowledge creation and knowledge diffusion (Muller and Zenker, 2001; Pereira and Vence, 2021; Wyrwich, 2019). They also have an important role to foster innovation in national and regional innovation ecosystems (Hertog, 2000; Shearmur and Doloreux, 2013; Santos, 2020). Therefore, KIBS are well-recognized agents of economic development (Brenner et al., 2018; Corrocher and Cusmano, 2014) and they are central actors in knowledge-based economies (Di Giacinto et al., 2020; Miles, 2005; Doloreux and Shearmur, 2012).

In particular, territorial servitization (also called knowledge-intensive territorial servitization - KITS) is the aggregated outcome of the mutually dependent association between KIBS firms and servitized manufacturers within a focal territory, which can generate positive benefits for both companies (firm-level) and for the regions (meso-level) in which this association occurs (Horváth and Rabetino 2019; Bellandi and Santini, 2019; Lafuente et al., 2017; Liu et al., 2019).

Indeed, KIBS firms have been associated with the firm-level servitization strategy, meaning the manufacturers´ transition towards more service-oriented business models (Baines et al., 2017; Kowalkowski et al., 2017). Manufacturers can use the value-adding services provided by KIBS firms to complement their capabilities for the development, provision, and delivery of advanced product-service systems (Bustinza et al., 2019a; Gebauer and Binz; 2019; Lafuente et al., 2017; Kamp and Ruiz De Apodaca; 2017; Vendrell-Herrero and Wilson, 2017). In a broader perspective, KIBS firms have contributed to the revitalization of industrial sectors in several regions (e.g., Germany, Italy, Spain) with positive results in employment increase, economic development and, business creation (Bellandi and Santini, 2019; Lafuente et al., 2017; Liu et al., 2019).

Based on the territorial servitization literature, there is some evidence that spatial proximity generates knowledge spillovers (Liu et al., 2019). They result from knowledge and technology transfers made by KIBS and boost the manufacturers' productivity (Mitze and Makkonen, 2020; Moralles and Moreno, 2020). In this regard, the spatial proximity of KIBS with manufacturers contributes to enhancing the performance of manufacturers since specialized services support improvements in the manufacturers' value chain (Bustinza et al., 2021; Vaillant et al., 2021). Nevertheless, the extant literature has not provided much empirical evidence on the above-discussed assumptions (Lafuente et al., 2019; Seclen-Luna and Moya-Fernandez, 2020; Vaillant et al., 2021; Vendrell-Herrero et al., 2020b).

One way to improve the manufacturers´ performance depends on their capacity of identifying, assimilating, and exploiting external knowledge (Ayala et al., 2017; Bustinza et al., 2021; Cohen and Levinthal, 1990; Daghfous et al., 2013). Thus, manufacturers´ capacity to exploit the knowledge spillovers depends on their absorptive capacity (Vendrell-Herero et al., 2020a). This sheds light on the absorptive capacity as a boundary condition for territorial servitization benefits. While the absorptive capacity has been further investigated in innovation studies (e.g., Moralles and Moreno, 2020; Ubeda et al., 2019; Wang et al., 2020), its moderating effect in the territorial servitization context still needs further investigation (Vendrell-Herero et al., 2020a).

This article aims to uncover the influence of KIBS deepening on manufacturer's productivity. Specifically, the Total Factor Productivity (TFP) measure is employed. We also advance the extant literature by investigating the moderating role of the absorptive capacity. For this purpose, an econometric analysis of regional and financial data from 125 Brazilian manufacture firms was collected during the timeframe of 2010 to 2017. Furthermore, a

threshold regression model was used to explore whether the effect of KIBS deepening on productivity growth is dependent on minimum levels of manufacturers' absorptive capacity.

The contributions of this article are twofold. First, while most of the territorial servitization studies (e.g., Bellandi and Santini, 2019; Gebauer and Binz, 2019; Lafuente et al., 2017) have concentrated on the regional effects, the firm-level results of the association between KIBS and manufacturers are largely unexplored (De Propis and Storai, 2019; Gomes et al., 2019). Thus, we provide empirical evidence concerning the impacts of KIBS deepening on the TFP of manufacturers. Second, we reinforce the role of absorptive capacity to the greater appropriation of the external knowledge from KIBS. Thus, manufacturers rely on the absorptive capacity to achieve the firm-level benefits of the territorial servitization in terms of manufacturers´ productivity.

The paper is organized as follows. The second section presents the conceptual background and hypothesis development. The third section is concerned with the research method used for this study. The fourth section presents the results and the fifth section the robustness checks. The sixth section draws upon the discussions. Finally, the main considerations and limitations are found in the seventh section.

## 4.2 BACKGROUND THEORY AND HYPOTHESES DEVELOPMENT

There has been an increasing interest in the use of knowledge-based services into manufacturers' operations and service delivery due to their positive impact on manufacturers´ competitiveness as well as regional development, which is known as territorial servitization (Bellandi and Santini, 2019; Gebauer and Binz, 2019; Gomes et al., 2019; Horváth and Rabetino, 2019; Lafuente et al., 2017; Liu et al., 2019).

Territorial servitization has originated in the servitization research since scholars have realized that regions with resilient manufacturing sectors stimulate the use of services provided by KIBS firms (De Propis and Storai, 2019; Lafuente et al., 2017). Hereafter, this also contributes to the development of KIBS sectors and, concurrently, to the revitalization of manufacturing sectors (Lafuente et al. 2017; Liu et al., 2019). It is supposed to have a virtuous circle in territorial servitization – the local manufacturing sector simultaneously stimulates and is stimulated by developing a complementary KIBS sector (Gomes et al., 2019; Lafuente et al., 2017). Therefore, territorial servitization refers to the symbiotic relationship and interaction process between manufacturers and KIBS firms (Lafuente et al., 2017).

At a regional-level, territorial servitization effects go beyond the firm limits and can contribute to a more consolidated manufacturing sector characterized by agglomeration economies (Horváth and Rabetino, 2019; Liu et al., 2019). In this regard, the association between manufacturers and KIBS firms can support regional development via positive externalities, knowledge spillovers, and positive effects on input-output markets (Gomes et al., 2019; Horváth and Rabetino, 2019; Liu et al., 2019). These effects create employment creation, entrepreneurial activity, local competitiveness, and other economic and social growth outputs (Gebauer and Binz, 2019; Lafuente et al., 2017; Liu et al., 2019; Sforzi and Boix; 2019).

At a firm-level, KIBS firms stimulate the service innovation and provision that are necessary to support the manufacturers´ servitization strategies (Bustinza et al., 2021; Gomes et al., 2019; Horváth and Rabetino, 2019; Liu et al., 2019). KIBS firms act as knowledge partners that interact with manufacturers in their servitization ecosystems (Bustinza et al., 2021; Bellandi and Santini, 2019; Gebauer and Binz, 2019). Moreover, KIBS firms act to enhance the manufacturers' capabilities and generate the conditions to servitize, reducing technological uncertainty and overcoming the lack of resources (Bustinza et al., 2021; Opazo-Basáez et al., 2020).

### 4.2.1 The impact of KIBS deepening in manufacturer total productivity

In the territorial servitization literature, KIBS are understood as critical partners of manufactures and as a vector for regional development (Lafuente et al., 2017; Liu et al., 2019). In this sense, the higher is the concentration of KIBS in a given region, the higher is the potential to generate firm-level and regional-level positive results (Gebauer and Binz, 2019). KIBS deepening refers to the concentration of KIBS in a given region and it has been considered as an enabler of territorial servitization (Gomes et al., 2019). For example, Gomes et al. (2019) found that the increase in KIBS deepening raises the levels of servitization in manufacturers, which also reinforces the contributions of KIBS as providers of value and services for these companies.

The benefits for manufacturers resulting from the proximity with KIBS can be the results of real collaborations, for instance, when manufacturers use and implement specialized services in their value chain (Bustinza et al., 2019b). However, there are advantages due to the spatial proximity with KIBS. Spatial proximity between KIBS and manufacturers creates relational capital and social embeddedness, as both companies benefit from tacit and explicit

knowledge spillovers resulting from co-location (Capello and Faggian, 2005; Gomes et al., 2019, Liu et al., 2019). Moreover, the interactions between complementary and closely located manufacturers and KIBS firms facilitate knowledge flows and the creation of innovative product-service systems, enhancing company and local value chain competitiveness and regional development (Bustinza et al., 2021; Gomes et al., 2019 Lafuente et al., 2017). Thus, a critical mass of KIBS firms with capabilities in specialized services allows the co-located manufacturers to access, co-design, and embed service competencies in their operations (Propris and Storai, 2019).

The extant literature provides several examples regarding the positive effects of spatial proximity with KIBS on the manufacturers. Seclen-Luna and Moya-Fernandez (2020) argue that spatial proximity increases the manufacturer´s innovation capabilities. Other studies have demonstrated positive results in the manufacturer´s productivity (Antonelli and Gehringer, 2015; Gebauer and Binz 2019; Zhou et al. 2017), and operational efficiency (Antonelli and Gehringer, 2015; Gebauer and Binz, 2019; Zhou et al., 2017). Opazo-Basáez et al. (2020) and Gomes et al. (2019) state the successful provision of advanced services and servitization.

Although these examples demonstrate the positive influence of KIBS deepening in manufacturer's productivity, much uncertainty still exists about this association. For instance, studies argue that spatial proximity per se does not ensure collaborations between KIBS firms and manufacturers since the space itself is not enough to promote knowledge spillovers (Mariotti et al., 2015). Furthermore, exposure to knowledge due to spatial proximity can also create negative results, including lock-in problems and coordination failures (Boschma, 2005; Vendrell-Herrero et al., 2020a). In this case, Vendrell-Herrero et al. (2020a) identified that service capabilities provided by KIBS firms generate productivity gains for manufacturing exporters (they need to adjust do different market conditions) but they have the opposite effect for manufacturing non-exporters (face domestic markets only and thus operate in a more stable environment).

Based on this reasoning and, mainly, on the above-mentioned controversial results, we assess the relationship between KIBS deepening and the manufacturer´s productivity. We hypothesize that regions with a higher density of KIBS will be more able to generate knowledge spillovers that will generate positive gains in manufacturer´s productivity. Thus, a first hypothesis is presented:

***H1: There is a positive relationship between regional KIBS deepening and manufacturing firms' productivity.***

### 4.2.2 The moderating role of the absorptive capacity

Absorptive capacity is the ability of companies to identify, absorb and exploit knowledge to their business operations (Cohen and Levinthal, 1990; Zahra and George, 2002). It allows companies to recognize the value of new knowledge available in the environment and to assimilate and combine it with in-house capabilities to promote new improvements in operational performance, innovation development and, financial growth (Duan et al., 2021; Wang and Han, 2011; Zahra and Hayton, 2008). Many studies agree that absorptive capacity is one of the most important determinants for innovation (Chen et al., 2009; Lau and Lo, 2015). For example, Duan et al. (2021), using longitudinal data of China's high-tech manufacturing industries, show that absorptive capacity has a positive moderating effect on the relationship between transnational knowledge spillover and innovation. Kim et al. (2021) state that Thai manufacturers with high levels of absorptive capacity achieve better innovation performance and, consequently, superior financial results. Lastly, Siachou et al. (2021) argue that high levels of absorptive capacity facilitate the digital transformation of incumbent organizations. Thus, absorptive capacity plays a key role in innovation.

In the servitization literature, absorptive capacity has been investigated from different perspectives. Ayala et al. (2017) state that servitization requires the integration of external knowledge, similar to what happens in the buyer-supplier integration. Zhou et al. (2020) found that stronger ties with service suppliers strengthen the knowledge spillover force at a high level of servitization and increase a manufacturer's return-on-investment from the servitization strategy. Lastly, Sousa and da Silveira (2020) argue that absorptive capacity enables manufacturers to identify and exploit useful customer knowledge. While the traditional servitization discusses the exploitation of external knowledge from customers and suppliers, the territorial servitization literature rarely relates absorptive capacity and KIBS firms.

The absorptive capacity is critical for KIBS firms and manufacturers (Doroshenko et al., 2014; Zahra and George, 2002). As professional services become sophisticated and complex, the absorptive capacity helps the KIBS firms to better understand their customer needs and, thus, develop an effective solution (Daghfous et al., 2013; Grandinetti, 2011). From a manufacturer perspective, the absorptive capacity aims to integrate external knowledge from KIBS and to transform it into capabilities needed for technological development and service provision (Haakonsson et al., 2020; Vivas and Barge-Gil, 2015). However, manufactures have developed some absorptive capacity that enables them to internalize external knowledge

(Gomes et al. 2019; Vendrell-Herrero et al., 2020a). Moreover, manufacturers with a suitable absorptive capacity may attract new KIBS to their territory (Horváth and Rabetino, 2019).

Nevertheless, absorptive capacity is not a binary concept (has or has not). In this sense, manufacturers need to possess a minimum level of absorptive capacity to benefit from KIBS´s stock of knowledge (Vendrell-Herrero et al., 2020a). This discussion is more mature concerning, for instance, the effect of foreign direct investment on firm-level productivity (e.g., Girma, 2005; Moralles and Moreno, 2020). Others previous research has indicated nonlinear moderation relationships regarding absorptive capacity levels for sales growth (Kohtamäki et al., 2020), innovation performance (Ubeda et al., 2019), and productivity spillovers (Girma, 2005; Moralles and Moreno, 2020). In the same vein, it seems that manufacturers need a minimum level of absorptive capacity to take advantage of opportunities from the available knowledge spillovers in higher levels of KIBS deepening. Nevertheless, this has been less investigated under the territorial servitization context (Vendrell-Herrero et al., 2020a). Thus, the following second hypothesis is presented:

***H2: A manufacturing firm's absorptive capacity moderates positively the relationship between KIBS deepening and manufacturing firms' productivity.***

## 4.3 METHOD

### 4.3.1 Data sources and variables

We collect data from the consolidated financial statements of 125 Brazilian manufacturers that were included in the Economatica database for the period from 2010 to 2017. The final sample considered eight years and included 1000 observations. Economatica is one of the largest financial databases that contain data of companies listed in the America Latina and US stock exchanges, which includes data from the largest Brazilian manufacturers listed in the B3 (Brazilian Stock Exchange). Based on the research goals, we restricted the final sample to companies in the manufacturing sectors, but we did not incorporate manufacturers with missing data (e.g., incomplete, or inconsistent data) to achieve greater reliability in the data analysis. Additionally, we selected the range of manufacturers that maximized the sample size while keeping a balanced panel, which is required by the threshold model (Wang, 2015). The sectoral distribution of such companies is presented in Table 4.1. These manufacturers are categorized according to the NACE classification of industries and services.

Table 4.1 - Sectorial distribution of manufacturers

| NACE Code | Sector | Share |
|---|---|---|
| 10 | Manufacturer of food products | 13% |
| 13 | Manufacture of textiles | 12% |
| 24 | Manufacture of basic metals | 10% |
| 29 | Manufacture of motor vehicles, trailers, and semi-trailers | 9% |
| 20 | Manufacture of chemicals and chemical products | 8% |
| 25 | Manufacture of fabricated metal products, except machinery and equipment | 7% |
| 28 | Manufacture of machinery and equipment | 7% |
| 14 | Manufacture of wearing apparel | 6% |
| 17 | Manufacture of paper and paper products | 5% |
| 32 | Other manufacturing | 5% |
| 21 | Manufacture of basic pharmaceutical products and pharmaceutical preparations | 4% |
| 23 | Manufacture of other non-metallic mineral products | 3% |
| 26 | Manufacture of computer, electronic and optical products | 2% |
| 30 | Manufacture of other transport equipment | 2% |
| 19 | Manufacture of refined petroleum products | 2% |
| 16 | Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | 2% |
| 18 | Printing and reproduction of recorded media | 2% |
| 11 | Manufacture of beverages | 1% |
| 22 | Manufacture of rubber and plastic products | 1% |

Regarding our measures, the dependent variable is the Total Factor Productivity (TFP). It reflects the variation in the technological efficiency in which factors (e.g., creativity, knowledge, and managerial practices, etc.) are employed, and can be understood as the rate of productivity growth above the rate of capital growth or as growth not explained by production factors (LeSage and Robert, 2009; Moralles and Moreno, 2020).

The use of the ordinary least squares (OLS) for the TFP estimation was not appropriated due to the problem of the simultaneity associated with the choice of inputs, which can generate inconsistent estimation parameters. Thus, previous studies employed the semiparametric procedures suggested by Olley and Pakes (1996) (OP) and/or Levinsohn and Petrin (2003) (LP). They employ intermediate inputs to represent productivity, overcoming the endogeneity problem. Nevertheless, OP and LP can be associated with the functional dependence problem (Moralles and Moreno, 2020) but the use of the generalized method of moments (GMM) technique (Wooldridge, 2009) can mitigate it. Thus, we adopted Wooldridge's (2009) method to estimate the TFP by employing the following proxies: gross sales revenue as product, total fixed assets as capital, and legal labor obligations as a proxy for labor, since this variable

represents a fixed percentage of paid wages. To deal with inflationary effects, all data were deflated by Brazil's general price index (IGP-DI). Investment data can be reliable proxies for the intermediate output since financial statements in Brazil do not have a specific account that identifies materials as an intermediate input for the calculation of TFP. Nevertheless, Moralles and Moreno (2020) obtained literature-consistent results using Investment data as intermediate within a ACF (Ackerberg et al., 2015) correction for the OP approach.

Furthermore, our main explanatory variable is KIBS deepening, which was determined as a ratio between the number of people employed by KIBS firms in a specific region (city) and year by the total of people employed by firms in that specific region (city) and year. This measure was already employed by Sforzi and Boix (2019) in Italy and Spain but has not been explored in Brazil. The proportionate number of people employed in KIBS in a specific region is a good indicator of the degree of local servitization and reflects better the number of economic relevance of service businesses (Lafuente et al., 2019; Sforzi and Boix, 2019). Furthermore, considering that KIBS firms are strongly associated with highly qualified employees and intensive knowledge, we understand that a measure based on employees (not in the number of firms) is a better enabler for territorial servitization. Appendix A presents a list of the 59 Brazilian cities considered in the study.

Data from KIBS firms were retrieved from Dataviva. It consolidates reliable data from several official sources such as Employment and Income (RAIS), Brazilian International Trade (SECEX/MDCI), Brazilian Education, and International Trade. Following the Brazilian National Classification of Economic Activities (CNAE) we taken the KIBS categorized at the two-digit levels (61; 62; 63; 66, 69, 70, 71, 72, 73, 74, 78, 82, 95). This included three types of firms: (i) P-KIBS firms that provide professional services (e.g., accounting, consulting, and legal assistance services); (ii) T-KIBS offer specialized services related to technology (e.g., technology providers, software developers, etc.) and (iii) C-KIBS provide design and creative services (e.g., design companies and industrial architecture, etc.) (Guimarães and Meirelles 2014; Miles et al., 1995; J-Figueiredo et al., 2017). Appendix B shows the classification of KIBS using CNAE codes.

The absorptive capacity (ABC) measure was based on studies (e.g., Girma, 2005; Moralles and Moreno, 2020) that use the technological frontier distance (technology gap) as a proxy of absorptive capacity. Thus, it was calculated by the ratio of between TFP of a company i and the Maximum TFP, as shown as follows in equation 4.1.

$$ABC_{it} = \frac{TFP_{it}}{max(TFP)_{it}} \quad (4.1)$$

Additionally, we also used a set of firm-level and regional controls to avoid possible specification bias. First, at the firm-level, the size of the manufacturers is based on its patrimony while the age of the manufacturers is also considered. Second, it was also interesting to establish some kind of control regarding the market concentration environment to which a particular manufacturer was exposed. Thus, we followed Moralles and Moreno (2020) in using a proxy variable for a modified version of the Herfindahl-Hirschman index (HHI). It is presented in Equation 4.2, where Si is market share and N is the number of firms operating in a specific industry.

$$HHI = \sum_{i=1}^{N} (S_i)^2 \quad (4.2)$$

Specifically, by using the Eurostat aggregation of the manufacturing industry according to technological intensity-based (NACE-Revision 2), we applied four control dummies to capture firm technology intensity: (i) high technology (HT), (ii) medium-high technology (MHT), (iii) medium low technology (MLT) and (iv) low technology (LT). However, as the threshold model do not allow binary covariates, we iterated firm aforementioned technology intensity dummy with its market share proxy. This procedure helps to avoid size bias within the sectoral classification and avoid time-invariant controls specification bias.

At the regional-level, the following control variables were considered: GDP (gross domestic product), GDP per capita, % of agro GDP (measure to characterize country towns), and economic complexity; and finally, we applied the min-max normalization rescaling to all variables in order to evaluate parameters as elasticities Appendix C presents a summary of the variables, their definitions, as well as their sources.

### 4.3.2 Econometric model and estimation strategy

As above mentioned, we used the concept of TFP as a proxy for manufacturing productivity. To achieve the research goals and test the two hypotheses, we developed two equations (4.3 and 4.4) to express the influence of KIBS deepening in TFP (H1) and, the moderating role of absorptive capacity within this relationship (H2) as follows:

$$TFP_{ijt} = \beta_0 + \beta_1' X_{it-1} + \beta_2' d_i Z_{it} + \beta_3' R_{jt} + \beta_4' KIBS_{jt-1} I(KIBS_{jt-1} < \lambda_{11}) + \beta_5' KIBS_{jt-1} I(\lambda_{11} \geq KIBS_{jt-1} < \lambda_{12}) + \beta_6' KIBS_{jt-1} I(KIBS_{jt-1} \geq \lambda_{12}) + \alpha_i + \varepsilon_{ijt} \quad (4.3)$$

$$TFP_{ijt} = \beta_0 + \beta_1' X_{it-1} + \beta_2' d_i Z_{it} + \beta_3' R_{jt} + \beta_4' KIBS_{jt-1} I(ABC_{it} < \lambda_{21}) + \beta_5' KIBS_{jt-1} I(\lambda_{21} \geq ABC_{it} < \lambda_{22}) + \beta_6' KIBS_{jt-1} I(ABC_{it} \geq \lambda_{22}) + \alpha_i + \varepsilon_{ijt} \quad (4.4)$$

Where:

X denotes company-level controls (Patrimony, Stock, Age, HHI);

Z denotes controls at the firm level (Firm's market share);

d denotes firm-level controls (matrix of dummy variables that control for the sector of i, with a two-digit NACE classification);

R denotes the controls at the regional-level (GDP per capita, % of Agro GDP, Economic complexity);

KIBS denotes KIBS deepening;

ABC denotes absorptive capacity;

I is the indicator function;

α denotes the time-invariant characteristics of the firm (fixed effects);

λ denotes the threshold values to be estimated; and

ε denotes the stochastic disturbance.

Noteworthy, for equation (4.3), KIBS deepening represents both the threshold and the regime-dependent variables. For equation (4.4), the threshold variable is KIBS deepening, while ABC is the regime-dependent variable. To check the nonlinearity hypothesis, a double-threshold regression model was adopted. Specifically, this study employs the threshold regression strategy proposed by Hansen (1999). Moreover, we followed Girma (2005), Moralles and Moreno (2020) and Polloni-Silva et al. (2021) and employ a set of quantiles to estimate the threshold parameter (λ).

The threshold test p-values will allow us to evaluate if nonlinearity processes apply to the relationships stated within our hypothesis according to the regime-dependent variables, i. e., test whether KIBS deepening had different impacts depending on their level of concentration, and furthermore, the moderating role of firm-level absorptive capacity.

## 4.4 RESULTS

Table 4.2 presents the main results of the threshold regressions. Thus, in Column 1, we show the results for one-year lagged KIBS deepening as the dependent variable of the regime to check the effect on productivity variation for high, intermediary, and low lagged values of KIBS deepening. However, in column 2, we demonstrate the results when we apply ABC as a moderator for the effects of KIBS deepening on TFP variation for high, intermediary, and low ABC values.

As shown in column 1 of Table 4.2, the results indicate that for low and intermediate levels of KIBS deepening, the effects on manufacturing productivity are non-significant. Conversely, the effect on manufacturing productivity was positive and significant for higher levels of KIBS deepening. Thus, it was supposed that the local manufacturers benefit from productivity spillovers in regions with high KIBS deepening levels. To complement the analysis, we also tested the double threshold model to verify the existence of three distinct regimes; however, we achieved p-values of 0.320 and 1.000 for the threshold test. Accordingly, the null hypothesis (i.e., no non-linearity) could not be rejected. Therefore, KIBS deepening does not explain the distinct regimes in the local manufacturer´s productivity, leading to the rejection of H1. Based on our results, only the presence of KIBS firms in a given region is not a sufficient condition to promote productivity gains.

We also tested to demonstrate whether the absorptive capacity was a moderator for capturing productive positive spillovers from KIBS deepening (see column 2 of Table 4.2). By estimating the threshold model with KIBS deepening as the threshold variable and ABC as the moderator variable of the regime, three levels of ABC were considered: low, intermediary, and high-levels of absorptive capacity. The results show that (i) for low levels of ABC values, the manufacturing productivity is negatively affected (meaning that local manufacturers suffer from the productivity losses, although the presence of KIBS where they are located); (ii) for intermediate levels of ABC values, the effects on manufacturing productivity are null and non-significant and, (iii) for high-levels of ABC values, the TFP of manufacturers is positively affected (meaning that the spatial proximity with KIBS firms produces productivity gains, indicating the existence of productivity spillover). These results suggest that absorptive capacity plays a moderating role in the relationship between KIBS deepening and manufacturers´ productivity. Similarly, we also tested our preliminary results using the double threshold model and its results also confirm the existence of three distinct regimes

Consequently, high absorptive capacity is an essential condition for local manufacturers to benefit positively from KIBS deepening in the territorial servitization context.

Table 4.2 - Results for the threshold regressions

| VARIABLES | (1)<br>KIBS deepening regime-dependent | (2)<br>ABC regime-dependent |
|---|---|---|
| **Low KIBS deepening (<$\lambda_{11}$)** | 0.0136 | |
| | (0.0127) | |
| **Intermediary KIBS deepening (≥$\lambda_{11}$ e <$\lambda_{12}$)** | -0.0117 | |
| | (0.0124) | |
| **High KIBS deepening (≥$\lambda_{12}$)** | 0.0150* | |
| | (0.00830) | |
| **Low ABC (<$\lambda_{21}$)** | | -0.374*** |
| | | (0.0359) |
| **Intermediary ABC (≥$\lambda_{21}$ e <$\lambda_{22}$)** | | -0.00305 |
| | | (0.00789) |
| **High ABC (≥$\lambda_{22}$)** | | 0.161*** |
| | | (0.0139) |
| **Age** | -0.238** | -0.154*** |
| | (0.0969) | (0.0489) |
| **Stock** | -0.160 | -0.146*** |
| | (0.114) | (0.0514) |
| **Patrimony** | 0.266*** | 0.281*** |
| | (0.0679) | (0.0422) |
| **HT*mktshare** | 0.00317 | 0.000532 |
| | (0.0164) | (0.0110) |
| **MHT*mktshare** | -0.0683*** | -0.0629*** |
| | (0.0217) | (0.0184) |
| **MLT*mktshare** | 0.226 | -0.0159 |
| | (0.210) | (0.0896) |
| **LT*mktshare** | -0.0297*** | -0.0225** |
| | (0.0106) | (0.00996) |
| **HHI** | 0.0395*** | 0.0287*** |
| | (0.0133) | (0.00849) |
| **Economic Complexity** | -0.0216** | -0.0199*** |
| | (0.0106) | (0.00372) |
| **GDP pc** | -0.000548 | 0.00445 |
| | (0.0120) | (0.00915) |
| **Agro GDP** | 0.0232 | 0.0155 |
| | (0.0191) | (0.0157) |
| **Constant** | 0.0488 | 0.0231 |
| | (0.0345) | (0.0165) |
| **Threshold 1 ($\lambda_1$)** | 0.466 | -0.377 |
| **Threshold 2 ($\lambda_2$)** | 0.496 | 0.108 |
| **Threshold test p-value (single)** | 0.320 | 0.000 |
| **Threshold test p-value (double)** | 1.000 | 0.000 |
| **Observations** | 875 | 875 |
| **R-squared** | 0.077 | 0.454 |
| **Number of manufacturers** | 125 | 125 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 4.5 ROBUSTNESS CHECKS

The robustness checks were performed to verify the validity of our results. First, we checked whether endogeneity was an issue. Namely, we employed the C-statistic test (also referred to as the difference-in-Sargan test) to check if endogeneity was significant (Baum et al., 2003; Polloni-Silva et al., 2021). Specifically, we used the lagged values of the KIBS and ABC variables as instruments, which is a commonly used procedure in this type of studies (Burnow, 2020). In sum, endogeneity was not significant for KIBS (p-value: 0.567) or ABC (p-value: 0.702), demonstrating the validity of our previous results.

Second, we also evaluated the models expressed in equations 4.3 and 4.4 for estimating the TFP by using the method of Mollisi and Rovigatti (2017) (MR). By adding dynamic panel instruments to improve efficiency and gain predictive power, the MR method remains consistent and performs better than Wooldridge's single-step GMM framework (Wooldridge, 2009) as the number of observations increases. Thus, our results were also tested using the MR estimation method. The new results of the TFP estimation are shown in Table 4.3. In column 1, the model indicates that for low levels of KIBS deepening, the effects on manufacturing productivity are significant but negative. This result is significant but negative, and the other results are similar to Table 4.2. In column 2 (Table 4.3), the results for the absorptive capacity are presented. For low and intermediate levels of ABC, the effects of the presence of KIBS are null on the productivity of manufacturing firms. For high levels of ABC, these effects are positive and significant. These results are very close to those reported in Table 4.2. Furthermore, the control variables also presented similar results as well.

Finally, we also performed a sensitivity test in order to assess the stability of the results. Thus, we removed from the sample the manufactures that were located in the cities of Conde (PB), Pradópolis (SP) and Barueri (SP), which represented the extreme values of top 1% and bottom 1% for the KIBS deepening. This analysis allowed us to identify whether these outliers could be distorting the results. As shown in Table 4.4, the sensitivity test results are similar to the results for the threshold regressions presented in Table 4.2.

Table 4.3 - Results for the threshold regressions using MR estimation for TFP

| VARIABLES | (1)<br>KIBS deepening regime-dependent | (2)<br>ABC regime-dependent |
|---|---|---|
| **Low KIBS deepening ($<\lambda_{11}$)** | -0.255*** | |
| | (0.0282) | |
| **Intermediary KIBS deepening ($\geq\lambda_{11}$ e $<\lambda_{12}$)** | -0.0172 | |
| | (0.0117) | |
| **High KIBS deepening ($\geq\lambda_{12}$)** | 0.167*** | |
| | (0.0192) | |
| **Low ABC ($<\lambda_{21}$)** | | 0.0154 |
| | | (0.0126) |
| **Intermediary ABC ($\geq\lambda_{21}$ e $<\lambda_{22}$)** | | -0.0102 |
| | | (0.0124) |
| **High ABC ($\geq\lambda_{22}$)** | | 0.0160* |
| | | (0.00840) |
| **Age** | -0.0888** | -0.240** |
| | (0.0434) | (0.0975) |
| **Stock** | -0.228*** | -0.156 |
| | (0.0749) | (0.114) |
| **Patrimony** | 0.352*** | 0.274*** |
| | (0.123) | (0.0684) |
| **HT*mktshare** | 0.00616 | 0.00290 |
| | (0.0136) | (0.0160) |
| **MHT*mktshare** | -0.0506** | -0.0680*** |
| | (0.0202) | (0.0218) |
| **MLT*mktshare** | -0.0852 | 0.216 |
| | (0.106) | (0.202) |
| **LT*mktshare** | -0.0283*** | -0.0304*** |
| | (0.0106) | (0.0106) |
| **HHI** | 0.0153 | 0.0397*** |
| | (0.0105) | (0.0135) |
| **Economic Complexity** | -0.0184*** | -0.0206* |
| | (0.00524) | (0.0105) |
| **GDP pc** | 0.0209 | -0.00145 |
| | (0.0166) | (0.0119) |
| **Agro GDP** | 0.0134 | 0.0228 |
| | (0.0173) | (0.0186) |
| **Constant** | -0.00300 | 0.0477 |
| | (0.0124) | (0.0344) |
| **Threshold 1 ($\lambda_1$)** | 0.473 | -0.377 |
| **Threshold 2 ($\lambda_2$)** | 0.466 | 0.108 |
| **Threshold test p-value (single)** | 0.373 | 0.000 |
| **Threshold test p-value (double)** | 1.000 | 0.000 |
| **Observations** | 875 | 875 |
| **R-squared** | 0.446 | 0.078 |
| **Number of manufacturers** | 125 | 125 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 4.4 - Sensitivity test results

| VARIABLES | (1) KIBS deepening regime-dependent | (2) ABC regime-dependent |
|---|---|---|
| **Low KIBS deepening (<$\lambda_{11}$)** | 0.0153 | |
| | (0.00851) | |
| **Intermediary KIBS deepening (≥$\lambda_{11}$ e <$\lambda_{12}$)** | 0.00358 | |
| | (0.00950) | |
| **High KIBS deepening (≥$\lambda_{12}$)** | -0.0227** | |
| | (0.00781) | |
| **Low ABC (<$\lambda_{21}$)** | | -0.358** |
| | | (0.109) |
| **Intermediary ABC (≥$\lambda_{21}$ e <$\lambda_{22}$)** | | 0.00150 |
| | | (0.00365) |
| **High ABC (≥$\lambda_{22}$)** | | 0.172*** |
| | | (0.0252) |
| **Age** | 0.00169 | 0.00154 |
| | (0.00522) | (0.00250) |
| **Stock** | -0.0329 | -0.0280 |
| | (0.0496) | (0.0422) |
| **Patrimony** | 0.00849 | 0.0100 |
| | (0.0168) | (0.0399) |
| **HT*mktshare** | 0.00219 | 0.00501 |
| | (0.00939) | (0.00401) |
| **MHT*mktshare** | -0.00140 | -0.00229 |
| | (0.00321) | (0.00162) |
| **MLT*mktshare** | 0.00690 | 0.00326 |
| | (0.0102) | (0.00360) |
| **LT*mktshare** | -0.00893 | -0.00287 |
| | (0.00783) | (0.00643) |
| **HHI** | 0.00317 | 0.000172 |
| | (0.00232) | (0.00239) |
| **Economic Complexity** | -0.00176 | -0.00381 |
| | (0.00381) | (0.00296) |
| **GDP pc** | -0.00161 | -0.000942 |
| | (0.00489) | (0.00447) |
| **Agro GDP** | 0.00161 | 4.41e-05 |
| | (0.00269) | (0.00153) |
| **Constant** | -0.00455 | -0.00107 |
| | (0.00340) | (0.00526) |
| **Threshold 1 ($\lambda_1$)** | 0.460 | -0.377 |
| **Threshold 2 ($\lambda_2$)** | 0.476 | 0.108 |
| **Threshold test p-value (single)** | 0.0333 | 0.000 |
| **Threshold test p-value (double)** | 0.6133 | 0.000 |
| **Observations** | 854 | 854 |
| **R-squared** | 0.044 | 0.445 |
| **Number of years** | 7 | 7 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 4.6 DISCUSSIONS

The results allow us to elaborate on various discussion topics. First, the extant territorial servitization research holds the assumption that collaborations between KIBS firms and manufacturers generate benefits for both firms and regional development (Lafuente et al., 2017; Liu et al., 2019). Moreover, studies (e.g., Gomes et al., 2019; Seclen-Luna and Moya-Fernández, 2020; Fan and Li, 2021) also highlight that the spatial proximity between these two types of firms enables face-to-face interaction, increases collaborations, and facilitates knowledge transfer. In this sense, proximity makes the transfer of knowledge and resources necessary for territorial servitization (Gomes et al., 2019; Seclen-Luna and Moya-Fernández, 2020). Nevertheless, our results did not support that spatial proximity only is sufficient to produce productivity spillovers since the hypothesis (H1) was not confirmed. This result is also aligned with other studies that recognize the concentration of KIBS firms in a specific territory as an inductor of territorial servitization, although they emphasize the conjoined presence of other conditions (e.g., the structure of productive know-how; public funding; university presence; and entrepreneurial ecosystem) to create positive impacts (Figueroa-Armijos, 2019; Horváth and Berbegal-Mirabent, 2020; Horváth and Rabetino, 2019).

Second, our results contribute to advance the discussion concerning the role of absorptive capacity in territorial servitization. We agree that KIBS firms provide specialized knowledge that supports manufacturers in their servitization strategies (Bustinza et al., 2019a; Liu et al, 2019). Thus, KIBS are key actors in the product-service innovation ecosystems (Bustinza et al., 2019b). Nevertheless, we found that absorptive capacity plays a key role in this relationship. Indeed, manufacturers need a certain level of absorptive capacity to seize the social capital and the proximity with the KIBS firms. For manufactures with low-level of absorptive capacity, this effect is negative, meaning that manufacturers that do not have a minimum level of absorptive capacity end up suffering the loss of productivity. Another potential explanation for these negative results would be the flow of workers out of manufacturers towards KIBS, whereas many of these experienced manufacturing workers are obviously attractive to business services companies (Henning, 2020). In this sense, KIBS end up capitalizing this high-skill workers specially from manufacturers with lower absorptive capacity, which can result in lost productivity. Conversely, for manufacturers with a high level of absorptive capacity, this effect is positive. This means that these firms gain productivity by being in a location with concentrations of KIBS.

These results are similar to Vendrell-Herrero et al. (2020a) in their analysis of the effect of service competencies on the productivity of non-exporting manufactures. More important yet, they contradict the understandings that exposure to knowledge sources always generates neutral or positive consequences. Therefore, aligned with Vendrell-Herrero et al. (2020a), we also reinforce the paradox of learning (Schad et al., 2016). In this case, the knowledge transfer to manufacturers requires a minimum level of absorptive capacity to be understood (Cohen and Levinthal, 199; Grandinetti, 2018). Firms with this comparative disadvantage (low absorptive capacity) are not able to seize the positive effects of the KIBS concentration compared to those with a high level of absorptive capacity. In addition, companies with higher levels of absorptive capacity are more able to adapt themselves to changes in the dynamic markets since they capture these opportunities provided by KIBS and transform them into improved products, processes, and services.

Third, KIBS firms are also critical actors for the development of digital servitization (Bustinza et al., 2019b) since they provide technical knowledge and services for manufactures (Feser and Proeger, 2018; Gebauer and Binz, 2019; Lafuente et al., 2017). Digital servitization refers to the convergence between servitization and digitalization (Frank et al., 2019; Sjödin et al., 2020; Paiola et al., 2021). Moreover, digital servitization calls for an ecosystem approach in which several actors (suppliers, distributors, service partners, and customers) need to collaborate to provide smart product-service systems (Sklyar et al., 2019; Tronvoll et al., 2020). In contexts characterized by the intensive use of digital technologies (e.g., internet of things, cloud computing, big data, etc.), manufacturers can rely on KIBS firms that provide specialized knowledge-intensive services for supporting their digital transformation. Thus, based on our results, it is valid to assume that manufacturers with low absorptive capacity face significant problems in adopting digital servitization, consequently, they are not able to take advantage of the benefits of this business trend.

## 4.7 CONCLUSIONS

This study aimed to investigate the relationship between KIBS deepening and manufacturer´s productivity in the context of territorial servitization. Moreover, it also assessed the moderating role of absorptive capacity in this relationship. To achieve the objective, an econometric analysis using a threshold regression model of regional and financial data from 125 Brazilian manufacturers collected during the timeframe of 2010 to 2017 was carried out. Results indicate that KIBS deepening on its own does not bring productivity benefits.

Manufacturers may collect positive gains if they have high levels of absorptive capacity. These results offer several contributions to the literature and also provide useful guidance for practitioners.

### 4.7.1 Theoretical implications

The present study has three theoretical contributions. First, territorial servitization studies have addressed the symbiotic relationship between KIBS and manufacturers with positive benefits at the regional-level (Lafuente et al., 2017; Liu et al., 2017) but few studies have discussed its results at the firm-level as well as the internal capabilities that are necessary to achieve such results (Lafuente et al., 2019). Thus, this study contributes to advance the emergent territorial servitization literature by addressing these two issues. Second, although territorial servitization studies have highlighted the relevance of KIBS deepening for manufacturers´ innovation and servitization strategies (e.g., Gomes et al., 2019; Seclen-Luna and Moya-Fernandez, 2020), we revealed that the concentration of KIBS firms (consequently, spatial proximity with manufacturers) does not have a direct and positive influence in manufacturers´ performance. It is required that these manufacturers have a certain level of absorptive capacity to exploit potential knowledge spillover from KIBS firms (Zahra and George, 2002). In this sense, this study contributes by revealing the absorptive capacity as a boundary of territorial servitization. Third, interesting results were obtained considering the level of absorptive capacity of the investigated manufacturers. Thus, manufacturers with low absorptive capacity have difficulties in recognizing, assimilating, and transforming available knowledge into productivity gains, whereas manufacturers with high absorption capacity capture knowledge and transform it into improved products and services resulting in productivity gains. Therefore, this result contributes to the literature by challenging traditional innovation growing literature on paradoxes of learning, which are directly linked to absorptive capacity (Hislop et al., 2018).

### 4.7.2 Managerial implications

This study has important implications for managers and policy-makers. First, Territorial servitization seems an alternative to optimizing the offer of product and service packages while generating positive results for companies and territories (Lafuente et al., 2017). However, manufacturers need to follow an ecosystem perspective, including a range of actors such as

clients, suppliers, and service partners (Sklyar et al., 2019). This means that managers must be aware of the requirements, capabilities, and demands of prior knowledge so that this relationship with other actors from the ecosystem, in this case, KIBS firms, to gain positive performance results (Paiola et al., 2021). Second, we presented the absorptive capacity as a conditional attribute for the manufactures to obtain positive results in productivity. Thus, managers must prioritize strategies that enhance the absorption capacity level of their organizations so that they can obtain gains in productivity. In terms of policy implications, policymakers should prioritize and encourage policies for the creation and sustainability of KIBS, especially in territories that concentrate manufacturers with high absorption capacity, as our results show that this combination of factors can result in productivity gains, consequently improving regional competitiveness and local industry.

### 4.7.3 Limitation and future research

Several limitations need to be considered. First, since Brazil does not have a large financial database for the calculation of productivity indicators, our sample is relatively small. Moreover, it contains only large manufacturers. Thus, our results and conclusions should be careful considered regarding small and medium-sized manufacturers. Thus, future research should consider analyses with larger samples that also include small and medium manufacturers as well as different databases. Second, our variable KIBS deepening does not specify the type of KIBS firms. Recent studies highlighted the importance of technological KIBS for the development of capabilities linked to Industry 4.0 and digital servitization (Bustinza et al., 2021; Vaillant et al., 2021). Thus, we suggest that new studies consider the impact of different types of KIBS firms on the manufacturers´ performance. Lastly, we used the technological frontier distance (technology gap) as a proxy for absorptive capacity (Girma, 2005). However, other approaches of representing absorptive capacity are available in the literature, such as the research and development intensity of companies and human capital embodied (Fu, 2008; Griffith et al., 2003). Hence, using others measures for absorptive capacity should be interesting to validate our findings. Equally important, other organizational attributes should be included in future studies as antecedent factors that stimulate and enhance the connections between KIBS and manufacturers as well as the benefits from them.

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**Appendix A – List of Brazilian cities where manufacturing companies are located**

| | | |
|---|---|---|
| Alvorada (RS) | Gravataí (RS) | Pradópolis (SP) |
| Barbacena (MG) | Guarulhos (SP) | Rio De Janeiro (RJ) |
| Barretos (SP) | Indaiatuba (SP) | Rio Do Sul (SC) |
| Barueri (SP) | Itajaí (SC) | Salvador (BA) |
| Belo Horizonte (MG) | Jaraguá Do Sul (SC) | Santa Barbara D'Oeste (SP) |
| Blumenau (SC) | Joinville (SC) | Santa Cruz Do Sul (RS) |
| Brusque (SC) | Jundiaí (SP) | Santo André (SP) |
| Camaçari (BA) | Lajeado (RS) | São Bernardo Do Campo (SP) |
| Campinas (SP) | Manaus (AM) | São José Dos Campos (SP) |
| Cataguases (MG) | Mogi Guaçu (SP) | São Leopoldo (RS) |
| Caxias Do Sul (RS) | Mogi Mirim (SP) | São Paulo (SP) |
| Conde (PB) | Montes Claros (MG) | São Sebastião Do Caí (RS) |
| Contagem (MG) | Natal (RN) | Sapucaia Do Sul (RS) |
| Cotia (SP) | Nova Friburgo (RJ) | Sobral (CE) |
| Cruzeiro (SP) | Nova Odessa (SP) | Tijucas (SC) |
| Curitiba (PR) | Osasco (SP) | Timbo (SC) |
| Eldorado Do Sul (RS) | Parnamirim (RN) | Uberaba (MG) |
| Eusébio (CE) | Pojuca (BA) | Várzea Paulista (SP) |
| Fortaleza (CE) | Ponta Grossa (PR) | Viana (ES) |
| Fraiburgo (SC) | Porto Alegre (RS) | |

**Appendix B – Classification of KIBS using CNAE codes**

| CNAE Code | Description |
|---|---|
| 61 | Telecommunications |
| 62 | Information Technology Services Activities |
| 63 | Information service activities |
| 66 | Activities auxiliary to financial services, insurance, pension plans and health plans |
| 69 | Legal, accounting and auditing activities |
| 70 | Corporate headquarters and business management consulting activities |
| 71 | Architectural and engineering services; technical testing and analysis |
| 72 | Scientific research and development |
| 73 | Advertising and market research |
| 74 | Other professional, scientific and technical activities |
| 78 | Labor selection, management and leasing |
| 82 | Office, administrative support services and other business services |
| 95 | Repair and maintenance of computer and communication equipment and personal and household items |

Source: Adapted from Guimarães and Meirelles (2014); Miles et al. (1995) and J-Figueiredo et al. (2017)

## Appendix C - Definition of variables and descriptive statistics

| Variable | Definition | Source | mean | min | max | sd |
|---|---|---|---|---|---|---|
| Gross Revenue (x1000 BRL) | Consolidated gross revenue | Economática | 5483142 | 0 | 1.77E+08 | 1.55E+07 |
| Capital (x1000 BRL) | Consolidated inventory of fixed assets (plant and equipment) | Economática | 2547146 | 0 | 3.84E+07 | 6052215 |
| Labor (x1000 BRL) | Consolidated expenditures on labor and other social securities | Economática | 96544.4 | 0 | 3141737 | 241515.8 |
| Investment (x1000 BRL) | Consolidated spending on investments | Economática | 259702.3 | -1082.344 | 1.73E+07 | 1437537 |
| Patrimony (x1000 BRL) | Consolidated net worth | Economática | 2582825 | -8424175 | 5.48E+07 | 6621894 |
| Stock (x1000 BRL) | Consolidated stock | Economática | 769549.7 | 0 | 1.22E+07 | 1836451 |
| Age | Company Age | B3 website | 55.1 | 2 | 134 | 27.52962 |
| HHI | Herfindahl-Hirschman index | B3 website | 0.3880297 | 0 | 1 | 0.2502732 |
| GDP pc | Gross Domestic Product per Capita | IBGE | 42412.85 | 6952.51 | 182102.8 | 18779.4 |
| Agro GDP | Participation of agriculture and cattle ranching in the gross domestic product | IBGE | 0.007325 | 3.92E-06 | 0.2030683 | 0.0196235 |
| Economic Complexity | Diversity of economic activities considering the products exported by the municipality | Dataviva | 6.258829 | -8.367 | 24.29 | 8.995926 |
| KIBS deepening | Number of people employed in KIBS in city as a share of total employment in cities | Dataviva | 0.0981049 | 0.0028043 | 0.3108657 | 0.0507685 |

# 5 CONSIDERAÇÕES FINAIS

Esta dissertação teve como objetivo avaliar os impactos da concentração de KIBS na produtividade das empresas de manufatura brasileiras. Para alcançar tal objetivo, o estudo foi desenvolvido a partir de duas etapas. A primeira, um estudo de escopo, teve a finalidade de identificar os principais temas dispostos na literatura sobre as conexões entre as empresas de manufatura e as KIBS; além de sistematizar os efeitos intraorganizacionais e regionais da servitização territorial. A segunda etapa, análise econométrica, consistiu a aplicação de um modelo de regressão de limiar com dados regionais e financeiros de 125 empresas de manufatura brasileiras com a proposta de destacar os efeitos da concentração de KIBS na produtividade de empresas de manufatura e determinar se esses efeitos dependem de um nível mínimo da capacidade de absorção. A seguir são apresentados os principais resultados e contribuições do trabalho. Na sequência, as limitações e sugestões para estudos futuros.

## 5.1 IMPLICAÇÕES TEÓRICAS E PRÁTICAS

Na primeira etapa, os resultados apresentaram os principais (i) mecanismos envolvidos nas conexões entre KIBS e fabricantes (co-criação de valor, transferência de conhecimento, suporte à inovação e implementação da servitização), (ii) resultados em nível de firma (competitividade, desempenho operacional e financeiro), e (iii) efeitos em nível regional (desenvolvimento econômico, aglomeração de KIBS e desenvolvimento de políticas públicas). Além disso, foram identificadas lacunas de pesquisa com a proposta de direções de pesquisas futuras para avançar o campo de pesquisa. Estes resultados são considerados as principais contribuições teóricas desta etapa, já que a literatura referente as conexões entre KIBS e empresas de manufatura é majoritariamente relacionada aos processos de inovação e transferência de conhecimento. Desde modo, este estudo contribuiu para a expansão deste conhecimento ao passo em que formaliza a importância das KIBS para a servitização (conceito que foi o impulsionador da servitização territorial), e relaciona como estes processos de cocriação entre KIBS e empresas de manufatura podem gerar benefícios para as empresas e, para os territórios onde estão localizadas.

Além disso, esta etapa apresenta implicações gerenciais à medida em que formaliza a importância dos gerentes das empresas de manufatura em buscarem colaborações com as KIBS, já que estas apresentam diversos benefícios organizacionais. Para os formuladores de políticas,

este estudo demonstrou a importância de apoiar a interação entre as empresas KIBS e os setores de manufatura, já que estas conexões aumentam os efeitos agregados relacionados ao desenvolvimento econômico e a criação de empregos.

Na segunda etapa desse trabalho, os resultados identificaram a concentração de KIBS por si só não é capaz de produzir efeitos positivos na produtividade das empresas de manufatura. É necessário que essas empresas tenham um nível mínimo de capacidade de absorção (ZAHRA e GEORGE, 2002). As empresas de manufaturas com baixa capacidade de absorção apresentam dificuldades para transformar o conhecimento disponível em ganhos de produtividade, enquanto que as manufaturas com alta capacidade de absorção captam o conhecimento e o transforma em produtos e serviços aprimorados, resultando em ganhos de produtividade. Logo, este estudo contribui para a literatura ao destacar a importância da concentração de KIBS para o aumento da produtividade das empresas de manufaturas mas com a condição de possuírem capacidade de absorção necessária para transforarem os conhecimentos e tecnologias dispostos pela concentração de KIBS em indicadores de produtividade. Neste sentido, este estudo também contribui teoricamente ao constatar a capacidade de absorção das empresas de manufatura como um atributo/mecanismo que possibilita a servitização territorial.

Esta etapa também apresenta implicações gerenciais vinculadas ao desenvolvimento da capacidade de absorção. Os gestores devem priorizar estratégias que aumentem o nível de capacidade de absorção de suas organizações para que possam obter ganhos de produtividade. Em termos de implicações políticas, os formuladores de políticas devem priorizar e estimular políticas de criação e sustentabilidade de KIBS, principalmente em territórios que concentram fabricantes com alta capacidade de absorção, pois os resultados mostram que esta combinação de fatores pode resultar em ganhos de produtividade, consequentemente melhorando a competitividade regional e a indústria local.

## 5.2 LIMITAÇÕES E PESQUISAS FUTURAS

As principais limitações encontradas no desenvolvimento do estudo foram:

- O Brasil não possui banco de dados relevantes para o cálculo de indicadores de produtividade, o que tornou a amostra pequena e limitada à apenas uma base de dados;
- O estudo empregou apenas dados de grandes empresas que estavam listadas na Bolsa de Valores, o que limita e torna cautelosa a generalização dos resultados;

- A variável de concentração de KIBS não considerou a distinção entre os três tipos de KIBS encontrados na literatura (P-KIBS, T-KIBS e C-KIBS);
- A variável de capacidade de absorção teve como proxy a aplicação do método de Girma (2005) sendo a distância da fronteira tecnológica (gap tecnológico), porém, outras abordagens de representação da capacidade de absorção estão disponíveis na literatura, como a intensidade de pesquisa e desenvolvimento das empresas e o capital humano incorporado (FU, 2008; GRIFFITH *et al.*, 2003).

Desde modo, recomenda-se como estudos futuros:

- A ampliação dos dados através do uso de outras bases de dados;
- A inclusão de pequenas e médias empresas, visto que estas são cruciais para no contexto econômico brasileiro e validariam os resultados apresentados neste estudo;
- A distinção entre os tipos de KIBS e verificação como cada um impacta em indicadores de produtividade contribuiria na expansão dos resultados deste estudo;
- Uso de outros indicadores de capacidade de absorção para validar os atuais resultados;
- A inclusão de outros indicadores organizacionais afim de ampliar o conhecimento sobre os atributos necessários para as conexões benéficas entre KIBS e empresas de manufatura no contexto da servitização territorial.

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