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PROBABILITY OF GENERATIONAL AGRICULTURAL SUCCESSION EXPLAINED THROUGH A HOLISTIC STRUCTURAL EQUATIONS MODEL IN COSTA RICA

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Abstract

Most of the quantitative studies only analyse socioeconomic variables, leaving aside psychological aspects or generational integration related factors. This approach has exhibited low explicative power of the problem. The main objective of this investigation is to obtain the weight that the socioeconomic, psychological and generational integration process variables have over agricultural succession through structural equations. The data was obtained from 126 horticulture farms from Zarcero, Costa Rica. The results indicate that the generational integration process is the determining factor of generational succession, which is accurately explained through the psychological factors exposed by the theory of planned behaviour. The socioeconomic variables add little to the understanding of the problem. These results demonstrate that regardless of the socioeconomic conditions, the key determining factor is the integration of the sons/daughters in the farm activities.
Keywords: A*gricultural planning, family farms, horticulture, econometric models, Costa Rica*
JEL Codes: *J13, D1, D64, Q15, J62*

1. Introduction

The quantity of farms with a stablished successor has been declining constantly at a global level for more than a decade (Lobley et al., 2010; Uchiyama et al., 2008). This underlying condition holds family-based farming at risk, which represents more than 98% of all produce activities Worldwide, 53% of cultivable land (Graeub et al., 2016) and exemplifies key contributions that help form the social and cultural fabrics of rural communities (Jervell, 1999; Joosse & Grubbström, 2017).

The lack of successors carry a series of associated problems. Within these, it has been identified that farmers of older age that do not have a clearly designated successor deal with greater risk aversion and consequently, lesser of a tendency to adopt new technologies. As a result, farms without a clear successor have less productivity and are more likely to enter on a stagnation period than those that have (Duesberg et al., 2017; Suess-Reyes & Fuetsch, 2016). Likewise, if a family succession is not effectively fulfilled for the farm, and the latter is taken in charge by an external farmer, specific knowledge is lost during the process, hence, levels of productivity are affected in the short jeopardizing the continuity of the farm (Bertoni & Cavicchioli, 2016).

Generational succession is a complex process, therefore its analysis from solely a quantitative point of view is a challenge. Primarily, the reductionist and mechanical approach that dichotomous variable based answers suggest, has to be avoided (Fischer & Burton, 2014), these methods tend to simplify the probability of succession down to only two possible scenarios. Furthermore, the results from one-way quantitative models (e.g. minimum least squares) cannot be considered as a universally accepted truth, since contextual, psychological and long-term factors may significantly influence the outcome (Pitts et al., 2009).

Different attempts have been made to include this complexity into the process, many of them have been focused on qualitatively analysing the problem, choosing factors that have been defined as key determinants for succession. Moreno-Pérez et al. (2011) analysed how family and farm characteristics are related to the presence of successors and work intensification. Others have focused their analysis on strategies that are practiced by the main farmer and the successor, in order to obtain a positive succession (Taylor et al., 1998).

On the other hand, some investigations have focused on farm owners and how their actions influence generational succession. Conway et al. (2017) mentions that farm owners exercise a type of symbolic violence over their children, maintaining the control over the farm and belittling the young farmers' work. Wiley et al. (2005) and Fischer & Burton (2014) state the importance of actions that generate an early communication with the descendants through their contact with the farm and the related agricultural work. Similarly, mainly at a Latin-American these topcis have been approached through the concept that succession is in its true form a Generational Integration Process (GIP) (Perrachón, 2016), where adequate relations between generations and the inclusion in the decision-making processes regarding the farm, are key actions for successful succession. Likewise, a reduced quantity of investigations consider the effect of psychological variables on succession; these studies are mainly related to the main farmer's attitude towards agricultural succession and other aspects related to factors such as subjective norms and perceived behavioural control (D. May et al., 2019; Morais et al., 2017, 2018; Nuthall & Old, 2017).

Most of the quantitative studies are based on discrete answer models of two options (e.g. Mann, 2007; Cavicchioli et al., 2015), nonetheless, these have exhibited a low explicative power of generational succession (Fischer & Burton, 2014). One of the reasons attributed to this low explicative power indicate that these types of models may not contemplate adequately certain factors that affect the process which are not observable (latent) (Hennessy & Rehman, 2007). These can be related with subjective, psychological and social construction factors that still have not been explored (Fischer & Burton, 2014).

All the previously cited investigations have added to a better understanding of generational succession. These have provided very valuable points of view and variables that have cemented the base over which to pose more integral approaches. Even so, the lack of a model that can successfully unify methodologies and deliver a better insight of the process is observed. The approach of agricultural succession should involve at least latent variables, socioeconomical aspects, the GIP and psychological factors. Given this, the main objective of this investigation is to obtain the weight that socioeconomical and psychological variables and the GIP represent for farm succession through a unified model that uses structural equations.

2. Theoretical Framework

An analysis that incorporates the elements included in the conceptual framework of Bergevoet et al. (2004) is proposed. These indicate that the strategies that a farmer adopts are determined by their socioeconomic characteristics and their psychological drivers. Therefore, psychological and socioeconomic variables were considered as key determining factors that explain the process of generational succession. Additionally, the GIP is added as an influential factor in the generational succession (Perrachón, 2016).

2.2. Psychological Factors That Affect Farmers' Decisions

The TPB exposed by Ajzen (1985) was applied to systematically include psychological components in this research, this theory provides three analysis groups:

1. Attitude towards behaviour (ATB): the disposition to respond favourably or unfavourably against an object, person, institution, or event.
2. Subjective norms (SN): influence of important references, these can be individuals, institutions or society through the approval or disapproval of a specific behaviour. The SN can exert pressure to execute or not a behaviour. Some actors that are influential regarding the decision of the main farmer to begin an integration process are: family (Morais et al., 2017) and society (Morais et al., 2017).
3. Perceived behavioural control (PBC): the individual conviction towards the possibility to exercise a certain behaviour, since the abilities to do it are available and this behaviour will generate a predictable result.

Ajzen (1985) proposes that intention is a good predictor of individual behaviour since it is considered as its prelude. The intention is comprised by the ATB, SN and PBC. Given this, the general evaluation of the main farmer on these three factors will determine their positive or negative intention towards a directed behaviour to promote the permanence of their children on the farm. It is considered as a general rule that if the ATB and the SN towards behaviour are favourable and the PBC is high, then the intention to have a certain behaviour will be greater (Davis et al., 2002). The use of TPB to identify the intention of the farmer in relation to concrete actions has been used before, as an example in the adoption of technology (Lynne et al., 1995), saving of water (Pino et al., 2017), migration (D. May et al., 2019; Nakagawa, 2018), response towards policies (Deng et al., 2016), decision to start a business (Bergevoet et al., 2004) and to cooperate (D. E. May, 2012).

2.3. Generational Integrational Process (GIP)

At a Latin American level, the importance of the GIP has been identified in agricultural succession; this process is defined as the relation between the different generations of a family that commences since the birth of a new generation (children, grandchildren) until the death of the current heads (father and mother) (Perrachón, 2016). Accordingly, a good agricultural GIP will generate better probabilities that a successful generational succession happens (Perrachón, 2016). According to the revised literature, the GIP is composed by at least six actions conducted by the main farmer. These are:

1- Communication between the farmer and his/her children over the intention of succession: the necessity of communication between the successor and the head is fundamental for the process. Agricultural departments globally present communication as the first action inside the process over which all other related decisions are taken. With the intention to achieve this understanding, the children must accept determined policies of the parents although they do not completely agree with them and the parents must make an effort to adapt to the necessities of the successors' development (Cabrera, 1998).

2- Inclusion of the successor in the decision-making process: Gallo and Peluso (2013), mention that one of the most influential factors on the emancipation of the children is the lack of participation in the decision-making process of the farm. The lack of including future farmers in the decision-making process generates low management capacities and risks the continuity of the farm (Uchiyama et al., 2008).

3- Grant paid accordingly to farm labour: Mazorra (1999) indicates that recognition for the successor through payment is of great importance, in which the main farmer uses pay as an incentive for their children to keep working on the farm.

4- Grant necessary resources so descendants can study: effective succession is not only distinguishing a successor that will be in charge of the farm, on the contrary, he/she has to be prepared to manage the farm successfully. Dirven (2002) indicates that formal education constitutes an invaluable capital and can generate synergies with acquired experiences on production techniques, the operation of the agricultural business, commercialization channels and management of credit.

5- Facilitate a segment of the farm so descendants can manage it independently: Mesen (2009, p. 87) mentions the importance to give new generations a segment of the farm so they can develop their own crops and manage them on the most independent way possible. Granting a segment of the farm is an informal transaction, due to the non-existence of a legal contract. The main farmer exercises this action so he/she can "train" the successor; as a result experience is gained. The existence of these spaces is necessary for knolegwe transfer, at the same time is a key determinant for agricultural succession Carolan (2018).

6- Planification: the creation of an action plan for succession. A proper planification helps contemplate legal aspects, protect viability and profitability of the farm and to maintain good family relationships. It is considered that a good planification for succession starts before the new generation is of age to assume the control over the farm (Bjuggren & Sund, 2001), where the first action of the planification is to have an identified successor, consequently this helps the main farmer to take explicit or tacit actions oriented towards succession.

2.4. Socioeconomic Variables That Affect Succession

Following the positions of Bertoni and Cavicchioli (2016), four types of socioeconomic variables related with generational succession were analysed:

1. Farm: it has been identified that farms with greater levels of capital have better levels of succession (Bertoni & Cavicchioli, 2016; Nuthall & Old, 2017). Likewise farms with greater specialization (Hennessy & Rehman, 2007; Wolf, 2003) or non-conventional production are correlated with greater levels of succession (Corsi, 2009; Kerbler, 2012).
2. Family: being male (Cavicchioli et al., 2015; Kerbler, 2008) and having a family with agricultural tradition (Mann, 2007) increase the probabilities of farm succession. Other family-related variables that have been used to study this topic are: quantity of children of the main farmer (Cavicchioli et al., 2018; Mishra & El-Osta, 2007), work outside of the farm from the spouse (Hennessy & Rehman, 2007) and age of the descendants (Aldanondo-Ochoa et al., 2007).
3. Farmer: age, for most cases has a positive effect on the probability of succession (Mishra & El-Osta, 2008; Nuthall & Old, 2017), in which at an older age of the main farmer, the probability to find a designated successor increases. For other variables, such as the main farmer's formal education, some studies suggest positive (Cavicchioli et al., 2015; Kerbler, 2008; Kimhi & Nachlieli, 2001) and negative effects (Aldanondo et al., 2007; Corsi, 2009; Wolf, 2003) regarding succession.
4. Context: the employment rate of the region has presented an "s-shape" in two studies developed by Bertoni and Cavicchioli (2016) and by Cavicchioli et al. (2018) respectively. Likewise, farms that benefit from governmental payments (e.g. subsidies) have better succession rates (Kerbler, 2008; Mishra & El-Osta, 2008). Context variables such as distance from the centre of development (Cavicchioli et al., 2018) and population density also have been studied (Cavicchioli et al., 2018).

2.5. Status of Succession for The Farm

Family succession is an observable variable, but its conceptualization and structuring for a systematic-quantitative analysis is complex. In most quantitative-oriented studies, a binary

approach is exhibited and for most cases the analyses are given using proxy variables. Therefore, the generational succession status can take a value of one or zero; the value of one is typically associated to scenarios that are considered positive from a generational succession point of view. Some examples of positive scenarios are: if the main farmer has a family succession plan clearly established (Mishra & El-Osta, 2007), if the farm has younger descendants older than 15 years working full-time (Corsi, 2009), positive desire of the following generations to continue with the family farm (Cavicchioli et al., 2015) or if it is observed that the farm has high probabilities to continue being worked by a family member (Glauben et al., 2009). However non-binary quantifications of succession with more than two options (ordinal), give the possibility to the main farmer to generate an answer that better adjusts to reality avoiding the simplistic approach of only two scenarios.

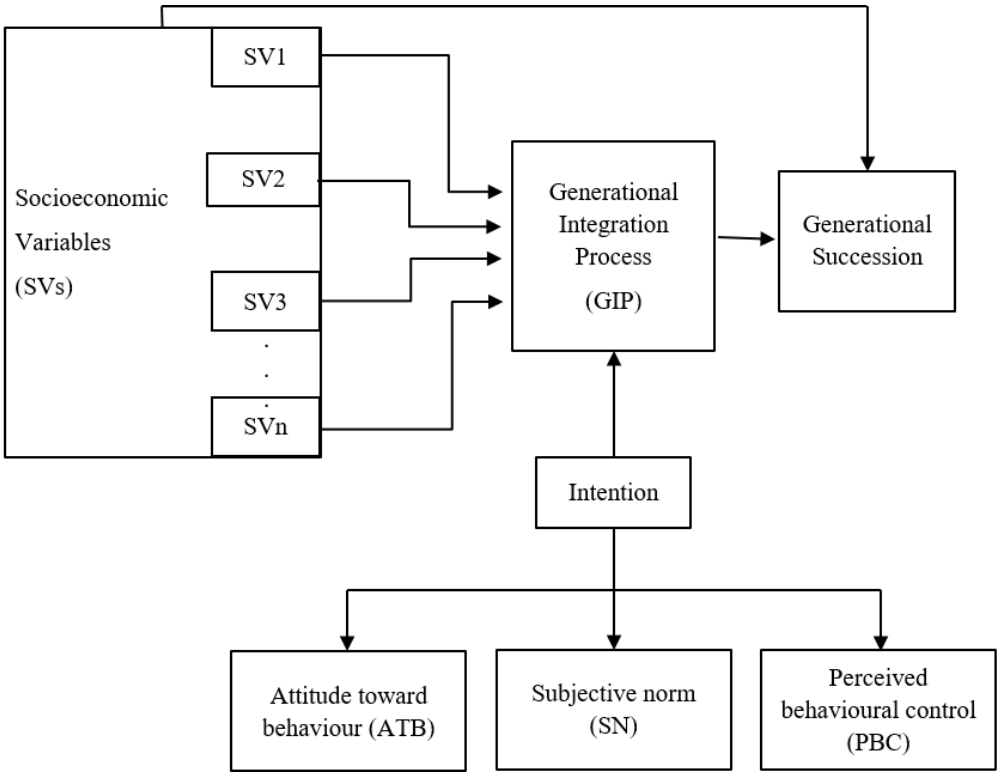


Figure 1. Integral Model Framework for The Explanation of the Generational Agricultural Succession

2.6. Proposed Model

The level of certainty of succession for the farm occurring is a result that will depend on the socioeconomic conditions as well as on the level of the GIP accomplished by the main.

Given this, the following relations are considered:

1- Hypothesis I: The socioeconomic variables will influence in two ways on the proposed model; a) they will have a direct relation over the generational succession (traditional approach), furthermore b) they will directly influence on the level of the GIP.

2- Hypothesis II: The level of the GIP will positively influence on the probability of succession of the farm. In which, at a greater level of the GIP, there will be a greater probability that the farm has a clearly identified successor.

3- Hypothesis III: At a better intention, a greater level of the GIP will be observed. Likewise, the components ATB, SN and PBC influence the intention of the farmer to pursue a GIP (according to the TPB). It is considered the GIP as the action that will be explained by the intention.

The previously described relations shape the theoretical model (Figure 1) which explains generational succession that was adopted for this investigation. Therefore, the probability of succession for a farm will depend on the GIP, socioeconomic variables, psychological variables and the interaction between them.

3. Methodology

3.1. Sample Gathering

Criteria for sample selection was the following:

1- Horticulture farmer from Zarcero canton.
2- Older than 35.
3- Have at least a son or daughter older than 15

According to Costa Rican law an adult farmer is someone who is older than 35 (Ley General de la Persona Joven and its reforms, 2002). Likewise, for children younger than 15, it is difficult to obtain results for the GIP.

Sample size was obtained by equation 1:

$$n = \frac{N * Z_{\alpha}^2 * p * q}{d^2 * (N-1) + Z_{\alpha}^2 * p * q} \quad (1)$$

$$n = \frac{198 * 1.96 * 0.76 * 0.24}{0.05^2 * (198-1) + 1.96 * 0.76 * 0.24}$$

$$n = 117$$

Where:

N=198 (Horticulture based producers older than 35)
e = 5%
Z = 1.96 (95% significant)
p = 0.76 (Corresponding to 76% of farmers of N that have descendants older than 15)
q = 0.24 (1-p)

Various farms were visited, and 126 valid surveys were obtained. A closed survey was applied where the level of the GIP for the main farmer was quantified for each of his/her children. An average of 2.74 children per producer was obtained, this generated an initial data base of 345 observations that allowed to obtain the level of the GIP that each main farmer had with their children. In total, 40 observations were eliminated due to lack of information, this ensured to have a final data base of 305 complete observations.

3.2. GIP quantification

The GIP was divided into six actions. Four of the actions were quantified by a 5-point Likert scale and two by binary questions. The Likert scale quantified actions are the following:

a) Action 1: communication between the farmer and his descendants over the intention of succession.

b) Action 2: inclusion in the decision-making process on the farm of the successor.

c) Action 3: the main farmer provided the necessary resources for his children to study.

d) Action 4: planification for the farm succession

A Likert item per action was generated where one signifies that the farmer has not taken part and five expresses that the action was taken adequately. The binary quantified actions were the following:

a) Action 5: grant pay according to the different tasks developed on the farm.

b) Action 6: facilitate a segment of the farm so that the descendants can administer on an independent way.

This way of quantification admits a minimum GIP of four points and a maximum of 22 points per descendant (Annex I).

3.3. Quantification of the psychological factors

The aspects related with ATB, SN and the PBC of the main farmer were quantified with a 5-point Likert scale. For ATB, three items were considered, in the first two the main farmer evaluated if the young farmers should stay (Agricultural work) or leave the agricultural sector, respectively. The third item is related directly with the desire of the farmer of their child`s permanence on the family farm (Whish of continuity).

In the case of the SN, two external agents were considered important for the main farmer which are: a) family and b) society. For the first agent (family), the level of commitment (Commitment) that the main farmer observes of the family with agricultural work was measured. For the second agent (society), the main farmer was asked over his/her perception on if society thinks that agricultural work is as important as any other profession (Importance).

Regarding the third component, a modification to the original approach of the TPB was made, because the PBC for most research is the evaluation that the interviewed has over their own capabilities to develop successfully any certain action. Nonetheless, in this case, the questions respond to the capacities that the main farmer perceives that his/her son or daughter have to take charge of the farm on an independent manner (Decision capacity and Cultivation capacity) and the capacity that the farm has to provide a decent standard of living for the successor (Possible income). (Annex II)

3.4. Measurement of the state of succession for the farm

Three levels according to succession probability were codified as follows:

1. Level 1: very high probability. The main characteristic corresponds to a clearly identified successor that works full time on the farm. The main farmers are completely sure that their descendants will continue to work on the farm, this is expressed by them with phrases like “I’m 100% sure” or “The succession is totally secured”.
2. Level 2: medium probability. The successor is identified, but the opinion of the main farmer is unsure regarding farm succession, this is expressed through phrases like: “We still don’t know”, “could be”, “it’s probable”.
3. Level 3: very low probability. The son/daughter may sporadically help on the farm but is not considered as a potential successor, this is recognized through expressions of the main farmer like “totally not probable” or “very unlikely”. Some typical examples of this classification are main farmers that have all children older than 25 years that work on another area.

3.5. Measurement of socioeconomic variables

The following variables were analysed:

1. Farm variables: land tenure (own, leased, borrowed, other), production and total hectares (continuous variable), diversification (variety of main crops), type of production (organic, conventional, mixed), gross income of the farm (ordinal of five points), level of capital (index composed by: type of irrigation, greenhouse m^2, car availability for the farm), residence in farm (yes/no), aggregated value to production (yes/no).
2. Context: associated to a cooperative (yes/no), how the products are commercialized (intermediate, direct sale, cooperative, others), land available to cultivate (yes/no), government support (yes/no).
3. Family variables: number of people that live with the main famer (discreet quantitative), number of children (discreet quantitative), gender of the children (male/female), age of the children (discreet quantitative), main activity of the children (study, work, both), level of education, tradition of becoming a farmer of the family (father, grandparents, others), income percentage originating from the farm inside the family total income, spouse working outside of the farm (yes/no).
4. Farmer variables: age (discreet quantitative), years of being a farmer (discreet quantitative), level of education (ordinal of five points), currently under a pension scheme (yes/no), outside farm work (yes/no).

In total, 26 models were applied. Likewise, the level of significance of each psychological factor was proven for the GIP. Each model was applied using as a basis the relations exposed on the theoretical approach (Figure 1). After this process, the variables that presented significant relations to obtain the final model were selected.

Next, the best adjusted model was obtained, this model was not based on the relations obtained in Figure 1. The goal was to obtain the best model according to the Root Mean Error of Approximation (RMSEA) criteria, freely correlating the variables with the dependent variable (probability of succession).

Due to the lack of normality of some of the variables and the presence of categoric variables, the WLSMV (Weighted Least Square Mean and Variance Adjusted) estimator was used due to the underlying conditions, this estimator presents the best results (Brown, 2015).

4. Results

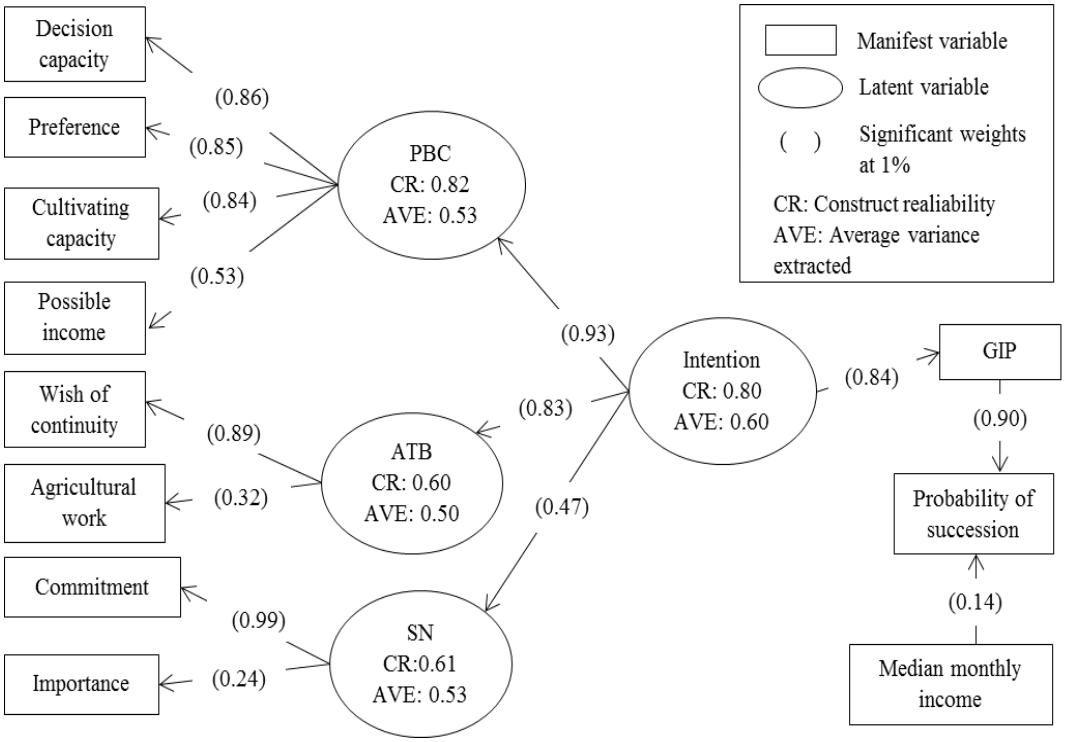
Based on the 126 farms analysed, the median farm size is 2.82 ha. Out of all the farms, 19 (15%) of the farms are organic certified and 93 (74%) of them do not process value-added products. Likewise, 107 (85%) produce two or more kind of vegetables. The average age of the principal farmer is 56.71 and the average time working on the farm is 39.78 years. According to the principal farmers` opinion, from 305 children, 116 (38%) are considered successors and 189 (62%) are not.

Out of all the socioeconomic analysed variables, only monthly income exhibits a significant correlation with probability of succession. To analyse the effect of the socioeconomical and psychological variables related to the GIP on agricultural generational succession Model I (Figure 2) was obtained. This model analysed in joint form the effect of mentioned variables through the Structural Equation Modelling (SEM) technique.

The construct of the PBC was established as the most influential on the intention of the main farmer to act on GIP. Regarding this construct, the main influence is related to the father's perception over the decision-making capacity at a management level over the farm of the successor (Decision capacity). Furthermore, the professional vocation that either son or daughter presents (Preference) and the technical capacities of the successor related with the planting process (Cultivation capacity) resulted as second and third most influential,

respectively. The variable with less importance regarding this construct is highlighted as the perception that the main farmer has towards the profitability of the farm, he/she manages (Possible income).

The latent variable of first order, ATB, possesses a considerable effect on the latent variable of second order: intention. In this case the perception that the main farmer has on if the youth of Zarcero should continue working in the agricultural sector, is not the most statistically significant variable, nonetheless, expresses a significant correlation. The observed variable which exhibits the greater loading over the construct ATB, is the fact that if the main farmer is in accordance with his son continuing to work on the family farm (Wish of continuity).



Note. GIP: Generational Integration Process. PBC: Perceived Behavioural control. ATB: Attitude towards behaviour. SN: Subjective Norms.

Figure 2. Configuration of the Explicative Model of Generational Agricultural Succession Based on Theoretical Relations (Model I)

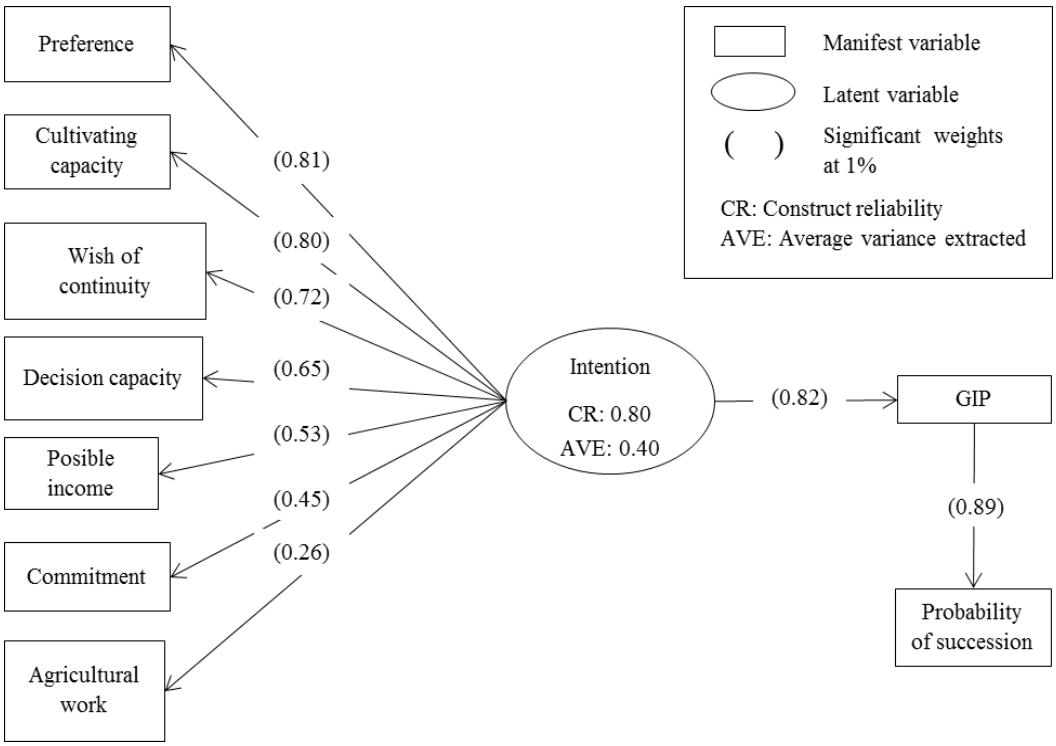
Unlikely, the way the main farmer thinks society perceives agricultural work (Importance) and the level of commitment that the family presents towards the agricultural activities on farm (Commitment), little affect the level of the GIP. This is reflected on the weight (0.47) that the SN presents over the intention of the farmer to take measures that include his son/daughter in agricultural tasks. None of the socioeconomical variables showed a significant association with the value of the GIP. The previous result is confirmed after analysing the effects of 30 socioeconomic variables and different combinations of main components containing them. As a result, the only variable that exemplified a significant and positive causality related to the GIP was the psychological variable Intention.

The target variable (probability of succession), is mainly explained by the level of the GIP (weight: 0.9). Among 30 socioeconomic variables and different combinations of main

components, only the median income demonstrated to have a significant relation with the probability of succession, yet, the weight of association is low (0.14).

An adequate stability is observed for each construct, with superior consistencies over 0.6. Likewise, in all cases a variance superior to 0.5 is obtained. This model managed to obtain a R^2 for the probability of succession of 0.81.

The Model II was generated after observing the small impact that the socioeconomic variables have over the GIP and the probability of succession of a farm. Furthermore, in the process of obtaining the best adjustable model, the latent variables of first order (PBC, ATB and SN) were eliminated, although the related observed variables were kept. The variables related to PBC present the greater weights, followed by the variables related to ATB and SN.



Note. GIP: Generational Integration Process. PBC: Perceived Behavioural control. ATB: Attitude towards behaviour. SN: Subjective Norms.

Figure 3. Configuration of The Explicative Model of Generational Agricultural Succession of Best Adjustment (Model II)

Model II presents a GIP with a weight of 0.89 over the probability of succession of the farm. Similarly, a high consistence (0.8) for the intention construct is observed. For this case, an R^2 is obtained for the probability of succession of 0.79, two points less in comparison to Model I.

Furthermore, a systematic comparison between both models (Table 1) was generated, obtaining for the case of Model II, better indicators of absolute type. Between the most important differences, a decline of 23.179 points in the Chi-square parameter was observed, this in addition to the RMSEA, is considered as one of the most important adjustment indicators in SEM. Likewise, Model II presents better indicators of incremental type.

Unexpectedly, the level of parsimony exhibited by Model I is better presented by Model II, turning this into the only indicator that presents this behaviour.

Table 1. Comparison between Model I and Model II

Indicator type	Adjustment estimators	Model I	Model II
Absolute indicators	Chi-square	68.002	44.823
	RMSEA (Root Mean Error of Approximation)	0.048	0.047
	P value_RMSEA	0.556	0.564
	GFI (Goodness of Fit Index)	0.986	0.996
	AGFI (Adjusted Goodnes of Fit Index)	0.974	0.992
Parsimony	SRMR (Standarize Root Mean Residuals)	0.086	0.09
Incremental	CFI (Comparative Fit Index)	0.959	0.972
	TLI (Tucker Lewis Index)	0.955	0.963
	IFI (Incremental Fit Index)	0.959	0.973

In general, a slight improvement on the adjustment of Model II over Model I is observed. In order to further reinforce this result, a change test is made on the Chi square (Table 2), in which the null hypothesis is rejected that indicates that the resulting number for the Chi square test of both is not significantly different.

Table 2. Significant difference test for the Chi square indicators between Model I and Model II

Model	Chi square	Degrees of freedom (DF)	Chi square change	DF change	P value
I	68.002	41			
II	44.823	27	23.179	14	0.94

This reinforces the choice of Model II, because the inclusion of the socioeconomic variables does not provide, in this case, significantly to the explanation of the phenomenon, thus it can be suggested that Model I is over-specified.

5. Discussion

Our results indicate that the incorporation of socioeconomic, psychological and GIP related variables into one singular model could generate a better explanation of the generational agricultural succession than analyses for each separate variable.

For this case, the socioeconomic variables have a small correlation with the probability of succession of the farm (hypothesis Ia). This coincides with the studies developed by Fischer and Burton (2014), in which the logistic and probabilistic models with low levels of explanation of this phenomenon were exposed. This problem is usually attributed to the lack of specific information on the subject, which generates the need to use proxy variables that could affect the adjustment of the models. Likewise, the use of simple and observable variables may not be the best focus for this subject, due to the intrinsic mechanical style that dichotomous models possess, which reduce a greatly complex process such as the generational succession to only two scenarios (1= Presents succession, 0= Does not present succession). For this research, specific information targeted on generational succession was collected, more than two scenarios were used to represent the probability of succession in a farm and the model was specified with a list of psychological, socioeconomic and GIP related variables, in which

simple and latent variables were considered. Nevertheless, the socioeconomic variables did not result as the best predictors for the probability of succession of a farm.

The explanation of the GIP through the TPB suggests an adequate approach (hypothesis III), even so, this was a first attempt to apply psychological theory in order to explain the motivators that makes a father/mother develop a gradual introduction process to the farm for his/her children. As a result, the exploration of other types of variables for each construct that complete the TPB (PBC, ATB and SN) is suggested. These results are in line with other research, as those of (Morais et al., 2017), in which the utility of TPB and SEM was indicated in order to find the motivators of the successors to take charge of the farm.

Surprisingly, the socioeconomic variables do not keep relation with the level of the GIP (hypothesis Ib). A priori, it was expected to find a positive relation between the GIP and other variables such as land size, median income, and others wealth-related yet, this was not the case. These results indicate that farms with very good socioeconomic conditions not necessarily possess greater levels of the GIP. This also suggests the GIP is more than a purely economic concept, therefore it includes an emotional factor on behalf of the main farmer that in this case, results as determinant. This outcome is confirmed by the weights exhibited by Model I over the PBC construct, in which the emotional aspects such as decision-making capacity, cultivating capacity and the preference that the main farmer observes with his son, weigh more on the decision to gradually include his/her son/daughter in the farm than the level of income that the farm could provide to the successor.

The fact that the subjective norm that greater influences in the farmer to take measures related with the GIP, is the level of involvement of the family in agricultural activities, has implications regarding the type of activities that could be promoted through local institutions. For example, the calls from the Ministry of Agriculture and Livestock (MAG) to inform of a disease or phenomenon, local markets and other activities, should start to be made on an amplified mode and not only be directed towards the main farmer.

Analysing the Chi square results, a significant improvement does not exist from Model I to Model II, these results generate a dilemma in the suitable approach because the socioeconomic variables are observed as to not contribute in a significant manner to the explanation of the phenomenon as a result. Following the simplest model principle, Model II is the best option to explain the agricultural generational succession, which is only based on the GIP (hypothesis II). These results present an evolution in the understanding of agricultural succession, because a great deal of quantitative studies are based solely on socioeconomic variables (Suess-Reyes & Fuetsch, 2016) leaving aside the psychological and GIP aspects.

6. Conclusions

Based on the results, the GIP is the determining factor for generational agricultural succession regardless of the socioeconomic level of the farm. This outcome possesses political implications to promote generational succession in Costa Rican farms. Politics oriented to improve socioeconomic conditions (e.g. subsidies and land granting), may generate important increases on public spending and not necessarily produce the maximum impact on permanence of the following generations on the family farm. Nonetheless, non-intensive spending political actions oriented towards family inclusion in agricultural work (SN), sensitizing of the main farmer regarding permanence of his/her children (ATB) and technical and management preparation of the youth (PBC) could maximize the impact of public spending on agricultural succession rate.

The results were obtained from small horticulture farms (< 5 ha) and that exhibited a high intensity on the use of labour for their work. However, the validation of the relations and the

loads obtained on other more extensive activities and that possess less of an intensity over the use of labour (e.g. rice and livestock) remains pending. Similarly, the influence of other more distant social circles such as neighbours or referent farmers of the areas, could also have an effect over the intention of the farmer to generate high levels of the GIP. Abovementioned relations were out of the range of study of this investigation but could suppose new factors to consider.

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Annexes

Annex I. Items used in the quantification of the generational integration process (GIP)

Indicate your degree of agreement with the following statements (5 very much in agreement – 1 disagree completely)					
I have clearly communicated my intention of succession to my son/daughter	5	4	3	2	1
I have or had clear which will be the role that my daughter/son will have on the farm once I retire	5	4	3	2	1
I have included my son/daughter in the decisions made for the farm	5	4	3	2	1
I have provided sufficient resources for my son/daughter for he/she to study formally (until turned 25)	5	4	3	2	1
Have you given land to your son/daughter for he/she to work on it? (1=Yes, 0=No)	1				0
Have you payed your son/daughter for his/her work on the farm? (1=Yes, 0=No)	1				0
	Max 22pts				Min 4pts

Annex II. Items used for the quantification of the psychological factors

Indicate your degree of agreement with the following statements (5 very much in agreement – 1 disagree completely)						
Factor 1: Control of Perceived Behaviour (CPB)						
Cultivating capacity	My son/daughter shows excellent cultivating skills on the farm?	5	4	3	2	1
Preference	My son/daughter like a lot agricultural work	5	4	3	2	1
Decision capacity	My son/daughter shows excellent skills regarding decisions making over the farm?	5	4	3	2	1
Possible income	The farm could will generate sufficient income for your son/daughter	5	4	3	2	1
Factor 2: Attitude towards behaviour (ATB)						
Wish of continuity	It is my desire that my daughter/son stay on the farm	5	4	3	2	1
Agricultural work	Most of the youth of Zarcero should stay working in agriculture	5	4	3	2	1
Non-agricultural work	It is recommended that the youth of Zarcero seek non-agricultural work opportunities	5	4	3	2	1
Factor 3: Subjective norm (SN)						
Importance	Agricultural work is as important as any other profession	5	4	3	2	1
Commitment	The members of my family are committed with agricultural work	5	4	3	2	1