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# Article

# Exploring the mechanisms underlying firms' intent to adopt circular business models

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# Exploring the Mechanisms Underlying Firms' Intent to Adopt Circular Business Models

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#### ABSTRACT

Firms play a vital role in the transition towards a circular economy (CE). However, the number of firms implementing CE initiatives, or circular business models (CBMs—economic models based on CE principles), is currently small. In light of this, this study quantitatively assesses the critical factors that influence firms' intentions to adopt CBMs, with the theories of Planned Behavior and the Resource-based View providing the theoretical background. We applied the PLS-SEM to 321 firms and found that attitude and perceived behavioral control of firm owners/managers, as well as long-term orientation and social pressure of firms, significantly influence the intention to adopt CBMs, with perceived behavioral control emerging as the most influential factor. The findings also confirm that finance and knowledge have a crucial influence on firm owners'/managers' perceptions of the conditions necessary to undertake CBMs. Overall, then, the study provides sound policy implications and scholarly evidence to fill the relevant research gap, and in so doing contributes to ensuring a better transition towards a CE.

#### KEY WORDS: circular business model, circular economy, intention, TPB, PLS-SEM.

#### JEL Classification: Q01, Q56, D2.

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# 1. Introduction

This article explores the factors that influence firms' intentions to adopt a circular business model (CBM), which is the mainstay of the circular economy (CE). The CE is an innovative economic model that has garnered significant interest from governments worldwide in the present decade as a prospective strategy for achieving sustainable development goals (Rodriguez-Anton et al., 2019). This novel economic model is superior to the linear economy due to its restorative and regenerative nature, which prevents resource waste and bolsters social and environmental capital (Kirchherr et al., 2018). The transition to the CE is projected to generate global growth of \$4.5 trillion by 2030, significantly enhance the resilience of global economies, and mitigate environmental externalities (García-Sánchez et al., 2021).

It is notable, though, that the countries leading the transition to the CE are primarily European nations with outstanding action plans, such as Finland's National Circular Economy Roadmap (Sitra, 2016), France's Circular Economy Roadmap (The French Ministry of Ecological and Transition, 2018), or Poland's Roadmap towards the Transition to the Circular Economy (Interministerial Committee for Circular Economy, 2017). Many other countries, especially global manufacturing centers, have yet to fully exploit the potential of the CE

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(Bocken et al., 2021). This disparity arises because the CE demands the engagement of all economic stakeholders, particularly firms, in adopting a new economic model for sustainable production. Yet, the majority of firms in less circularly developed countries have not actively participated in this transformative process. Only a small number implement CE initiatives or adopt CBMs (Banelienė & Strazdas, 2023). If the transition to a CE is limited to administrative agencies and public bodies, it will not be able to reach its full potential. Therefore, it is advisable for government policies or roadmaps for transitioning to a CE to place greater emphasis on encouraging firms' participation in this CBM process.

The primary objective of CBMs is to minimize the depletion of resources, mitigate waste generation, and reduce emissions within the framework of business operations. Geissdoerfer et al. (2020) elaborate on the fundamental components of CBMs, which encompass four key approaches: cycling, extending, intensifying, and dematerializing. The "cycling" involves the internal recycling of materials and energy within the system through reusing, remanufacturing, refurbishing, and recycling. "Extending" pertains to the extension of the life of each resource loop through the incorporation of durable and sustainable design principles. "Intensifying" refers to the expansion of the number of resource loops through innovative solutions such as the sharing economy or public transportation systems. "Dematerializing" is the process of delivering product functionality without relying on physical materials but through software solutions. In essence, CBMs are designed to capture value within self-sustaining loops.

There is extensive literature on firms' implementation of CBMs, but most of the research is theoretical in nature, with an emphasis on the concepts and principles of constructing CBMs. Moreover, the current literature is yet to produce evidence of firms' intentions to adopt CBMs, which is significant because intention has consistently been proven to be the most accurate predictor of actual behavior (Ajzen, 1991). This study therefore delves into this area. Methodologically, we extend behavioral theories to develop a conceptual framework in order to provide insights into the drivers and barriers that motivate or hinder firms' intention to adopt CBMs. By investigating the critical drivers of firms' intention to adopt CBMs, this study can advance the existing literature by using empirical evidence to provide valuable insights to policymakers, public administrations, and firms interested in embracing circular transformation.

The remainder of this paper is organized as follows. Section 2 reviews the background literature and proposes the hypotheses. Section 3 outlines the model specifications, data, and sample selection. Section 4 presents the empirical results and hypothesis testing. Section 5 discusses the main results and reveals the outcome of the hypothesis tests. Section 6 concludes the paper.

# 2. Theoretical Framework and Hypotheses

#### 2.1. Theoretical Framework

The existing literature has identified several factors—which can be divided into hard factors and soft factors—that influence a firm's intention (Lewis et al., 2006). While hard factors are changeable and may vary based on a firm's context, soft factors are long-term issues that are inherent to firms and more difficult to change. As such, soft factors such as culture, which is explored in research on organizational behavior by Lewis et al. (2006), Sciarell et al. (2020), and Boffa et al. (2023) are more limited but have a greater capacity to sustain firms' continued growth. In contrast, hard factors are more diverse and variable depending on the different justifications at points in time.

When considering a firm's intention, it is important to recognize that a firm, as an entity, does not possess an inherent intention. Instead, it is the individuals comprising the business who harbor intentions and act upon them (Abraham & Sheeran, 2003; Osterwalder, 2005). Therefore, psychological theories of individuals' intentions can be applied to firms, with adjustments made to fit the nature of the firm and to avoid biases from an individual's viewpoint (Teece, 2010).

Among the widely accepted models for predicting human intention is the Theory of

Planned Behavior (TPB) proposed by Ajzen (1991). According to TPB, human intentions are influenced by three types of considerations—attitudes toward behavior, subjective norms regarding the expectations of others, and perceived behavior control (PBC)—each of which can be influenced by expected support and/or potential resources (Ajzen, 1991). Several studies, such as Khan et al.'s (2020) on organizations' intentions regarding the CE, Luthra et al.'s (2022) on the operational behavioral factors of SMEs' CE practices, and Singh et al.'s (2018) on CE readiness in manufacturing MSMEs in India, have effectively applied TPB to investigate the factors contributing to the adoption of CE practices.

To identify the resources that can potentially facilitate PBC in the TPB framework, this study adopts the Theory of Resource-based View of the firm (TRB) proposed by Wernerfelt (1984), which emphasizes firms' behavior from the resource perspective. In Wernerfelt's work (1984), a firm's resources encompass tangible and intangible factors that are owned and/or controlled by the firm, including financial resources, labor resources, human-capital intensive resources (knowledge), and physical resources (in which technology plays an important role). According to Lewis et al. (2006), the elements encompassed by TPB and TRB are classified as hard factors, as they exhibit greater variability and can manifest differently at different points in time.

As a result, this paper integrates the classification framework proposed by Lewis et al. (2006) along with the theoretical foundations of TPB and TRB. Then, incorporating necessary adjustments, the study presents the following conceptual framework, as depicted in Figure 1.

#### 2.2. Hypotheses

#### 2.2.1. Attitude Towards Circular Business Models

Attitude is the first independent variable in the TPB framework with the ability to directly influence intention. Ajzen and Fishbein (1991) stated that attitudes can be assessed through organizations, minority groups, and individuals. However, organizations or groups do not possess an attitude themselves but, rather, reflect it through their people, especially those who occupy major decision-making roles, such as owners or managers (Bashi et al., 2023; Zucchella et al., 2021). Indeed, the attitudes of owners and managers can influence followers towards a specific behavior. Following this logical reasoning, combined with the original definition of Ajzen (1991), a firm's attitude can be defined as the degree to which its owners/managers form favorable or unfavorable assessments of a plan of action. For example, if a firm's owners/managers are ecologically responsible and

#### **Figure 1** *Conceptual Framework of the Study*



believe that the adoption of CBMs may meet their desire while also providing economic opportunities for businesses, they would hold a good attitude towards CBMs and be more likely to engage in CBMs (Singh et al., 2018). Such a mindset is likely to result in a proactive CBMs orientation, which in turn will have a favorable impact on the business's objectives and behaviors (Roxas and Coetzer, 2012). Thus, the hypothesis is proposed as follows.

 $H_1$ : Firm owners'/managers' attitude towards circular business models has a positive and direct impact on a firm's intention to adopt the circular business models.

#### 2.2.2. Social Pressure

In the TPB framework, the second element is commonly referred to as "subjective norm", which represents the perceived social pressure to either perform or not perform a behavior (Ajzen, 1991). Should individuals have a strong sense of subjective norms, they are more likely to respond to the pressure they perceive from various sources. When examining the behavior of firms, international experts such as Roxas and Coetzer (2012) and Singh et al. (2018) recommend substituting the term "social pressure" for the original variable to better capture its nature. The literature highlights several primary sources of social pressure, including the government, customers, partners, and other stakeholder groups associated with firms. When these stakeholders endorse specific activities, the owners/managers of an organization are more likely to consider implementing them. For example, in the context of CBMs, when a government legally mandates environmental standards and actively promotes CBMs, the intentions of certain firm owners/ managers are likely to be influenced (Wainaina et al., 2020). In some countries, government institutions play the most influential role in the decision-making processes of businesses, followed by other stakeholders (Roxas & Coetzer, 2012). This leads us to propose our second hypothesis:

 $H_2$ : A firm's social pressure has a positive and direct impact on the firm's intention to adopt circular business models.

#### 2.2.3. Perceived Behavioral Control

Perceived behavioral control, as defined by Ajzen (1991), encompasses the perceived ease or difficulty

of performing a behavior and is shaped by expected support and potential resources. This construct is believed to reflect both past experiences and anticipated challenges. In the context of adopting CBMs, the perception of a company's available resources plays a crucial role in shaping its behavioral intentions (Singh et al., 2018). That is, if owners/managers perceive their firms to have limited resources and consider the transition to CBMs to be costly and burdensome, these perceptions will inevitably influence their intention to embrace CBMs (Lewandowski, 2016).

Furthermore, it is worth noting that in the original TPB model proposed by Ajzen (1991), the three main independent variables—attitude, social pressure, and perceived behavioral control—not only influence the dependent variable of intention but also exhibit interrelationships among themselves. Considering this interdependence, this study aims to explore the impact of PBC on a firm's intention to adopt CBMs, as well as the correlations between attitude, social pressure, and PBC within the TPB framework.

On this basis, the following hypothesis is proposed:

H<sub>3</sub>: Firm owners'/managers' perceived behavioral control positively and directly impacts a firm's intention to adopt circular business models.

H4: There is a significantly positive correlation between attitude, social pressure, and PBC in the TPB framework.

#### 2.2.4. Long-term Orientation

Culture influences a firm's behavior as a soft factor, but not all its values are directly linked to proenvironmental behavior (Boffa et al., 2023). Long-term orientation, a critical cultural dimension, is particularly recognized as a significant factor in strengthening firms' preference for these types of practices (Saether et al., 2021). For instance, long-term-oriented firms often prioritize long-term planning, prudent financial management, and careful consideration of alternatives in their decisions, which aligns with the essence of environmentally friendly practices like CBMs (Nguyen et al., 2022). Thus, it can be implied that a greater emphasis on long-term orientation within a firm's values is associated with a greater preference for CBM adoption. Notably, a company's orientation towards short-term or long-term economic activities is most visibly manifested through the leadership of the business owner (Ranta et al., 2018). In other words, if firm leaders demonstrate a preference for short-sighted solutions or short-lived projects, it will significantly impact the firm's inclination to embrace long-term business models (Kirchherr et al., 2018). Conversely, firm owners/managers with a long-term orientation are more likely to embrace sustainable business models, such as CBMs. Accordingly, the following hypothesis is proposed:

H<sub>5</sub>: A firm's long-term orientation has a positive and direct impact on its intention to adopt CBMs.

#### 2.2.5. Financial resources

When a company aims to implement a CBM, they must typically invest a substantial amount of financial resource to acquire or upgrade technology and infrastructure, enabling the completion of material loops and the generation of additional economic value (Aranda-Usón et al., 2019). Insufficient investment or challenges in obtaining necessary financial resources can have a profound impact on the effectiveness of CBM implementation, particularly for small and medium-sized businesses (Rizos et al., 2016). In this context, the availability of financial resources, which is reflected in a firm's capital and financial support from stakeholders such as credit institutions, plays a crucial role in enabling firms to develop CBMs (Aranda-Usón et al., 2019). According to Aloini et al. (2020), business owners/managers are more likely to perceive a higher degree of CBM adoption if their company possesses strong financial resources or has the capacity to access a variety of capital sources with reasonable costs and straightforward procedures. Based on this understanding, the following research hypothesis is proposed:

H<sub>6</sub>: Financial resources have a positive and direct impact on the perceived behavioral control of firm owners/managers.

#### 2.2.6. Knowledge of Circular Business Models

In the transition from a linear business model to a CBM, it is essential for personnel in the field to acquire diverse knowledge in areas such as product design, materials, supply chain, and technology (Sinha, 2022). When firm owners/managers possess a solid understanding of CBMs, they can effectively navigate the potential economic benefits and risks associated with their implementation, leading to increased receptivity towards this approach (Kirchherr et al., 2018). Within the context of CBMs, knowledge encompasses a fundamental understanding of the concept and practice of CBMs, based on the owners'/ managers' prior knowledge or experience (Roxas & Coetzer, 2012). Even if a business owner's awareness of CBMs is limited, they can still facilitate more efficient resource utilization, stimulate greater employee participation, and positively align operations with their overall goals (Bashir et al., 2023; Sinha, 2022). Based on these factors, the following hypothesis is proposed:

 $H_{\gamma}$ : Firm owners'/managers' knowledge has a positive and direct impact on their perceived behavioral control.

#### 2.2.7. Labor Resources

Several studies, such as those of Lewandowski (2016) and Aloini et al. (2020), have demonstrated that internal expertise plays a crucial role in a firm's assessment of the ease or difficulty of CBMs. This is primarily due to the complexity of the various CBM cycles, each of which requires new skill sets to enable and facilitate value generation, delivery, and capture, as well as to foster collaborations and partnerships (Foundation, 2017). In order to effectively analyze and implement these new business models, firms' employees require a specific level of technical expertise and knowledge (Sawe et al., 2021). However, many businesses, particularly those operating in the agriculture or service industries, often lack the labor resources necessary to identify, evaluate, and implement more advanced technical alternatives that would enable them to embrace CBMs (Rizos et al., 2016). Consequently, the absence of sufficient labor resources can discourage firm owners/managers from adopting CBMs, which leads us to propose the following hypothesis:

H<sub>g</sub>: Labor resources have a positive and direct impact on the perceived behavioral control of firm owners/managers.

#### 2.2.8. Technology Resources

The successful deployment of CBMs also relies on technology resources (Kirchherr et al., 2018). For instance, previous attempts to implement CBMs, such as the 3R approach (reduce-reuse-recycle), have achieved only modest success due to the utilization 394

of basic technologies (Laurenti et al., 2018). In recent years, though, the CBM has achieved more impressive results primarily due to the application of advanced technologies such as big data, artificial intelligence (AI), and blockchain, which enable the establishment of self-sufficient processes and the management of cleaner manufacturing (Hsu, 2023). On the flipside of this, small firms often struggle to adopt CBMs due to their limited technological capabilities (Kirchherr et al., 2018, Reim et al., 2022). As a result, if firm owners/ managers perceive that their company possesses substantial technological potential, they are more likely to view the adoption of CBMs favorably, thus increasing their intention to adopt this model (Aloini et al., 2020).

H<sub>3</sub>: Technology resources have a positive and direct impact on the perceived behavioral control of firm owners/managers.

### 3. Data and Methodology

#### 3.1. Research Context

Vietnam provides a suitable setting for our research due to two key factors. Firstly, the country is actively adopting CE but faces challenges in encouraging firms to implement CBMs. Such a context enables us to investigate the underlying factors influencing the intention of firms more than would a context in which significant progress has already been made in implementing CBMs. Additionally, given that Vietnamese firms are already to some extent familiar with CBMs, this setting can greatly facilitate the survey process.

Secondly, Vietnam represents a diverse range of contexts, including its status as a developing nation, as an emerging economy, and as a nation with a strong commitment to sustainability. Thus, by conducting an empirical study in Vietnam, valuable insights can be gained for various countries facing similar challenges and opportunities in implementing CBMs.

#### 3.2. Data Collection

This study utilized the purposive sampling method to select manufacturing and merchandise businesses from various sectors in Vietnam. The data collection process involved distributing a self-reported survey to firm owners/managers with the assistance of the Vietnam Chamber of Commerce and Industry (VCCI). The survey was conducted from May 2022 to July 2022. The questionnaire consisted of two parts: (a) general questions about the firms' business backgrounds and (b) specific questions related to the studied constructs, including attitude, social pressure, perceived behavioral control, knowledge, long-term orientation, and intention to adopt CBMs.

The measures for constructs used in the survey were based on the five-point Likert scale, which has been validated by previous literature available in the field of pro-environmental behaviors. The details of measurement items, scales, and their sources are described in Table 1. A pilot study was undertaken prior to the actual data collection process to test the questionnaire's readability and validity. Several statements in the questionnaire were amended to make them more comprehensible for respondents, taking into account feedback gained from test polls. Given that all of our questions are set to be mandatory, the received data has no missing information. As many as 330 responses were received, but nine respondents were from the financial services sector or were staff members, so we omitted their responses, leaving us with 321 complete responses.

We followed Yamane (1967) to determining the appropriate sample size (as referenced in Israel, 1992), whose formula calculates the sample size (n) based on the total number of target surveyed businesses (N) and an acceptable standard error (e) (as specified in the selected research paper):

$$n = \frac{N}{1 + N \left(e^2\right)}$$

Based on the results of the Vietnam General Statistics Office in 2021, there are approximately 300,000 firms in Vietnam in the manufacturing and merchandising sector. Using Yamane's formula to determine the appropriate sample size for the study, a final medium-sized sample of 321 firms is an acceptable sample with a standard error of approximately 5.5%.

#### 3.3. Measurement model

Given that our paper assesses latent variables (variables that need to be measured indirectly through other variables) with many structural paths to test theoretical extensions from assumptions, partial least squares structural equation modelling (PLS-SEM) stands out as the most suitable method to measure the relationship between dependent variables and independent variables (Hair et al., 2019). The suitability of PLS-SEM for this study is also consolidated through its ability to work efficiently with small sample sizes and a large number of items. The PLS-SEM was estimated using STATA software version 16.

Our study consists of 40 measurement items. Following the instruction of Kock and Hadaya (2018), which is based on the inverse square root method, the ratio of five samples/items is the minimum for the estimation of PLS-SEM. Thus, our sample of 321 firms meets the priori condition.

# 4. Results

#### 4.1. Descriptive Analysis

The demographic composition of the 321 survey respondents representing firms is presented in Table 1. Regarding firm size, the classification is based on Vietnamese Government standards specified in Article 6 of Decree 39/2018/ND-CP.

#### 4.2. Data Screening and Robustness Check

Following the guidelines proposed by Hair et al. (2019), the foremost step in evaluating PLS-SEM results involves examining the measurement models, which differ for reflective and formative constructs. If the measurement models meet the required criteria, researchers then need to assess the structural model.

A four-step process is carried out in order to perform data analysis. First, Cronbach's alpha is a reliability measure of items within each construct, with an acceptable value in the range of 0.7 to 0.9 (Hair et al., 2019). All of our Cronbach's alpha measures are qualified within the range (see Appendix A.1).

Second, a preliminary test is carried out to remove measures of each construct that cannot explain sufficient variance in the construct. To provide acceptable item reliability, factor loading scores are calculated for each measure of each construct. Measures with factor scores of less than 0.5 are removed from the model because they cannot indicate more than 50 per cent of the indicator's variance (Hair et al., 2019). The retained measures are represented in Appendix A.2.

Third, we examine the measurement models,

#### Table 1

Respondent Profile

		Frequency	Percentage
Position of participants	Director	131	40.81
	Senior manager	190	59.19
Education of participants	University	257	80.06
	Master	62	19.31
	Doctor	2	0.62
Firm type	Merchandise	42	13.08
	Manufacturing	279	86.92
Firm location	Urban	186	57.94
	Rural	98	30.53
	Remote	37	11.53
Firm size	Micro-scale	110	34.27
	Small-scale	155	48.29
	Medium-scale	43	13.40
	Large-scale	13	4.05

which differ for reflective and formative constructs (Table 2). This measurement enables us to construct a representative set of all possible items within the conceptual domain of a construct (Diamantopoulos et al., 2012), most often using average variance extracted (AVE), which assesses the validity of indicators (Fornell & Larcker, 1981), with higher values generally indicating higher levels of reliability. In exploratory research, an AVE value greater than 0.5 is considered acceptable (Hair et al., 2019). However, values of 0.95 and higher are problematic since they indicate that the items are redundant, thereby reducing construct validity (Diamantopoulos et al., 2012). In our research, the AVE values of all measures ranged from 0.6 to 0.911, which supports the measures.

Fourth, hypotheses are tested using PLS-SEM, the results of which are shown in Table 3. The beta coefficient is presented above, while the p-value is presented in the parentheses below. We then measure the collinearity of the formative indicators using the variance inflation factor (VIF). Our VIF (shown in Table 4) values vary from 1.08 to 1.51, which falls within the ideal range of VIF (between 1 and close to 3) (Hair et al., 2019).

To perform a robustness check, we further tested

the goodness-of-fit index (GOF), as shown in Figure 2. The results of GOF = 0.4667 with a p-value > 0.05 indicate that the universal data fits well with the model without needing the subsets of the data (Kline, 2015).

#### 4.3. Hypotheses Testing

When all measurement model assessments are found to be satisfactory, we evaluate the structural results to test the hypothesis. In doing this, we found that all the constructs significantly impacted firms' intentions to adopt CBMs: influential power of PBC (0.309), attitude (0.305), long-term orientation (0.171), and social pressure (0.133). These findings provide support for hypotheses H1, H2, and H3.

The correlation between TBP drivers, representing H4, is partially confirmed by the fact that most of the relations are significant, except for attitude to PBC.

Additionally, among the resources, the findings confirmed the positive effect of financial resources and knowledge (0.362) on firm owners'/managers' perceptions of the ease or difficulty of implementing CBMs, providing support for hypotheses H6 and H7. However, the regression path of labor and technology resources on PBC is insignificant, so the null hypotheses H8 and H9 can be rejected.

# Table 2 Discriminant Validity—Squared Inter-factor Correlation vs. Average Variance Extracted

	Knowledge	Attitude	Pressure	Control	Intention	Culture	Finance	Labor	Technology
Knowledge	1.000	0.131	0.089	0.149	0.232	0.293	0.204	0.046	0.167
Attitude	0.131	1.000	0.075	0.077	0.228	0.082	0.146	0.027	0.041
Pressure	0.089	0.075	1.000	0.242	0.172	0.070	0.145	0.009	0.034
Control	0.149	0.077	0.242	1.000	0.272	0.133	0.234	0.015	0.053
Intention	0.232	0.228	0.172	0.272	1.000	0.166	0.250	0.042	0.087
Culture	0.293	0.082	0.070	0.133	0.166	1.000	0.111	0.027	0.164
Finance	0.204	0.146	0.145	0.234	0.250	0.111	1.000	0.027	0.053
Labor	0.046	0.027	0.009	0.015	0.042	0.027	0.027	1.000	0.075
Technology	0.167	0.041	0.034	0.053	0.087	0.164	0.053	0.075	1.000
AVE	0.932	0.866	0.780	0.725	0.721	0.951	0.740	0.642	0.771

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Variable	Intention	Control	Attitude	Pressure
Attitude	0.305***	0.022		0.150***
	(0.000)	(0.664)		(0.003)
Pressure	0.133***	0.331***	0.182***	
	(0.008)	(0.000)	(0.003)	
Control	0.309***		0.188***	0.451***
	(0.000)		(0.002)	(0.000)
Culture	0.171***			
	(0.000)			
Finance		0.278***		
		(0.000)		
Knowledge		0.136***		
		(0.015)		
Labor		-0.002		
		(0.969)		
Technology		0.047		
		(0.353)		

#### Table 3

Structural Model—Standardized Path Coefficients

Note: (p-values are shown in parentheses; \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively)

#### Table 4

Variable	Intention	Control	Attitude	Pressure
Attitude	1.157	1.263		1.083
Pressure	1.364	1.219	1.319	
Control	1.450		1.329	1.083
Culture	1.212			
Finance		1.446		
Knowledge		1.514		
Labor		1.106		
Technology		1.263		

#### Multicollinearity Check (VIFs)

# 5. Discussion and Implications

#### 5.1. Theoretical Contributions and Implications

The findings of this study contribute significantly to the existing literature by providing empirical evidence in the domain of CE and by identifying the critical factors that influence a firm's intention to adopt CBMs. By validating the research hypothesis, this study enhances the theoretical understanding of CBMs, particularly in the setting of Vietnam. In addition, this study develops a new conceptual framework based on the socio-psychological models of the Theory of Planned Behavior (TPB) and the Theory of Resource-Based View (TRB). This framework offers an alternative perspective through which to examine a firm's intention to adopt CBMs. It emphasizes the importance of considering the viewpoint of firm owners and managers who play a significant role in decision-making processes. Moreover, the framework identifies four



Goodness-of-fit Index Measurement



main factors—attitude, perceived social pressure, perceived behavioral control, and long-term orientation value—that explain a firm's intention to adopt CBMs. These factors align with and reinforce the ideas proposed by Singh et al. (2018), Khan et al. (2020), and Luthra et al. (2022) in their studies on critical factors influencing firm behavior regarding CBM adoption.

Meanwhile, in terms of the causal links between the TPB variables, most of the relationships have been confirmed except for the effect of attitude towards perceived behavioral control. This suggests the need for careful consideration of the pre-aware norms that may not align with the current settings.

The study also quantifies the relationship between firm resources and perceived behavioral control (PBC), providing valuable insights into the role of resources in influencing a firm's perceived control over CBM adoption. However, among the various firm resources that are considered influential in shaping firm behavior, this study only confirms the significant impact of financial resources and knowledge (human-intensive resources). This finding supports the conclusions of Aranda-Usón et al. (2019) and Aloini et al. (2020), who emphasized the importance of finance in firms' circular activities and the significance of financial incentives for CE investment projects. It also coincides with Sinha's (2022) findings, which highlighted the need for extensive knowledge integration into business processes during the transition to the CE to ensure the success of CBMs.

Notably, we find that technology and labor resources do not have a significant influence on the intention to adopt CBMs. This contrasts with the findings of Lewandowski (2016), Laurenti et al. (2018), and Kirchherr et al. (2018), who assert that technology and human resources (such as team size, business planning, and leadership) are crucial drivers of CBMs, enabling the closure of material loops and the shift towards circular practices. These differing results spark a controversial debate, highlighting the complexity of factors influencing CBM adoption. Indeed, while financial resources and knowledge are confirmed as influential factors, the limited impact of technology and labor resources warrants further examination and consideration in the context of firms embracing CE practices.

#### 5.2. Practice Contributions and Implications

With the majority of predictor constructs significantly influencing the dependent variables and validating the research hypothesis, it is clear that this study provides significant practical implications for various stakeholders involved in promoting the adoption of CBMs.

Perceived behavioral control (PBC), particularly in relation to financial and knowledge resources, has been confirmed to have the strongest influence on firms' intention to adopt CBMs. In this regard, governments play a crucial role in facilitating CBM adoption by implementing specific policies and incentives. For instance, measures such as tax reductions, low-interest loans, and grants can make it easier for firms to access financial resources for CBMs. Moreover, financial institutions should align their policies and incentives to support CBM adoption by offering credit assistance and economic incentives. Additionally, firm owners/managers should prioritize financial resources and develop effective financial management systems to support their ordinary activities, thus providing them with greater opportunities for credit assistance and affording them greater funding options to invest in CBMs.

Regarding knowledge of CBMs, governments, and associations should provide workshops or training conferences to enhance the understanding of CBMs among firm owners/managers and to highlight the benefits of CBMs for stakeholders and sustainable growth. Having a secure grasp of CBM principles and practices is essential to ensuring that business owners/managers are well-informed about the advantages and disadvantages of CBMs. However, it should be noted that even when business owners/managers possess a comprehensive understanding of CBMs, they may still face challenges in translating theoretical knowledge into practical actions. Business owners/managers should therefore proactively update their staff's expertise through various channels and equip them with skills through appropriate methods, such as self-training and internal classes.

Governments and professional associations also play important roles in promoting positive attitudes towards CBMs among businesses. One way to achieve this is by leveraging mainstream media platforms to raise awareness and generate interest in CBMs. In addition, professional associations can contribute to the adoption of CBMs by conducting trial projects and studying successful business cases. These initiatives serve as practical demonstrations and provide valuable insights into the benefits and challenges associated with CBMs. By sharing knowledge and experiences through case studies and project evaluations, professional associations can guide businesses in their CBM implementation journeys, which in turn can help firms develop a more positive attitude towards CBMs as they gain a better understanding of the potential advantages and tangible outcomes associated with their adoption.

Another important contribution of the study is that it confirms the effect of perceived social pressure on firms' intention to implement CBMs, which coincides with the ideas of previous researchers. Social pressure, which represents the influence of social norms on firms' responsibility towards the environment and society, has a substantial impact on firm owners'/managers' intention to adopt CBMs. Governments, particularly in countries with a top-down institutional strategy, should educate the public on the necessity of CBMs and develop policies that both compel and economically incentivize businesses to adopt cleaner production practices. It is crucial to note that government pressure should be accompanied by economic incentives or innovative fiscal policies, rather than solely placing businesses in a "green prison" as past models of sustainable development have done.

Lastly, firms should foster a long-term orientation and integrate sustainable practices into their strategic planning. By considering the long-term benefits of CBMs and aligning their objectives with sustainable growth, firms can drive their intention to adopt and implement CBMs. This finding is in line with previous research and suggests that governments should communicate the long-term benefits of CBMs effectively in order to gain the goodwill of businesses, particularly those with long-term objectives.

#### 6. Conclusion

The concept of CE has received significant attention from both academics and practitioners in the field of environmental economics. However, there are growing concerns regarding firms' slow transition to CBMs. Recognizing this gap in the literature, this study explores the factors that influence firms' intention to adopt CBMs. Based on empirical findings, this study reveals that PBC, attitude towards CBMs, long-term orientation value, and the perceived social pressure of firm owners/managers all play a significant role in shaping firms' intention to adopt CBMs. Notably, financial resources and knowledge emerges as an influential resource for PBC.

Besides a number of key contributions to the literature, we must also acknowledge that it suffers from certain limitations. For instance, we cannot verify the role of labor resources and technology resources in creating perceived behavioral control. This may be because firms' labor resources are predominantly short-term contractual workers or because the involvement of human and technology resources are minimal; hence, firms do not view these as reliable resources for economic growth. Future research should consider obtaining more intensive information and conducting surveys on a broader range of firms in order to gain deeper insights into the role of labor and technology resources in perceived behavioral control.

In addition, due to the use of a self-reported survey, there is a risk that our data suffers from response bias. However, to avoid such bias, we asked questions that were more related to firms' broader situations rather than questions solely focused on individuals' viewpoints. Future research could expand this type of research to different time periods, industries, and countries in order to provide valuable insights into the applicability and generalizability of the findings. Comparing results across diverse settings would allow for a comprehensive understanding of the factors influencing firms' intentions to adopt CBMs and their relevance in different economic and cultural contexts.

Extending the perspective beyond the circular economy and circular business models, we anticipate a landscape defined by a continuous stream of innovative trends driving organizations towards the intersection of sustainable production and digitalization, facilitated by globalization. The progression towards closed-loop systems is poised to solidify as a dominant norm, transcending distinctions between developed and developing nations. In conclusion, this study makes notable contributions both theoretically and practically. It advances our understanding of the factors that influence firms' intentions to adopt CBMs and provides actionable recommendations for various stakeholders, offering a roadmap for governments, financial institutions, and firms to collaborate in adopting and implementing CBMs. By working together and embracing these recommendations, we can collectively contribute to the advancement of sustainable practices, economic resilience, and a more environmentally friendly future.

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# References

- Abdullah, M. M. B., Uli, J., & Tarí, J. J. (2008). The influence of soft factors on quality improvement and performance: Perceptions from managers. *The TQM Journal*, 20(5), 436-452. https://doi. org/10.1108/17542730810898412
- Abraham, C., & Sheeran, P. (2003). Acting on intentions: The role of anticipated regret. *British Journal* of social psychology, 42(4), 495-511. https://doi. org/10.1348/014466603322595248
- Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes, 50(2), 179-211. https://doi.org/10.1080/0887044 6.2011.613995
- Aloini, D., Dulmin, R., Mininno, V., Stefanini, A., & Zerbino, P. (2020). Driving the transition to a circular economic model: A systematic review on drivers and critical success factors in circular economy. *Sustainability*, *12*(24), 10672. https://doi.org/10.3390/ su122410672
- Aranda-Usón, A., Portillo-Tarragona, P., Marín-Vinuesa, L. M., & Scarpellini, S. (2019). Financial resources for the circular economy: A perspective from businesses. *Sustainability*, 11(3), 888. https://doi. org/10.3390/su11030888
- Banelienė, R., & Strazdas, R. (2023). Green innovation for competitiveness: impact on GDP growth in the European Union. *Contemporary Economics*, 17(1), 92-108. https://doi.org/10.5709/ce.1897-9254.501
- Bashir, M., Alfalih, A., & Pradhan, S. (2023). Managerial ties, business model innovation & SME performance: Moderating role of environmental turbulence. *Journal of Innovation & Knowledge*, 8(1), 100329. https://doi.org/10.1016/j.jik.2023.100329
- Bocken, N. M., De Pauw, I., Bakker, C., & Van Der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of industrial and production engineering*, 33(5), 308-320. https://doi.org/10.1080/21681015.2016.1172124

- Boffa, D., Prencipe, A., Papa, A., Corsi, C., & Sorrentino, M. (2023). Boosting circular economy via the b-corporation roads. The effect of the entrepreneurial culture and exogenous factors on sustainability performance. *International Entrepreneurship and Management Journal*, 1-39. http: // doi.org/10.1007/s11365-023-00835-8
- Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of hightechnology firms. *Academy of management journal*, 49(3), 544-560. https://doi.org/10.5465/ amj.2006.21794671
- Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *Journal of the Academy of Marketing Science*, 40(3), 434-449. https://doi.org/10.1007/ s11747-011-0300-3
- Díaz-García, M. C., & Jiménez-Moreno, J. (2010). Entrepreneurial intention: the role of gender. International entrepreneurship and management journal, 6(3), 261-283. https://doi.org/10.1007/ s11365-008-0103-2
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal* of marketing research, 18(1), 39-50. https://doi. org/10.1177/002224378101800104
- García-Sánchez, I. M., Somohano-Rodríguez, F. M., Amor-Esteban, V., & Frías-Aceituno, J. V. (2021). Which region and which sector leads the circular economy? CEBIX, a multivariant index based on business actions. *Journal of Environmental Management*, 297, 113299. https://doi.org/10.1016/j. jenvman.2021.113299
- Geissdoerfer, M., Pieroni, M. P., Pigosso, D. C., & Soufani, K. (2020). Circular business models: A review. *Journal of cleaner production*, 277, 123741. https://doi.org/10.1016/j.jclepro.2020.123741
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, 31(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203
- Hsu, C. C. (2023). The role of the core competence and core resource features of a sharing economy on the achievement of SDGs 2030. *Journal of Innovation & Knowledge*, 8(1), 100283. https://doi. org/10.1016/j.jik.2022.100283
- Inter-Ministerial Committee for circular economy. (2017). Poland's Roadmap towards the Transi-

tion to the Circular Economy (CE). Available at: https://circulareconomy.europa.eu/platform/ sites/default/files/md\_goz\_final\_en\_r4\_4.pdf

- Khan, O., Daddi, T., Slabbinck, H., Kleinhans, K., Vazquez-Brust, D., & De Meester, S. (2020). Assessing the determinants of intentions and behaviors of organizations towards a circular economy for plastics. *Resources, Conservation* and Recycling, 163, 105069. Reservation and Recycling, 163, 105069. https://doi.org/10.1016/j. resconrec.2020.105069
- Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the circular economy: Evidence from the European Union (EU). *Ecological economics*, 150, 264-272. https://doi.org/10.1016/j. ecolecon.2018.04.028
- Kline, P. (2015). A handbook of test construction (psychology revivals): Introduction to psychometric design. Routledge.
- Laurenti, R., Singh, J., Frostell, B., Sinha, R., & Binder, C. R. (2018). The socio-economic embeddedness of the circular economy: An integrative framework. *Sustainability*, 10(7), 2129. https://doi. org/10.3390/su10072129
- Lewandowski, M. (2016). Designing the business models for circular economy—Towards the conceptual framework. Sustainability, 8(1), 43. https://doi. org/10.3390/su8010043
- Lewis, W. G., Pun, K. F., & Lalla, T. R. M. (2006). Exploring soft versus hard factors for TQM implementation in small and medium-sized enterprises. *International Journal of Productivity and Performance Management*, 55(7), 539– 554. doi:10.1108/17410400610702142
- Nguyen-Thi-Phuong, A., Le-Kim, S., Nguyen-Thu, H., & Nguyen-Anh, T. (2022). The influences of cultural values on consumers' green purchase intention in emerging markets: an evidence from South Korea and Vietnam. *Current Psychology*, 1-18. https://doi.org/10.1007/s12144-022-04064-0
- Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the association for Information Systems*, 16(1), 1. https:// doi.org/ 10.17705/1CAIS.01601
- Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J. (2018). Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, 135, 70-82. https://doi.org/10.1016/j.resconrec.2017.08.017

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- Reim, W., Yli-Viitala, P., Arrasvuori, J., & Parida, V. (2022). Tackling business model challenges in SME internationalization through digitalization. *Journal of Innovation & Knowledge*, 7(3), 100199. https://doi.org/10.1016/j.jik.2022.100199
- Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., ... & Topi, C. (2016).
  Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, 8(11), 1212. Available at: https://ssrn.com/ abstract=2664489
- Rodriguez-Anton, J. M., Rubio-Andrada, L., Celemín-Pedroche, M. S., & Alonso-Almeida, M. D. M. (2019). Analysis of the relations between circular economy and sustainable development goals. *International Journal of Sustainable Development & World Ecology*, 26(8), 708-720. https://doi.org/10. 1080/13504509.2019.1666754
- Roxas, B., & Coetzer, A. (2012). Institutional environment, managerial attitudes and environmental sustainability orientation of small firms. *Journal of Business Ethics*, 111, 461-476. https://doi. org/10.1007/s10551-012-1211-z
- Saether, E. A., Eide, A. E., & Bjørgum, Ø. (2021). Sustainability among Norwegian maritime firms: Green strategy and innovation as mediators of long-term orientation and emission reduction. Business Strategy and the Environment, 30(5), 2382-2395. https://doi.org/10.1002/bse.2752
- Sawe, F. B., Kumar, A., Garza-Reyes, J. A., & Agrawal, R. (2021). Assessing people-driven factors for circular economy practices in small and mediumsized enterprise supply chains: Business strategies and environmental perspectives. *Business Strategy* and the Environment, 30(7), 2951-2965. https:// doi.org/10.1002/bse.2781
- Sciarelli, M., Gheith, M. H., & Tani, M. (2020). The relationship between soft and hard quality management practices, innovation and organizational performance in higher education. The TQM Journal, 32(6), 1349-1372. https://doi.org/10.1108/ TQM-01-2020-0014
- Singh, M. P., Chakraborty, A., & Roy, M. (2018). Developing an extended theory of planned behavior model to explore circular economy readiness in manufacturing MSMEs, India. *Resources, Conservation and Recycling, 135*, 313-322. https://doi. org/10.1016/j.resconrec.2017.07.015
- Sinha, E. (2022). Identifying enablers and outcomes of circular economy for sustainable development: A systematic literature review. *Business Strat*-

Tu Tran-Thi-Thanh, Anh Nguyen-Thi-Phuong

egy & Development, 5(3), 232-244. https://doi. org/10.1002/bsd2.195

- Sitra (2016). Leading the cycle: Finnish road map to a circular economy 2016–2025. Available at: https:// circulareconomy.europa.eu/platform/sites/default/files/selvityksia121.pdf
- Sreen, N., Purbey, S., & Sadarangani, P. (2018). Impact of culture, behavior and gender on green purchase intention. *Journal of retailing and consumer services*, 41, 177-189. https://doi.org/10.1016/j.jretconser.2017.12.002
- The French Ministry of Ecological and Solidarity Transition (2018). France Unveils Circular Economy Roadmap. Available at: https://circulareconomy. europa.eu/platform/sites/default/files/frec\_anglais.pdf
- Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning*, 43(2-3), 172-194. https://doi.org/10.1016/j.lrp.2009.07.003
- Wainaina, S., Awasthi, M. K., Sarsaiya, S., Chen, H., Singh, E., Kumar, A., ... & Taherzadeh, M. J. (2020). Resource recovery and circular economy from organic solid waste using aerobic and anaerobic digestion technologies. *Bioresource Technology*, 301, 122778. https://doi.org/10.1016/j. biortech.2020.122778
- Wernerfelt, B. (1984). A resource-based view of the firm. Strategic management journal, 5(2), 171-180. https://doi.org/10.1002/smj.4250050207
- Zucchella, A., Previtali, P., & Strange, R. (2021). Proactive and reactive views in the transition towards circular business models. A grounded study in the plastic packaging industry. *International Entrepreneurship and Management Journal*, 1-30. http: // doi.org/ 10.1007/s11365-021-00785-z

# **APPENDIX A.1**

# Table 5

Cronbach's Alpha Measurement of Items

Variables and ref-	Items	Descriptions	Cronbach's Alpha
Knowledge	know1	I have knowledge about CBMs	0.8450
(Roxas & Coetzer	KIIOW I	Thave knowledge about Obivis	0.8430
2012)			
)	know2	I know about legal documents related to CBMs	0.8424
	know3	I know about the role of businesses in advancing CBMs	0.8412
	know4	My past knowledge and practices are related to CBMs	0.9637
Attitude	att1	I favor sustainable economic models	0.8232
(Sreen et al., 2018)			
	att2	It is important to me to do business and not harm the environment	0.8363
	att3	I believe that CBMs can save nature and its resources	0.8228
	att4	I believe that CBMs can help my business develop sus- tainably	0.8442
	att5	Given a choice, I would prefer CBMs over linear business models	0.8225
Social pressure (Rox- as & Coetzer, 2012	sp1	The state has issued official documents requiring busi- nessess to apply the principles of CBMs	0.8857
	sp2	The local government regularly propagates and encour- ages businessess to apply CBMs	0.8802
	sp3	The state's media often mentions that CBMs encourage businesses to apply CBMs	0.8559
	sp4	Businessess in the same industry as mine are applying CBMs	0.8825
Perceived behav- ioural control	pbc1	The board of directors and senior managers in our com- pany support CBMs	0.7652
(Sreen et al., 2018)	pbc2	My company has sufficient resources to implement CBMs	0.7889
	pbc3	CBMs are conveniently integrated into the existing system of my company	0.7080
	pbc4	Information about CBMs can be easily accessed	0.7044
	pbc5	My company has experience in implementing similar practices to those of CBMs	0.7062
Intention	intent1	My business is interested in CBMs	0.7052
(Díaz-García & Jimé-			
nez-Moreno, 2010)			
	intent2	My business is considering applying CBMs	0.6450
	intent3	My business is seriously planning to apply CBMs	0.8701
	intent4	My business will prioritize resources to invest in CBMs	0.6448
	intent5	My business is applying activities asymptotic to CBMs	0.6332

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### Table 4

Cronbach's Alpha Measurement of Items (Continued)

Variables and ref-	Items	Descriptions	Cronbach's Alpha
erences			
	intent4	My business will prioritize resources to invest in CBMs	0.6448
	intent5	My business is applying activities asymptotic to CBMs	0.6332
Long-term orienta-	long1	Our company's development strategy is economic	0.8531
tion		growth associated with environmental protection	
(Sreen et al., 2018)			
	long2	Our company prefers long-term plans	0.8754
	long3	Persistence is important to our company	0.8509
	long4	Our company doesn't mind giving up its current benefits	0.9739
		in order to ensure future success	
Financial resources	fin1	My businesses is confident in using capital sources to ad-	0.8233
(Díaz-García & Jimé-		dress difficulties and seize opportunities	
nez-Moreno, 2010)			
	fin2	The current capital sources of my businesses are suffi-	0.7568
		cient to invest in CBMs	
	fin3	My business can diversify capital sources if investing in	0.7269
		CBMs	
	fin4	My business is not dependent on external capital sources	0.7349
		if investing in CBMs	
Labour resource	labo1	My business has a large and qualified staff to meet the	0.7750
(Collins and Smith,		current production and business requirements.	
2006).			
	labo2	My business has staff that are sufficiently well qualified	0.8037
		to apply CBMs	
	labo3	The knowledge and skills of our staff are effectively ap-	0.7178
		plied in daily work at the businesses	
	labo4	The staff in my business have the ability to quickly adapt	0.7960
		to any situation	
Technology resource	tech1	My business actively applies science and technology in	0.8370
(Laurenti et al., 2018)		its business processes	
	tech2	My business is applying environmentally friendly pro-	0.8453
		duction technologies	
	tech3	My business cooperates with universities and research	0.8448
		institutes to promote technological competence	
	tech4	My business regularly trains employees in the use of new	0.9324
		technologies	

# **APPENDIX A.2**

### Table 6

Measurement Model—Standardized loadings

	Reflective	Reflec-							
	Knowledge	Attitude	Pressure	Control	Intention	Culture	Finance	Labor	tive Tech-
									nology
know1	0.977								
know2	0.942								
know3	0.977								
att3		0.941							
att4		0.920							
sp1			0.869						
sp2			0.876						
sp3			0.912						
sp4			0.874						
pbc3				0.849					
pbc4				0.874					
pbc5				0.831					
intent1					0.740				
intent2					0.874				
intent4					0.874				
intent5					0.900				
cul1						0.982			
cul2						0.960			
cul3						0.983			
fin2							0.867		
fin3							0.825		
fin4							0.887		
labo1								0.848	
labo2								0.826	
labo3								0.822	
labo4								0.700	
tech1									0.944
tech2									0.944
tech3									0.905
tech4									0.695

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