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Leaks in the IT Workforce Pipeline: Investigating IT Students and Their Plans to Leave or Stay in the IT Profession

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LEAKS IN THE IT WORKFORCE PIPELINE: INVESTIGATING IT STUDENTS AND THEIR PLANS TO LEAVE OR STAY IN THE IT PROFESSION

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Abstract

To remain competitive in the fast-paced information technology (IT) industry, companies will have to rely heavily on the next generation of IT professionals. Yet we know little about future IT professionals' career plans: Are contemporary career attitudes tempting IT students to leave the IT profession? And can early professional identification prevent potential exit plans? Based on a survey with 180 IT students, we investigate how their turnaway intention from IT is shaped by their boundaryless career attitudes (BCAs), namely the desire for interdisciplinary work and the desire for inter-organizational mobility, and how professional identification influences this relationship. We find divergent effects of the two BCA forms on turnaway intention. In addition, we find a reducing effect of professional identification on turnaway intention, but also surprising interaction effects with BCAs. Our findings indicate that IT students with different BCAs follow distinct career paths across organizations and professions. Our study contributes to research on IT careers and provides guidance for organizations on how to employ future, boundaryless IT professionals.

Keywords: career; boundaryless; turnaway; professional identification; interdisciplinary work

1   Introduction

The war for talents in the Information Technology (IT) sector has been ranked among the most worrisome concerns of IT executives (Kappelman et al., 2017). To drive future technological progress, many companies will have to rely heavily on the next generation of IT professionals. Nonetheless, the job market frequently loses IT professionals through attrition after graduation or during early career stages (Setor and Joseph, 2021). This leak in the IT workforce pipeline exacerbates the ongoing IT skills shortage, making IT graduates' persistence in the profession both a key research issue and a key practical issue. Therefore, understanding IT graduates' career decision-making (Walker and Tracey, 2012) is significant in the IT profession's sustainability, consequently requiring better understanding of future IT professionals' career attitudes.

One phenomenon that will be crucial to research on future IT professionals is the impact of boundaryless career attitudes (BCAs) on IT careers (Gubler et al., 2014, Guan et al., 2019). Professionals with boundaryless careers are largely driven by two BCA forms: (1) the desire for interdisciplinary work and new experiences (IDW) and (2) for inter-organizational mobility (IOM) (Briscoe et al., 2006). Boundaryless careers thus correspond to the contemporary mindset shared especially by young individuals who strive for diverse work experiences rather than hierarchical advancement (Guan et al., 2019). As a result, professionals with BCAs frequently design their careers independently of their current organization or profession (Tams and Arthur, 2010, Arthur, 1994).

Predicting BCAs' influence on future IT professionals' career decision-making is difficult. Studies investigating contemporary IT careers have shown that boundaryless IT professionals exhibit increased inter-organizational and inter-professional mobility (Ituma and Simpson, 2009, Joseph et al., 2012). Due to IT's strong integration into various contexts in companies (Rutner et al., 2011, Niederman et al., 2016) and ease of transferring IT skills between organizations and even professions (Ferratt et al., 2005, Ang and Slaughter, 2004, Joseph et al., 2012), we expect the next generation of IT professionals to develop stronger preferences for IDW and IOM. Consequently, increased BCAs might lead IT students to explore professions outside IT, thus increasing the risk of leaving the IT profession (i.e., turnaway from IT). In contrast, the strong occupational culture in IT indicates high professional identification (PI) (Guzman et al., 2008, Riemenschneider and Armstrong, 2021), which decreases the intention to leave IT (Brooks et al., 2015). Thus, PI might be a powerful starting point for lowering turnaway risk due to contemporary career attitudes and for retaining young IT professionals. Therefore, investigating interactions between BCAs and PI and their influence on the next generation's career decisions is promising.

We dedicate this study to generating improved understanding of future IT career development by investigating IT students' levels of BCAs and PI. Specifically, we want to determine the extent of BCAs' influence on plans to leave or stay in the IT profession. Furthermore, we investigate how PI shapes BCAs' influence on the intention to leave the IT profession through the following research questions:

- *How do different forms of boundaryless career attitudes affect IT students' intentions to leave the IT profession?*
- *How does early professional identification influence the relationship of boundaryless career attitudes and turnaway intention of IT students?*

To answer these questions, we surveyed 180 IT students. We found contrasting impact of the two BCA forms on turnaway intention. Based on the analysis' results, we derived examples of IT students with BCAs and now provide recommendations for organizations on how best to employ them. Our study is expected to provide theoretical implications for research on future IT careers and to present organizations with guidance on empowering the next generation of IT professionals.

2 Theoretical Background

In the following, we define this paper's underlying concepts and present existing research. We introduce BCAs and their consequences and provide research on PI and turnaway in the IT context.

2.1 Boundaryless Career Attitudes

Boundaryless careers are defined as the opposite of organizational "bounded" careers (Arthur, 1994), that is, career paths of "sequences of job opportunities that go beyond the boundaries of single employment settings" (DeFillippi and Arthur, 1994). Instead of aspiring to a career within a single organization, individuals with boundaryless careers pursue job opportunities outside their organizations and even outside their profession (Arthur, 1994, Tams and Arthur, 2010). As a consequence, the responsibility of career planning in boundaryless careers is passed on to the individual (Arthur, 1994, Guan et al., 2019), while organizations are increasingly given the role of observers and supporters.

Boundaryless professionals are largely driven by two career attitudes (Briscoe et al., 2006): the desire for IDW and for IOM, each triggering different career mobility behavior. While IDW increases the wish to switch professions, IOM increases the wish to switch organizations. This division deepens understanding of why research on boundaryless careers has so far revealed varied effects on job and career outcomes, specifically on organizational commitment. While the desire for IDW does not necessarily influence organizational commitment, the desire for IOM significantly decreases organizational commitment (Çakmak-Otluoğlu, 2012, Briscoe and Finkelstein, 2009).

High mobility in the IT labor market makes it relevant to investigate the boundaryless career concept in the IT industry. First, repeated organizational change was found to be prototypical for the IT profession (Joseph et al., 2012, Moquin et al., 2019, Eckhardt et al., 2016). Furthermore, IT professionals increasingly opt for turnaway, that is, for leaving the IT profession (Joia and Mangia, 2017, Joseph et al., 2015, Armstrong et al., 2015). Therefore, IT workforce research on turnover and turnaway contributes to greater understanding of organizational and professional mobility among IT professionals. While both types of career mobility have been highly researched with IT professional samples, we are not aware of any IS paper that investigates boundaryless career plans of IT students. Since with Generation Y, an increase in flexible careers is expected (Suleman and Nelson, 2011), the study of BCAs and their impact on current IT students' career plans promises better understanding of IT careers' future development.

2.2   Professional Identification

PI refers to the degree to which individuals define themselves as members of a profession (Wan-Huggins et al., 1998), thus providing a reference to help professionals make sense of their work and, to some extent, the essence of their lives. As part of identity theory (Ashforth et al., 2007), PI explains how individuals incorporate the values and attributes of the profession into the self-identity (Loi et al., 2004), which consequently highly influences human motivation (Hogg and Terry, 2000). Research has shown that PI is formed not only with the actual practice of the profession, but already in the first years of education (Clouder, 2003, Anderson-Gough et al., 2018). Through professional socialization, (future) members of professions get to know their professional values and attributes (Pratt et al., 2006, Kowtha, 2018). Research on PI hints to its positive influence on various job/career outcomes. It for example improves job satisfaction (Russo, 1998, Brooks et al., 2015), organizational commitment (Loi et al., 2004) and positively relates to intrinsic and extrinsic career goals (Greco and Kraimer, 2020).

IT workforce research has identified PI as part of the occupational culture in IT (Guzman et al., 2008, Dinger et al., 2015, Riemenschneider and Armstrong, 2021). Hence, IT professionals are characterized by a strong identification with their profession (Riemenschneider and Armstrong, 2021, Carter and Grover, 2015). This strong identification with IT was found to have different effects on mobility behavior of IT professionals. First, Dinger et al. (2015) discuss that identification with the profession can increase the perception of available job alternatives, and may consequently drive the intention to quit. Second, Brooks et al. (2015) demonstrate a negative influence of PI on turnaway intention via the moderators' job satisfaction and affective commitment. These findings suggest that PI decreases turnaway, while it increases turnover of IT professionals. Organizations must therefore consider the advantages and disadvantages of measures to increase professional identification of their IT workforce (Dinger et al., 2015).

2.3   Turnaway Intention

The IT profession has suffered from high turnaway rates for years – meaning that over the course of their careers, a high proportion of IT professionals leave the profession (Armstrong et al., 2015, Joia and Mangia, 2017). Research on IT turnaway hints at various causative mechanisms. Because IT career success is still often equated with responsibility for personnel, many IT professionals decide to climb the corporate ladder by switching to managerial positions (Joseph et al., 2012, MacCrory et al., 2016). Second, the IT profession imposes high demands in workload and working hours (Rutner et al., 2008), leading to such negative psychological consequences as stress and burnout (Pawlowski et al., 2007) or work exhaustion (Armstrong et al., 2015), eventually increasing turnaway risk. However, leaving a profession also entails high transition costs (e.g., training) and a correspondingly high risk during career transition (Ng and Feldman, 2007). Weighing turnaway's risk is therefore an essential element in employees' decision-making process.

IT professionals' turnaway has often been studied as a consequence of job characteristics and experiences (Armstrong et al., 2015, Joseph et al., 2015, Brooks et al., 2015). However, the theory of

boundaryless careers provides a framework to study turnaway as a planned career transition. In this paper, therefore, we examine IT students' plans to leave the IT profession during their careers and investigate the role of BCAs and PI in these plans. Rather than trying completely to avoid future boundaryless IT professionals' career transitions, researchers and companies might want to initiate alternative methods of providing career development for future IT professionals with BCAs. Near our conclusion, therefore, we provide recommendations on how best to employ different types of IT students with BCAs.

3 Hypotheses Development

To explore the relevance of BCAs and PI in relation to future IT professionals' career plans, we examine both concepts and their impact on IT students' turnaway intention. To investigate known influences of IT professionals' turnaway, we integrate the control variables of age, gender, satisfaction with study program, and perceived after-graduation career prospects. Figure 1 illustrates our research model. In the following, we explain the individual hypotheses in detail.

3.1 Direct Effects

Individuals who hold BCAs have a) a high preference for IDW, and/or b) a high preference for IOM. We propose that these two attitudes have contrasting effects on the turnaway intention of IT students.

Preference for interdisciplinarity and new experiences is characterized by enjoyment of working with other disciplines and the active search for constant challenges (Briscoe et al., 2006). Individuals with this type of BCA derive satisfaction from being challenged and collaborating with others while maintaining active relationships beyond organizational and disciplinary boundaries (Briscoe et al., 2006). We suggest that IT students holding this type of BCA plan to seek jobs and follow careers that involve boundary-spanning activities (Rutner et al., 2011, Niederman et al., 2016) and therefore require a high level of interaction with representatives outside IT. Such interaction enables them to foster networks outside the IT profession, thereby reducing barriers to moving to other functional areas (Joia and Mangia, 2017). In addition, these individuals seek new experiences and challenges in their jobs (Briscoe et al., 2006). Because of eagerness for new challenges, we suggest that IT students preferring interdisciplinary work and new experiences are relatively open to career transitions and consider moving into disciplines outside of their field of study. Due to preference for working with other disciplines and eagerness for new challenges, we hypothesize:

H1a: *Preference for interdisciplinary work and new experiences increases IT students' turnaway intention from IT.*
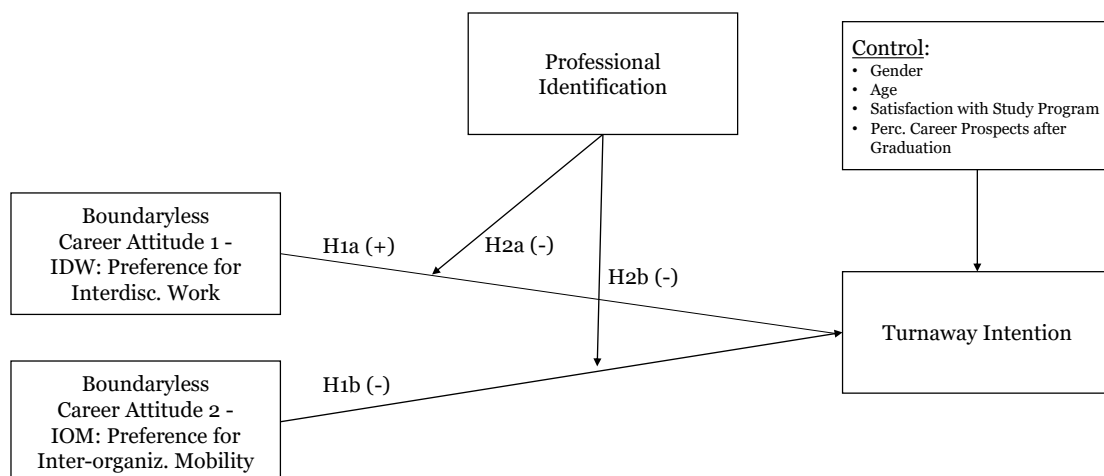

Figure 1. Research Model on Interactions of Boundaryless Career Attitudes and Professional Identification and Their Influence on IT Students' Turnaway Intention from IT

A preference for IOM is characterized by the desire to gain versatile experience through regular career transitions between organizations (Arthur, 1994). Individuals with organizational mobility preference therefore forgo the security of a single employment and regularly seek new opportunities in new organizations (Briscoe et al., 2006). We suggest that these IT students use regular, organizational transitions to advance their careers inter-organizationally and do not necessarily wish for advancement outside IT (Sullivan and Arthur, 2006). Instead, we propose that if IT students plan frequent moves between organizations, they may want to do so within the IT profession for the following two reasons.

First, the IT profession provides the perfect framework for regular organizational transitions (Joseph et al., 2012). Due to high demand and their skills' inter-organizational portability, IT professionals can easily and regularly switch employers (Ferratt et al., 2005, Ang and Slaughter, 2004). Second, switching organizations without simultaneously switching professions reduces transaction costs (e.g., training) and the risk of a failed career transition (Ng and Feldman, 2007). We therefore propose that IT professionals with IOM choose the lower-risk career transition between organizations and use IT skills' transferability between organizations to increase the likelihood of a successful career transition (Ng and Feldman, 2007). Given the many employment opportunities in IT and lower risk from organizational mobility, we suggest that this group of IT students uses the IT profession as a safe haven fulfilling their preference for inter-organizational experiences. Thus, we hypothesize:

H1b: Preference for inter-organizational mobility decreases IT students' turnaway intention from IT.

3.2   Interaction Effects

We propose that PI moderates the relationship between BCAs and IT students' turnaway intention. High PI allows professionals to feel as a part of a professional group, which eventually makes it more difficult for them to leave the profession (Brooks et al., 2011, Hogg and Terry, 2000). Since PI is formed in early years of education (Clouder, 2003, Anderson-Gough et al., 2018), we propose that PI has significant influence on IT students' career plans. Hence, we suggest that PI a) reduces the effects of the preference for IDW and b) enhances the effects of the preference for IOM on turnaway intention

First, we suggest that strong PI binds future IT professionals to their profession, even if they have a desire for IDW. We propose that among these IT students, those with a simultaneously high level PI will pursue their wish for new experiences within, rather than outside, the IT profession. Thus, they will plan to avail themselves of the many boundary-spanning activities the IT profession entails (Rutner et al., 2011, Niederman et al., 2016) and to target interface functions within the IT profession instead of planning to leave it. Since PI is a major factor influencing turnaway in IT (Brooks et al., 2011), we hypothesize:

H2a: Professional identification moderates the relationship between preference for interdisciplinary work and turnaway intention such that it buffers (decreases) the increasing effect of interdisciplinary work on turnaway intention from IT.

We further suggest an amplifying effect of PI on the relationship of IOM preference on turnaway intention. IT students with high PI and the desire to move between organizations are attracted to the IT profession because they feel a strong calling to the profession (Dinger et al., 2015) and because the IT profession offers ample opportunities to transfer quickly and frequently between organizations (Ferratt et al., 2005, Ang and Slaughter, 2004).

Easy transfer of IT skills from one organization to another (Ferratt et al., 2005) will provide a safe zone for future IT professionals to move up the career ladder across organizations. We suggest that high PI will further encourage these IT students in their plans not to leave IT and instead plan their careers inter-organizationally. Thus, we hypothesize:

H2b: Professional identification moderates the relationship between preference for inter-organizational mobility and turnaway intention such that it enhances the decreasing effect of inter-organizational mobility on turnaway intention from IT.

4 Research Method

To evaluate the proposed research model, we conducted an online survey and collected 180 responses from IT students in Germany. We then analyzed the research model using multiple linear regression analysis with moderation. In the following, we explain the survey and the data collection and analysis.

4.1 Survey Development

For survey development, we followed published studies that targeted students (Adams et al., 2006, Briscoe et al., 2006). We used only pre-tested and published scales, that – when possible – were specifically designed for or had already been tested with student samples. If this was not possible, we adapted items to our study's specific context through small changes, such as adding "after graduation" to the questions (see example for Perceived Career Prospects in Table 1).

Table 1 provides an overview of the scales used. For IDW and IOM, we used two scales with four items each by Briscoe et al. (2006). PI was measured with a six-item scale, specifically designed for students by Adams et al. (2006). For turnaway intention, we adapted a four-item scale used by Brooks et al. (2015). For satisfaction with study program, we adapted a job satisfaction scale by Morris and Venkatesh (2010). Perceived career prospects after graduation was measured with a four-item scale by Weng et al. (2010). All items were rated on a 7-point Likert scale, from "1" = "Strongly disagree" to "7" = "Strongly agree".

4.2 Data Collection

For investigating our research questions, we defined our target group as IT students currently enrolled in one or more of the following study programs: computer science, software engineering, games engineering, information systems, data engineering, media informatics, robotics, and other similar programs. In early December 2020, we sent the questionnaire to approximately 700 IT students at three German universities offering the study programs listed above. We contacted students via email (e.g., mailing lists) or social media (e.g., student groups). Students received no recompense for completing the survey. Rather, we indicated the study's scientific purpose and emphasized that the survey was anonymous and voluntary. The survey remained open for one month. In total, we collected 301 responses (rate = 43%). We decided to use only full responses for this survey and accordingly reduced the sample to n=180.

Type	Construct	Source	Example
Independent Variables	IDW – Preference for interdisc. work	(Briscoe et al., 2006)	I enjoy tasks that require me to interact with people in many different disciplines.
	IOM – Preference for inter-organiz. mobility	(Briscoe et al., 2006)	In my ideal career, I would work for several organizations, instead of just for one.
Moderator	PI – Professional identification	(Adams et al., 2006)	I can identify positively with members of the IT profession.
Dependent Variable	TAI – Turnaway intention from IT	(Brooks et al., 2015)	It is likely that I will also explore career opportunities outside of the IT profession.
Control Variables	Satisfaction with study program	(Morris and Venkatesh, 2010)	Overall, I am satisfied with my study program.
	Perceived career prospects after graduation	(Weng et al., 2010)	With my skills and competence, it will be very easy to find a suitable job after graduation.

Table 1. Survey Development

We suspect that the questionnaire's extensive length combined with the survey's voluntary nature resulted in this rate of non-completion. However, with 180 full responses, we are confident that we collected a representative sample of IT students.

Table 2 provides an overview of the sample's characteristics. The majority was male (77.2%), consistent with enrollment statistics of IT degree programs in Germany. Most respondents pursued a bachelor's degree (85.0%) and were in the final stages of their studies (third year or higher: 65.0%). Accordingly, the majority was from 21 to 23 years old (56.1%).

4.3   Data Analysis

To test the research model, we used multiple linear regression analysis with moderation (Cohen et al., 2013). As a software tool, we used SPSS v.26. First, we tested the scales for their reliability. Table 3, displays the included scales' descriptive and correlation statistics. All scales provided a coefficient alpha of at least 0.7, indicating acceptable or higher reliability (Nunally and Bernstein, 1994). Since we are aware of the consequences of multicollinearity, especially when analyzing interaction terms (Shieh, 2011), we decided to mean-center all independent variables (including control variables). We tested the model for variance inflation factors (VIF). The highest VIF was 1.479, indicating no issue with multicollinearity in our model (<5) (Cohen et al., 2013). In addition, before conducting the analysis, we checked for violations of the assumptions for regressions and tested for non-normal distribution of residuals (Cohen et al., 2013). After ensuring that no assumptions were violated, we built three models for linear regression. The first model covered the influence of the control variables on the dependent variable. In the second model, we added the independent variables, and, in the third model, we added the interaction terms.

	Characteristic	N = 180	100%
Gender	Female	34	18.9%
	Male	139	77.2%
	Other/na	7	3.9%
Age	18–20 years old	45	25.0%
	21–23 years old	101	56.1%
	24–26 years old	20	11.1%
	>26 years	14	7.8%
Degree	Bachelor	153	85.0%
	Master's or Similar	27	15.0%
Study Period	First Year	26	14.4%
	Second Year	37	20.6%
	Third Year	89	49.4%
	>3 years	28	15.6%

Table 2.   Sample Demographics

Variable	Reliability statistics			Correlation statistics							
	Mean	SD	Cronb. α	Age	G	SSP	CP	IDW	IOM	PI	TAI
Age	-	-	-	1							
Gender	1.20	0.39	-	-0.06	1						
SSP	5.45	1.09	.885	-0.12	0.05	1					
PCP	5.79	0.84	.729	0.08	-0.29**	0.35**	1				
IDW	5.55	1.06	.826	0.08	0.04	0.20**	0.28**	1			
IOM	4.12	1.42	.888	0.14	0.01	-0.04	0.24**	0.43**	1		
PI	4.74	1.14	.911	-0.01	-0.13	0.32**	0.16*	-0.08	-0.27**	1	
TAI	4.15	1.30	.867	0.13	0.07	-0.25**	0.06	0.23**	0.17*	-0.49**	1

Table 3.   Descriptive and Correlation Statistics

DV: Turnaway Intention, n = 180			
Variable	**Model 0**	**Model 1**	**Full Model**
IDW – Preference for Interdisc. Work		.300*	.285*
IOM – Preference for Inter-Org. Mobility		-.152	-.153*
PI – Professional Identification		-.482***	-.535***
Gender	.141	.081	.084
Age	.070	.048	.028
SSP – Satisfaction with Study Program	-.317***	-.206**	-.236**
PCP – Perc. Career Prospects after Graduation	.209*	.164*	.153*
PI*IDW (interaction)			-.082
PI*IOM (interaction)			.202**
R²	**0.107**	**0.371**	**0.405**
Significant codes p-value: *** : <0.001; ** : <0.01; * : <0.05 To enhance ease of interpretation, we report standardized coefficients.			

Table 4.   Results of Regression Analysis

5   Results

To test our research model, we followed hierarchical regression approaches and created three models. Table 4 provides an overview of the models and their results. The base model (Model 0) provides information on the influences of the four control variables on the dependent variable turnaway intention. Satisfaction with study program ($\beta=-.317$, <0.001) and perceived career prospects after graduation ($\beta=.209$, <0.05) influenced turnaway intention significantly. Age and gender had no significant influence.

We then added the independent variables (Model 1) and their interaction terms to the model (Full Model). IDW had significantly increasing influence on turnaway intention ($\beta=.285$, <0.05), indicating that students with preference for interdisciplinarity had higher intention to leave the IT profession at some point in their careers. Thus, H1a is supported. Furthermore, the results revealed a significant reducing effect of IOM on turnaway intention ($\beta=-.153$, <0.05), indicating that IT students who plan their careers in several organizations have significantly lower risk of leaving the IT profession. Thus, H1b is supported. Furthermore, the results demonstrate a significant reducing, direct effect of the moderator variable PI on turnaway intention ($\beta=-.535$, <0.001). The values for control variables remained stable, evidencing the Full Model's robustness.

The interaction terms revealed interesting results. We could not find a moderating influence of PI on IDW -> turnaway intention. Thus, H2a is not supported. Furthermore, we found a significant, positive moderation of PI on IOM –> turnaway intention ($\beta=.202$, <0.01). This interaction indicates that the effect of IOM on turnaway intention is less negative with high PI. Thus, the results reveal the opposite moderation effect of what we were expecting. Consequently, H2b is not supported. Figure 2 shows the results graphically.

6   Discussion

In the following, we describe our study's key findings by deriving examples of boundaryless IT students and providing recommendations on how organizations can best employ them.
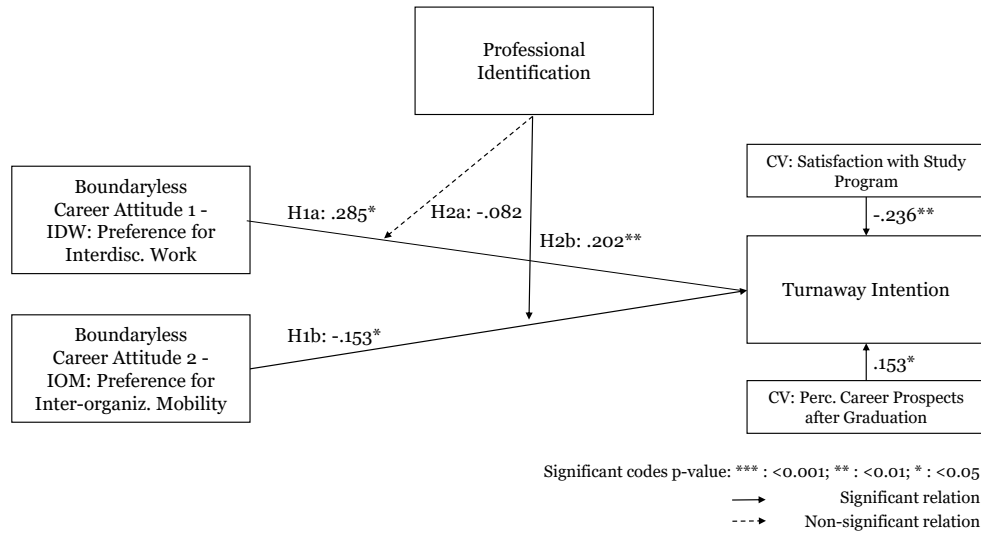
Figure 2. Results of Research Model

6.1 Key Findings and Insights

The results of the model showed that IT students with a preference for IDW are more likely to plan to leave the IT profession (H1a-supported). However, this relationship was not influenced by PI (H2a-rejected). We interpret this to mean that the preference for interdisciplinary experiences is so strong that this desire inevitably drives plans for exploration of career opportunities outside IT, regardless of PI degree. Furthermore, the results show that students with a preference for IOM plan their careers within IT (H1b-supported). We propose that the many job alternatives within IT keep these students in the IT profession. Thus, we suggest that students who hold IOM plan to use the IT profession as a safe haven to fulfill their desire for inter-organizational experiences. However, the significant positive interaction effect with PI (H2b-rejected) indicates that the effect of IOM on turnaway intention is less negative with high PI. We interpret that students with high IOM and PI are highly motivated to advance their careers in- and outside IT. With higher PI, their belief in successful transferability of skills increases, prompting them to use technical knowledge in other professions and to leave the IT field.

6.2 Examples of IT Students with BCAs and How Best to Employ Them

To provide pertinent discussion and illustrate the results with specific focus on this paper's practical relevance, we introduce four examples of IT students with BCAs and provide suggestions on how to employ them. Table 5 provides an overview the four examples. We derived examples according to the possible combinations of variables in the research model: *Example 1: The Adventurist* = High Levels of IDW + Low PI (H1a); *Example 2: The Connector* = High Levels of IDW + High PI (H2a); *Example 3: The Beneficiary* = High Level of IOM + Low PI (H1b); *Example 4: The Ambitious* = High Levels of IOM + High PI (H2b). In the following, we detail these combinations.

Example 1: The Adventurist - Preference for Interdisciplinary Work & Low Professional Identification

Description: Boundaryless IT students belonging to *Example 1: The Adventurist* are characterized by high IDW – preference for interdisciplinary work and new experiences (H1a) – and low PI, meaning they prefer interdisciplinary tasks, seek new professional experiences, and are driven by challenges without experiencing high identification with IT. IDW's significant influence on turnaway intention indicates that these students plan to avail themselves of career opportunities outside IT during their careers and will transition between disciplines. Their main inner driver is gaining interdisciplinary experience, independent of the IT field.

Name (Interaction)	Description	Implications for IT careers and companies
The Adventurist (High IDW * Low PI)	***Characteristics:*** High preference for interdisciplinary work and low professional identification ***Career plans:*** Consideration of leaving IT profession ***Motivation:*** Gaining interdisciplinary experiences, also outside IT	***Expectations for careers:*** These future employees will seek to explore and exploit different directions during their careers, including outside IT. ***Should be hired for:*** Interdisciplinary tasks and boundary-spanning activities in- and outside of IT ***Measures in companies:*** Offer career paths with interdisciplinary switches within company
The Connector (High IDW * High PI)	***Characteristics:*** High preference for interdisciplinary work and high professional identification ***Career plans:*** Consideration of leaving IT, but bound by high PI ***Motivation:*** Gaining interdisciplinary experiences inside IT	***Expectations for careers:*** These future employees will seek to explore and exploit different directions during their careers, in- and possibly outside IT. ***Should be hired for:*** Interdisciplinary tasks and boundary-spanning activities in IT ***Measures in companies:*** Offer IT jobs with plenty of interactions with other disciplines
The Beneficiary (High IOM * Low PI)	***Characteristics:*** High preference for inter-organizational mobility and low professional identification ***Career plans:*** Switching between organizations but within IT ***Motivation:*** Using IT as a secure playground with additional benefits to switch between organizations	***Expectations for careers:*** These future employees will seek to explore inter-organizational experiences by switching between organizations. ***Should be hired for:*** Work with little onboarding time and required external knowledge ***Measures in companies:*** Offer movement between subsidiaries, short-term jobs for workers free to leave after the project (e.g., project work)
The Ambitious (High IOM * High PI)	***Characteristics:*** High preference for inter-organizational mobility and high professional identification ***Career plans:*** Switching between organizations with possible changes out of IT ***Motivation:*** Gaining inter-organizational experience combined with high personal growth need	***Expectations:*** These future employees will seek to explore inter-organizational experiences while also considering a transition to other professions. ***Should be hired for:*** Fast-paced interdisciplinary groups, possibility for hiring as boomerang employees and for management positions ***Measures in companies:*** Offer experience outside of organization (e.g., subsidiaries, expat arrangements) and flexible reentry.

Table 5. Examples of IT Students with Boundaryless Career Attitudes

Implications: Companies must expect that these future employees will seek to explore and exploit different directions during their careers. As this example of boundaryless IT students might gain exceptional value for the company due to their interdisciplinary knowledge (DeFillippi and Arthur, 1994), companies should not miss to offer career paths with possible interdisciplinary switches within the company. By providing fluid transitions between different within-organization jobs, companies could benefit significantly because, over the course of their careers, these employees offer considerable knowledge in different directions (Sullivan and Arthur, 2006, Tams and Arthur, 2010).

Example 2: The Connector – Preference for Interdisciplinary Work & High Professional Identification

Description: Boundaryless IT students belonging to *Example 2: The Connector* are characterized by a high preference for IDW and a high level of PI (H2a), meaning they prefer interdisciplinary tasks, while feeling highly connected to IT. Even if PI does not significantly influence the relationship between IDW and turnaway intention, this group has a significant, lower risk for turnaway due to the strong direct influence of PI on turnaway intention (Brooks et al., 2015). Their main inner driver is to gain interdisciplinary experience during their career, inside and potentially outside the IT field.

Implications: Companies must expect that these future employees will seek interdisciplinary experience during their career in IT. Due to the high affinity to IT and the wish to interact with others, this type of employee is the perfect connector between IT and other disciplines. Companies should therefore employ these boundaryless IT students primarily for boundary-spanning activities and interdisciplinary tasks to satisfy their preference for interdisciplinary work through frequent interactions with other disciplines.

Example 3: The Beneficiary - Preference for Inter-organizational Mobility & Low Professional Identification

Description: Boundaryless IT students belonging to *Example 3: The Beneficiary* are characterized by high preference for IOM (H1b), meaning they plan to switch organizations during their careers. However, this group has significantly reduced risk of leaving the IT profession. Because they do not exhibit a high PI level, PI does not influence their plans to remain in IT. Rather we suggest that this group of students is determined to stay in the IT field because of its benefits. For example, they might want to benefit from the good pay, prestige, and job security that the IT profession entails (McKnight et al., 2009). We also suggest that *Beneficiaries* use the high demand for IT professionals for easy transitions between organizations. Thus, we propose this group of IT students uses IT as a secure haven, with additional benefits, to fulfill their need to switch organizations.

Implications: Companies must expect these future employees to follow their plans to switch organizations. At first glance, this appears disadvantageous for organizations, but it also brings considerable advantages, especially in terms of experience from other companies (Ferratt et al., 2005). Companies should hire these employees primarily for work with little onboarding time and the need for extraordinary solutions. After all, these employees will have a high level of IT knowledge since they do not tend to switch professions. In addition, these employees bring external knowledge from other companies, from which the organization can benefit significantly.

Example 4: The Ambitious - Preference for Inter-organizational Mobility & High Professional Identification

Description: Boundaryless IT students belonging to *Example 4: The Ambitious* are characterized by high preference for IOM and high PI (H2b). While PI might be expected to enhance IOM's decreasing influence on turnaway intention, that influence is increased by the interaction term, implying that IOM's effect on turnaway intention is less negative with high PI. We propose that this group consists of ambitious IT students who prefer IOM, in combination with high need for personal growth. While they strongly identify with the IT profession, they are also more willing to leave it because their advanced technical skills reduce the risk of a failed career transition and make it easier to change organizations and professions (Ng and Feldman, 2007). In combination with a high need for personal growth resulting from PI, we suggest that these IT students might follow the impulse to benefit from their technical skills in other professions and management positions.

Implications: This example of boundaryless IT students is characterized by a high degree of mobility from which companies can benefit. These future employees connect to the IT profession, while benefiting from knowledge within and outside IT, as well as from other companies. Companies should offer career paths involving experience outside the organization, for example, through contracts with subsidiaries or as expats. Furthermore, companies might recruit them for management positions and as boomerang employees (Maier et al., 2021).

6.3   Theoretical Contribution

We see this study's theoretical contribution in the following three research areas. First, by investigating BCAs and demonstrating their influence on career plans in the IT context, we contribute to research on IT careers (Joia and Mangia, 2017, Joseph et al., 2012) and on IT turnaway (Armstrong et al., 2015, Brooks et al., 2015, Joseph et al., 2015, Reich and Kaarst-Brown, 1999). While career transitions in IT are often viewed as a consequence of job characteristics and experiences at work (Armstrong et al., 2015, Joseph et al., 2015, Brooks et al., 2015), BCAs provide a framework for examining occupational

and organizational transitions in IT as planned rather than as individuals' reactive behavior. Our study thus extends the literature on the IT profession's boundaryless characteristic (Ituma and Simpson, 2009, Joseph et al., 2012) and paves the way for further research on understanding career transitions away from, but also potentially toward, the IT profession (late-entry IT professionals (Joseph et al., 2012)).

Second, we generate greater understanding of BCAs' impact on current IT students and thus contribute to better understanding of the next generation of IT professionals (Setor and Joseph, 2016, Prommegger et al., 2020a, Setor and Joseph, 2021). With our study, we illustrate how IT professionals' career planning does not begin when they enter the workforce; instead, IT students develop preferences for career development during their studies through interaction with colleagues and teaching staff and through initial professional experiences in IT, for instance, practical courses and internships. To the best of our knowledge, therefore, we are the first to demonstrate IT students' BCAs and their influence on career planning. Rather than only focusing on establishing measures to reduce turnover and turnaway in IT, our study calls for measures within universities, for example, mentorship or career planning (Setor and Joseph, 2021) and for measures in organizations such as designing promotion paths for future boundaryless IT professionals to promote young IT professionals' career persistence in IT.

Third, we contribute to research on PI in IT (Brooks et al., 2015, Brooks et al., 2011, Riemenschneider and Armstrong, 2021, Carter and Grover, 2015). While management literature suggests that PI begins to form during the educational years (Clouder, 2003, Anderson-Gough et al., 2018), PI among IT students and its' influence on the IT profession are underrepresented topics in IS research. In line with IT workforce literature (Brooks et al., 2015), we found PI's strong association with plans to stay in IT and surprising interaction effects with BCAs. We are convinced that the interaction between PI and BCAs will also provide interesting findings for research on IT professionals. We therefore hope our study will encourage PI's investigation among IT students and future IT professionals, to help shape future IT careers.

6.4   Practical Contribution

We would like to dedicate our practical implications to two parties: organizations and universities.

For organizations, our paper provides suggestions on how to employ IT students with BCAs (see Table 5). Based on our research model, we suggest that IT students with different forms of BCAs, in combination with low or high PI, provide different mindsets and skills that can benefit companies in different ways. Because we expect increased boundaryless careers in IT (Joseph et al., 2012, Prommegger et al., 2020b), organizations will need to find ways to provide boundaryless IT professionals with opportunities for development. Our results suggest that the IT profession acts as a safe haven by offering opportunities for inter-organizational movement and flexible work. Therefore, we suggest that organizations leverage their boundaryless structures to attract talented individuals from other organizations and retain IT students and professionals in the field. Boundaryless IT professionals provide broad skills, beyond the profession and the organization, that can greatly benefit employers. Designing atypical career paths in organizations to integrate boundaryless IT professionals can thus pay off for organizations.

Lastly, we recommend universities address contemporary career concepts in their study programs. To fulfill needs of IT students holding BCAs, universities offering IT-related study programs should provide opportunities for IT students to work interdisciplinarily and interact with students from varied backgrounds. Personalized curricula and a wide range of electives from different study plans will provide plentiful opportunities for IT students to interact with others and at the same time enable creation of broad skill sets. Upon graduation, these future IT professionals will bring broadly diversified skill sets, a modern mindset, and self-motivation to companies. More so, despite IT students' predominant BCAs, PI still carries great influence on turnaway intention. Thus universities should develop programs to promote early PI either to keep future IT professionals in IT or to bring boundaryless IT professionals back to IT in the long term.

6.5   Limitations and Future Research

We recognize that IT students' career plans may change during their actual careers. Just as career anchors (Chang et al., 2011), BCAs may change over time, and PI may decrease or increase with work experience. Accordingly, we call for investigation of the relationship between BCAs and PI with a data sample of IT professionals. Furthermore, we recognize that the study's geographical and cultural context (Germany) might have influenced our results and findings. For example, since students in Germany do not pay tuition fees, they might be freer than others in their career plans and choices and, therefore, be more willing to risk high transaction costs when switching professions. Finally, we would like to raise awareness about the study's response rate (43%) and especially about the rate of students who started the survey but did not fill out all relevant questions for this study (n=121). We acknowledge that both these rates could have impacted our results. Thus, we call for replication with a larger sample in different geographic and temporal contexts.

Additionally, while there is research on boundaryless careers in IT (Ituma and Simpson, 2009, Joseph et al., 2012), we are not aware of any that examine IT students' BCAs and their impact on career planning. Our paper shows that IT students' BCAs can be identified at an early stage of their studies. Therefore, measures for boundaryless IT career design should be taken at an early stage, so future IT professionals do not only leave IT, but also find their way back to the IT field. Research on boundaryless IT careers and the emergence of BCAs among IT students can help with this design. We are particularly interested in the extent to which and when BCAs emerge among IT students and how they, for example, influence the choice of field of study.

Furthermore, we believe great potential lies in combining research on job characteristics and work outcomes that trigger career transitions (Armstrong et al., 2015, Brooks et al., 2015, Joseph et al., 2015, Reich and Kaarst-Brown, 1999) with research on BCAs for investigating turnaway in IT. Each research stream investigates IT turnaway from a different perspective. However, it stands to reason that both reinforce each other. For example, IT professionals with BCAs, when experiencing burnout or exhaustion, may exhibit lower barriers to moving away from IT since turning away would naturally benefit their desire for change. Therefore, we encourage research on interaction effects of job characteristics, work outcomes and BCAs in the IT profession.

Finally, we would like to note that the investigation of individuals' BCAs can not only improve our understanding of IT turnaway but also our knowledge about individuals' transitioning into the IT profession. Our understanding of "late-entry" IT professionals is still limited (Joseph et al., 2012), but given the ongoing IT skills shortage, this group has great potential in the current IT job market. The study of late-entry IT professionals' BCAs could help us better understand this group, their career paths, and their motivations to move into IT; then we could appropriately support late-entry IT professionals during their transitions (Prommegger et al., 2020b). We thus encourage future research on late-entry IT professionals.

7   Conclusion

Lack of understanding of BCAs' influence on future IT professionals' career plans motivated this study. Thus we examined IT students' BCAs and their relationship with students' plans to leave IT during their careers, along with whether PI shapes this relationship. We found divergent effects of two BCA forms on intention to leave the IT profession. While a preference for interdisciplinary work increases IT students' intention to leave, a preference for inter-organizational mobility lowers their intention to do so. Furthermore, we found surprising interaction effects of BCAs with PI. Contrary to our expectations, PI did not significantly reduce effects of preference for interdisciplinary work on turnaway intention. Moreover, we found positive interaction terms for PI and inter-organizational mobility on turnaway intention, indicating that higher PI reverses the reducing effect of preference for inter-organizational mobility on turnaway intention. Overall, this study contributes to research on changing IT careers and provides practical guidance for the employment of future IT professionals with BCAs.

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