

Heterogeneity in Personal Innovativeness: Evidence from a Cluster Analysis

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Abstract

Individual readiness to engage with innovation represents an important component of broader economic and development processes. This study examines the structure and heterogeneity of personal innovativeness in the Croatian context using survey data collected from 400 respondents. A 20-item instrument capturing both pro-innovative behaviours and resistance to innovation was analysed using principal component analysis, which revealed a stable two-dimensional structure distinguishing proactive innovativeness and attitudinal openness to innovation. Based on these dimensions, cluster analysis identified three distinct profiles of individuals: High Innovators, Cautious Adopters, and Moderate Individuals. The results indicate that personal innovativeness is not uniformly distributed but organised into clearly differentiated behavioural segments. Further analysis shows statistically significant differences across clusters in education, age, and gender, with higher levels of innovativeness associated with higher educational attainment and younger age groups. The findings suggest that individual-level innovation potential is embedded in the socio-demographic structure, with implications for the design of development-oriented policies and organisational practices to foster innovation in Croatia.

Keywords: Personal innovativeness; cluster analysis; principal component analysis; innovation profiles; socio-demographic differences; Croatia; innovation and development

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Introduction

Innovation is widely recognised as a key driver of economic growth, competitiveness, and regional development. While much of the existing literature focuses on organisational and technological aspects of innovation, increasing attention has been given to the role of individuals as carriers of innovative behaviour. At the individual level, differences in openness to new ideas, willingness to experiment, and readiness to adopt novel solutions can significantly influence the diffusion and implementation of innovation processes (Rogers, 2003).

The concept of personal innovativeness has been developed to capture such individual differences. It is commonly defined as the degree to which an individual is willing to try out new ideas or technologies (Agarwal & Prasad, 1998). Empirical studies have shown that personal innovativeness plays an important role in shaping attitudes towards innovation, technology acceptance, and behavioural intentions (Agarwal & Prasad, 1998; Yi, Jackson, Park, & Probst, 2006). At the same time, research indicates that resistance to innovation, manifested as scepticism, caution, or reliance on social validation, is an equally important dimension influencing individual behaviour (Ram & Sheth, 1989; Rogers, 2003).

Despite these insights, personal innovativeness is often treated as a unidimensional construct, typically measured along a simple continuum from low to high innovativeness. Such an approach may overlook the possibility that individuals differ not only in the level of innovativeness, but also in the configuration of underlying attitudes and behaviours. Individuals may simultaneously exhibit openness to innovation alongside caution or hesitation, suggesting a more complex internal structure.

In this context, segmentation approaches offer a useful analytical perspective. Rather than assuming a homogeneous population, clustering techniques enable the identification of distinct profiles of individuals based on their innovation-related characteristics. Previous research in related domains has demonstrated the value of such approaches in uncovering heterogeneous behavioural patterns that are not visible through aggregate analysis (Wedel & Kamakura, 2000). However, applications of cluster-based profiling to personal innovativeness, particularly in smaller or emerging contexts, remain limited.

Furthermore, the relationship between personal innovativeness and socio-demographic characteristics remains poorly understood. While some studies suggest that factors such as age, education, and gender may influence innovation-related behaviour, empirical findings are often mixed and context-dependent (Rogers, 2003; Yi et al., 2006). This highlights the need for context-specific empirical evidence, especially in countries where research on individual-level innovation behaviour is still developing.

Against this background, this study aims to examine the structure and heterogeneity of personal innovativeness in the Croatian context. Using survey data collected from 400 respondents, the study first identifies the underlying dimensions of personal innovativeness through principal component analysis. It then applies cluster analysis

to uncover distinct profiles of individuals based on these dimensions. Finally, the study explores differences between identified clusters with respect to key socio-demographic characteristics.

By providing an empirical segmentation of personal innovativeness, this study contributes to a better understanding of how innovation potential is distributed at the individual level. The findings may be relevant for the design of policies and organisational practices aimed at fostering innovation and supporting development processes in Croatia.

Literature review

The notion of personal innovativeness

Personal innovativeness is commonly defined as an individual's willingness to engage with new ideas, experiment with novel approaches, and adopt innovations ahead of others (Agarwal & Prasad, 1998). Within the broader framework of diffusion of innovations, individual differences in innovativeness play a central role in explaining how innovations spread across populations (Rogers, 2003). Individuals differ not only in their readiness to adopt innovations but also in their levels of scepticism, caution, and resistance, suggesting that innovativeness is a multidimensional construct rather than a simple continuum (Ram & Sheth, 1989).

Empirical research has consistently demonstrated that personal innovativeness is associated with a range of important behavioural outcomes. In the context of technology adoption, more innovative individuals tend to act as early adopters and exhibit higher levels of self-efficacy and confidence in dealing with new systems (Agarwal & Prasad, 1998). Similarly, in the labour market context, personal innovativeness has been linked to employability outcomes. Pilav-Velić et al. (2020) show that innovative university graduates in Croatia and neighbouring countries tend to enter the labour market more quickly, highlighting the relevance of innovativeness not only for individual careers but also for broader economic development. Their findings also point to systemic challenges in education systems, particularly the insufficient development of critical thinking and innovation-related competencies.

Personal innovativeness research in the Croatian context

In the regional context, research on personal innovativeness has often been embedded within broader constructs such as entrepreneurial orientation, cognitive style, or innovation-related attitudes. For example, Pejić Bach et al. (2018) demonstrate that innovative cognitive style significantly contributes to entrepreneurial intentions in Slovenia, indicating that individual-level innovation-related traits play an important role in shaping economic behaviour. Although their study does not explicitly focus on Croatia or on profiling innovativeness, it provides important evidence for the relevance of innovation-related cognition in similar socio-economic environments.

At the same time, studies in the Western Balkans and Central and Eastern Europe suggest that innovativeness is closely related to cultural and value-based factors. Arsenijević et al. (2012), in a comparative study of students from Serbia, Croatia, and Bosnia and Herzegovina, find that attitudes toward innovation are significantly associated with value systems, particularly along the traditionalism-modernism dimension. Their results indicate that Croatian students exhibit a stronger orientation toward individualism and a greater willingness to change than those with more traditional value orientations, suggesting that innovativeness is embedded in broader cultural frameworks.

In Croatia specifically, research has also examined innovativeness at the macro-cultural level. Lažnjak (2011) analyses the dimensions of national innovation culture and shows that cultural factors such as uncertainty avoidance, power distance, and long-term orientation may influence innovation capacity. The findings suggest that multiple cultural dimensions coexist in Croatia, some of which may constrain innovation, particularly through risk aversion and resistance to change. This highlights the importance of examining innovativeness not only as an individual trait but also as a phenomenon shaped by broader socio-cultural conditions.

Sectoral and organisational studies further support the importance of innovativeness in the Croatian context. For instance, Gomezelj Omerzel and Smolcic Jurdana (2015) show that innovativeness in the tourism sector is influenced by a combination of entrepreneurial orientation, networking, and technological development, indicating that individual and organisational factors jointly contribute to innovation performance. More recent research in emerging markets also emphasises the role of education systems in fostering innovativeness. Zlatanović et al. (2024) demonstrate that institutional support, teaching practices, and student engagement significantly affect the development of innovative competencies in higher education, with implications that are transferable to Croatia and similar contexts.

Personal innovativeness and socio-demographic differences

Beyond its role as a psychological disposition, personal innovativeness has also been examined in relation to socio-demographic characteristics. However, prior research does not point to a single universal demographic profile of more innovative individuals. Instead, the literature suggests that age, gender, and education may matter, but their effects appear to be context-dependent and often mediated by domain, institutional setting, or the type of innovation under consideration (Agarwal & Prasad, 1998; Rogers, 2003).

Age is one of the most frequently discussed socio-demographic correlates of innovativeness. In innovation diffusion research, younger individuals are often assumed to be more open to novelty and more willing to experiment, especially in technology-related settings. Empirical work has offered partial support for this view. For example, Moore (2012), examining technology acceptance and personal innovativeness among school administrators, reported that age was inversely related

to personal innovativeness, whereas gender was not a significant contributor. At the same time, broader research on innovation and idea experimentation suggests that the relationship between age and innovativeness is not necessarily linear and may vary across contexts and forms of innovation (Packalen & Bhattacharya, 2019).

Findings on gender are even less consistent. Some studies report statistically significant sex or gender differences in attitudes toward innovation, while others find weak or no direct effects. In a regional comparative study of media students from Serbia, Croatia, and Bosnia and Herzegovina, Arsenijević et al. (2012) identified significant intercultural and intersex differences in attitudes toward innovations. By contrast, other studies in technology-related contexts have reported that gender is not a significant predictor of personal innovativeness when broader behavioural and contextual factors are taken into account (Moore, 2012). More recent work has continued to treat gender as a relevant explanatory variable, but often as one whose effect depends on the surrounding social or occupational environment rather than as a stable universal determinant (Kotsev & Stoycheva, 2024).

Education is often discussed as a factor that strengthens innovation capacity by fostering greater cognitive flexibility, exposure to new ideas, and higher self-confidence in dealing with novel situations. Direct studies linking educational attainment to personal innovativeness remain less common than studies on age and gender. Nevertheless, available evidence points in that direction. Pilav-Velić et al. (2020), studying graduates from Bosnia and Herzegovina, Croatia, and Serbia, found that more innovative graduates were employed faster than their peers, thereby linking personal innovativeness to outcomes associated with educational capital and labour-market readiness. At a broader level of innovation, demographic research on inventors also shows that educational attainment is strongly associated with innovative activity, even though such studies focus more on innovation output than on individual innovativeness as a trait (Jung & Ejermo, 2014).

In the Croatian and regional context, these socio-demographic relationships appear particularly relevant. Lažnjak (2011) showed that Croatian innovation culture is shaped by multiple value dimensions, some of which may inhibit innovation through uncertainty avoidance and resistance to change. Similarly, Arsenijević et al. (2012) linked innovativeness to broader value orientations and found both intercultural and intersex differences. Pejić Bach et al. (2018), although working in the Slovenian context, further demonstrated that an innovative cognitive style is meaningfully connected to entrepreneurial intentions in a neighbouring socio-economic environment. Together, these studies suggest that innovation-related individual differences in South-Eastern Europe are likely to be socially embedded rather than purely dispositional.

Taken together, prior literature suggests that socio-demographic variables should neither be treated as deterministic predictors of personal innovativeness nor ignored. The existing evidence is best described as mixed but meaningful: age often matters, gender shows inconsistent effects, and education tends to be positively associated with innovation-related capacities and outcomes. This provides a strong rationale for

examining whether distinct innovativeness profiles in Croatia are distributed unevenly across education, gender, and age groups.

Research gap

Existing research confirms that innovativeness is a relevant construct across different domains and levels of analysis, including individual behaviour, education, organisational performance, and national culture. However, direct empirical studies focusing on the internal structure and distribution of personal innovativeness within the Croatian population remain limited. Most existing studies either treat innovativeness as a predictor variable in specific contexts or analyse it at an aggregate or institutional level.

This creates a clear research gap. While it is known that innovativeness matters, less is understood about its structure at the individual level and whether distinct profiles of innovativeness can be identified within the population. Addressing this gap is particularly relevant in the context of regional development, where the distribution of individual innovation potential may influence the effectiveness of policies and organisational practices aimed at fostering innovation.

Accordingly, this study adopts a segmentation approach to personal innovativeness in Croatia. By identifying distinct profiles of individuals based on their innovation-related attitudes and behaviours, the study seeks to contribute to a more nuanced understanding of innovation readiness at the individual level and its potential implications for development processes.

Methodology

Research instrument

Personal innovativeness was measured using a multi-item scale conceptually grounded in the Personal Innovativeness in the Domain of Information Technology (PIIT) framework (Agarwal & Prasad, 1998), extended to capture both proactive innovation-related behaviour and resistance to innovation. The instrument reflects the dual nature of innovativeness as a combination of exploratory orientation and attitudinal openness, consistent with the diffusion of innovations perspective (Rogers, 2003) and research on resistance to innovation (Ram & Sheth, 1989).

In line with previous studies that applied and extended the PIIT construct in different contexts (e.g., Agarwal & Prasad, 1998; Yi et al., 2006; Pilav-Velić et al., 2020), the scale used in this study consists of 20 statements designed to capture multiple dimensions of personal innovativeness, including creativity, willingness to experiment, openness to new ideas, and scepticism toward innovation.

All items were measured on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). Negatively worded items were reverse-coded prior to analysis to ensure that

higher values consistently indicate higher levels of innovativeness or openness to innovation.

Table 1. Measurement of Personal Innovativeness

Code	Statement	Type
IN1	Peers often ask me for advice or information.	Direct
IN2	I enjoy trying out new ideas.	Direct
IN3	I look for new ways to do things.	Direct
IN4	I am generally cautious in accepting new ideas.	Reverse
IN5	I often improvise solutions when answers are not obvious.	Direct
IN6	I am sceptical about new inventions and new ways of thinking.	Reverse
IN7	I rarely trust new ideas until I see that most people accept them.	Reverse
IN8	I feel that I am an influential member of my peer group.	Direct
IN9	I consider myself creative and original in my thinking and behaviour.	Direct
IN10	I am usually one of the last people in my group to accept something new.	Reverse
IN11	I am an inventive type of person.	Direct
IN12	I enjoy participating in leading the group I belong to.	Direct
IN13	I am reluctant to accept new ways of doing things until others use them.	Reverse
IN14	I find it stimulating to be original in thinking and behaviour.	Direct
IN15	I tend to think traditional ways of doing things are best.	Reverse
IN16	I am challenged by ambiguity and unresolved problems.	Direct
IN17	I consider innovations only after others have used them.	Reverse
IN18	I am open to new ideas.	Direct
IN19	I am challenged by questions without clear answers.	Direct
IN20	I am often sceptical of new ideas.	Reverse

Source: Adapted from Agarwal & Prasad (1998)

The instrument was designed to capture different aspects of personal innovativeness, including openness to new ideas, creativity, experimentation, and resistance to change. After reverse-coding negatively worded items, the research instrument was prepared for online data collection.

Sample Description and Data Collection

The study is based on a sample of 400 respondents from Croatia. Data were collected via an online survey, participation was voluntary and anonymous, and the survey was administered in English.

In terms of education, the sample is heterogeneous, including respondents at all major educational levels. A total of 30 respondents (7.5%) reported having completed primary

education, 189 respondents (47.3%) secondary school or gymnasium, 69 respondents (17.3%) an undergraduate degree, 73 respondents (18.3%) a graduate degree, and 39 respondents (9.8%) a master's or doctoral degree. This distribution ensures sufficient variation in educational attainment, which is relevant given the assumed link between education and innovation-related behaviour.

Regarding gender, the sample consists of 261 male respondents (65.3%) and 139 female respondents (34.8%). Although the sample is not gender-balanced, it still enables meaningful comparison between groups.

With respect to age, 174 respondents (43.5%) are younger than 35 years, while 226 respondents (56.5%) are aged 35 years or older, providing a reasonable distribution across age groups.

It can be concluded that the sample size is adequate for the applied multivariate techniques, including principal component analysis and cluster analysis. While the non-probabilistic nature of the sample limits the generalisability of the findings, the observed heterogeneity in key socio-demographic characteristics supports the exploratory objective of identifying distinct profiles of personal innovativeness within the Croatian context.

Data Preparation and Statistical Analysis

Prior to statistical analysis, the dataset was screened and prepared for multivariate procedures. Negatively worded items were reverse-coded to ensure consistent interpretation of the scale, so that higher values across all variables indicate higher levels of personal innovativeness. This step is standard practice in the analysis of Likert-type scales to avoid distortion in factor structure and subsequent analyses (Hair et al., 2019).

To examine the underlying structure of personal innovativeness, principal component analysis (PCA) was applied. PCA is widely used as a data reduction technique to identify latent dimensions underlying a set of observed variables (Jolliffe, 2002). Given the expectation that dimensions of innovativeness may be correlated, an oblique rotation method (Promax) was employed. This approach allows for correlated components and is considered appropriate in behavioural research (Hair et al., 2019). Component scores derived from the PCA were retained for further analysis.

In the second step, cluster analysis was conducted to identify distinct profiles of individuals based on their positions on the extracted components. Clustering based on component scores rather than original variables reduces noise and enhances the interpretability of results (Ketchen & Shook, 1996). A fuzzy c-means clustering algorithm was applied, allowing for partial membership of observations across clusters. For interpretative purposes, each respondent was assigned to the cluster with the highest membership value.

The number of clusters was determined based on multiple criteria, including model fit indicators and interpretability of the solution. A three-cluster solution was selected as

it provided a meaningful and stable segmentation of respondents, while avoiding over-fragmentation of the sample.

Finally, differences between clusters in socio-demographic characteristics were examined using chi-square tests of independence. This method is appropriate for testing associations between categorical variables and group membership (Agresti, 2013).

All statistical analyses were performed using JASP version 0.19.3.

Results

Descriptive statistics and correlations

Table 2 presents descriptive statistics for the items measuring personal innovativeness. The mean values range from 2.678 to 3.902, indicating that respondents, on average, position themselves around the midpoint of the scale, with a slight tendency toward agreement with statements reflecting openness to innovation.

Table 2. Descriptive statistics of indicators measuring personal innovativeness

Variable	Mean	Std. Deviation
IN1	3.420	1.242
IN2	3.685	1.149
IN3	3.703	1.154
IN4_R	2.678	1.173
IN5	3.493	1.165
IN6_R	3.310	1.188
IN7_R	3.255	1.240
IN8	3.368	1.121
IN9	3.638	1.074
IN10_R	3.377	1.302
IN11	3.433	1.067
IN12	3.397	1.193
IN13_R	3.368	1.229
IN14	3.902	1.027
IN15_R	3.195	1.312
IN16	3.362	1.142
IN17_R	3.250	1.227
IN18	3.808	1.038
IN19	3.442	1.140
IN20_R	3.270	1.243

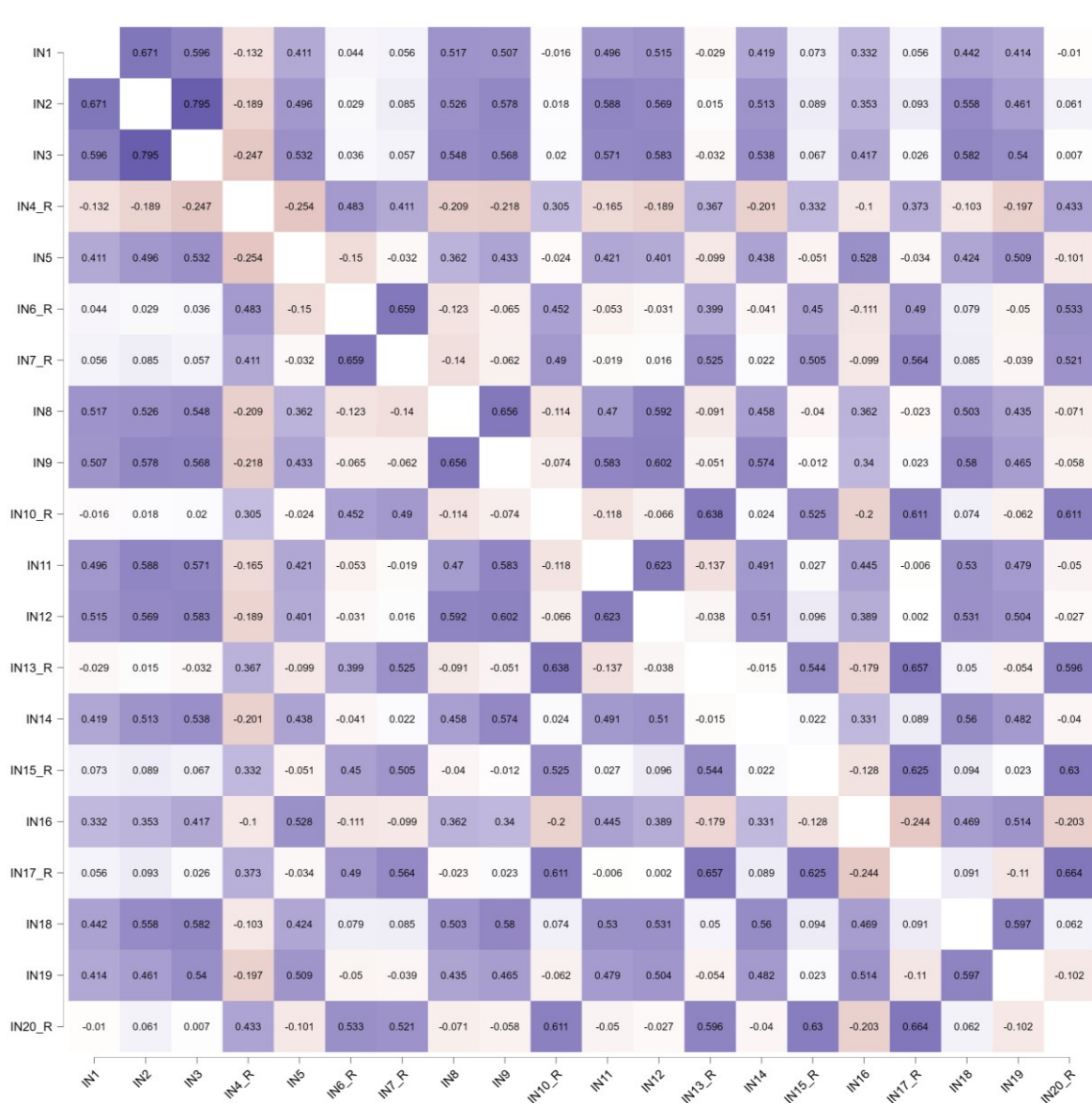
Source: Author's work

Higher mean values are observed for items related to creativity, originality, and openness (e.g., IN14, IN18, IN3), suggesting that respondents generally perceive

themselves as receptive to new ideas. In contrast, lower mean values for reverse-coded items (e.g., IN4_R) indicate that cautious or resistant attitudes are present but not dominant.

The correlation matrix (Figure 1) reveals several important patterns. First, items reflecting proactive and creative aspects of innovativeness (such as IN2, IN3, IN9, IN14, and IN18) are moderately to strongly positively correlated with each other, indicating that these behaviours tend to co-occur. This supports the idea that innovativeness has a coherent behavioural core.

Figure 1. Pearson's r heatmap



Source: Author's work

Second, reverse-coded items (e.g., IN4_R, IN6_R, IN7_R) show weaker or negative correlations with these proactive items, reflecting the conceptual distinction between openness to innovation and resistance to change. At the same time, these items are positively correlated with one another, suggesting that scepticism and caution form a consistent attitudinal pattern.

Finally, the absence of strong correlations among items indicates that multicollinearity is not a concern, while the overall pattern of relationships suggests the presence of underlying latent dimensions.

Principal Component Analysis

Principal component analysis with Promax rotation was conducted to examine the underlying structure of personal innovativeness. As shown in Table 3, the analysis yielded a clear two-component solution. The first component had an eigenvalue of 6.700 and explained 33.2% of the total variance, while the second component had an eigenvalue of 4.665 and explained an additional 23.6% of the variance. Together, the two components accounted for 56.8% of the total variance, indicating a satisfactory level of explained variance for this type of behavioural data.

Table 3. Principal Component Analysis – Component Characteristics

Component	Eigenvalue	Variance Explained (%)	Cumulative (%)
Component 1	6.700	33.2	33.2
Component 2	4.665	23.6	56.8

Source: Author's work

The rotated component matrix presented in Table 4 reveals a clean, interpretable structure. The first component is defined by items reflecting proactive and creative aspects of personal innovativeness, such as enjoyment in trying new ideas (IN2), seeking new ways of doing things (IN3), perceiving oneself as creative and original (IN9), and being open to unresolved problems and new ideas (IN16, IN18, IN19). Loadings on this component range from 0.574 to 0.837, indicating a strong, coherent behavioural dimension of innovativeness.

The second component, also shown in Table 4, is defined by reverse-coded items capturing caution, scepticism, and resistance to innovation. The strongest loadings are observed for IN17_R (0.842), IN20_R (0.831), and IN13_R (0.784), followed by the reverse-coded items IN15_R, IN7_R, and IN10_R. These loadings, ranging from 0.553 to 0.842, suggest that the second component reflects an attitudinal dimension related to openness to innovation, as reflected in the absence of resistance.

Table 4. Rotated Component Loadings (Promax Rotation)

Variable	Component 1	Component 2	Uniqueness
IN3	0.837	–	0.307
IN2	0.824	–	0.326
IN9	0.781	–	0.387
IN12	0.777	–	0.400
IN18	0.777	–	0.398
IN11	0.755	–	0.425
IN1	0.723	–	0.483
IN8	0.720	–	0.465
IN14	0.719	–	0.488
IN19	0.710	–	0.486
IN5	0.655	–	0.554
IN16	0.574	–	0.607
IN17_R	–	0.842	0.299
IN20_R	–	0.831	0.313
IN13_R	–	0.784	0.385
IN15_R	–	0.774	0.407
IN7_R	–	0.773	0.408
IN10_R	–	0.773	0.405
IN6_R	–	0.728	0.472
IN4_R	–	0.553	0.619

Source: Author's work

An important result is that the component structure is clearly differentiated, with no substantial cross-loadings between the two components. As indicated in Table 4, all items load strongly on a single component, supporting the distinction between two related but analytically separable dimensions of personal innovativeness. The first dimension can be interpreted as proactive innovativeness, while the second reflects attitudinal openness to innovation.

Overall, the PCA results presented in Tables 3 and 4 confirm that personal innovativeness should not be treated as a one-dimensional construct. Instead, the findings suggest that it comprises two complementary dimensions, providing a sound basis for subsequent cluster analysis.

Cluster Analysis

To identify distinct profiles of personal innovativeness, fuzzy c-means clustering was applied using component scores from principal component analysis. The model summary in Table 5 indicates that a three-cluster solution provides an adequate fit to the data. The model explains a moderate proportion of variance ($R^2 = 0.563$), while the silhouette coefficient (0.360) suggests a reasonable level of cluster separation, which is acceptable for behavioural data.

Table 5. Fuzzy C-Means Clustering – Model Summary

Number of Clusters	N	R ²	AIC	BIC	Silhouette
3	400	0.563	342.940	366.890	0.360

Source: Author's work

As shown in Table 6, the clusters are of unequal size, with Cluster 2 representing the largest segment (49.5%), followed by Cluster 3 (33.5%) and Cluster 1 (17.0%). Differences in within-cluster heterogeneity further indicate that Cluster 2 captures the largest share of the data's variability, suggesting it represents the dominant pattern of innovativeness within the sample.

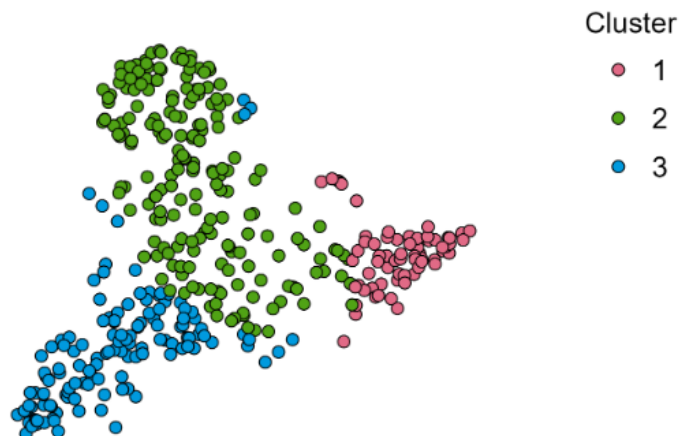
Table 6. Cluster Characteristics

Cluster	Size	Proportion (%)	Explained Within-Cluster Heterogeneity	Within Sum of Squares
1	68	17.0	0.153	50.520
2	198	49.5	0.605	200.163
3	134	33.5	0.243	80.257

Source: Author's work

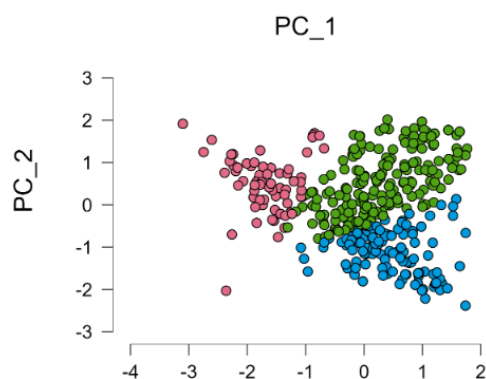
The spatial distribution of clusters is illustrated in Figures 1 and 2. The t-SNE visualisation (Figure 1) shows a clear grouping of observations into three clusters. In contrast, the distribution in the principal component space (Figure 2) confirms that the clusters are primarily differentiated along the two identified dimensions of innovativeness. The separation is particularly evident between Cluster 1 and the other two clusters, while Clusters 2 and 3 show partial proximity, reflecting their shared characteristics in terms of proactive innovativeness.

Figure 1. t-SNE Visualisation of Cluster Structure



Source: Author's work

Figure 2. Cluster Distribution in Principal Component Space



Source: Author's work

A more detailed insight into the structure of the clusters is provided in Table 7, which presents mean values of the observed variables across clusters. Clear and consistent differences are visible across both components.

Table 7. Mean Values of Innovativeness Items Across Clusters

Variable	C1	C2	C3
Component 1			
IN3	2.059	4.086	3.970
IN2	2.029	4.096	3.918
IN9	2.250	3.848	4.030
IN12	1.912	3.672	3.746
IN18	2.515	4.162	3.940
IN11	2.132	3.601	3.843
IN1	2.015	3.707	3.709
IN8	1.971	3.576	3.769
IN14	2.647	4.187	4.119
IN19	2.088	3.641	3.836
IN5	2.044	3.717	3.896
IN16	2.162	3.414	3.896
Average Component 1	2.152	3.809	3.889
Component 2			
IN17_R	3.647	3.823	2.201
IN20_R	3.750	3.894	2.104
IN13_R	3.912	3.848	2.381
IN15_R	3.456	3.818	2.142
IN7_R	3.632	3.803	2.254
IN10_R	3.926	3.924	2.291
IN6_R	3.750	3.778	2.396
IN4_R	3.485	2.884	1.963
Average Component 2	3.695	3.722	2.217

Source: Author's work

Cluster 1 is characterised by uniformly low scores on the first component (average = 2.152), indicating low levels of proactive innovativeness, including limited openness to new ideas, creativity, and experimentation. At the same time, this cluster exhibits relatively high scores on the second component (average = 3.695), suggesting a stronger presence of cautious and sceptical attitudes. This profile can be interpreted as representing individuals with low innovativeness and a relatively high level of resistance to change.

Cluster 2 shows high values on both components (average = 3.809 for Component 1 and 3.722 for Component 2), indicating individuals who are both proactive and open to innovation. These respondents score highly on items related to creativity, experimentation, and willingness to adopt new ideas, while also exhibiting low levels of resistance. This cluster represents the most innovation-oriented group in the sample.

Cluster 3 displays high values on the first component (average = 3.889), comparable to Cluster 2, but substantially lower values on the second component (average = 2.217). This indicates that, although individuals in this cluster demonstrate strong proactive innovativeness, they simultaneously exhibit higher levels of scepticism and hesitation toward new ideas. This profile can be interpreted as representing cautious innovators, who are engaged with innovation but do not fully embrace it without reservation.

Socio-Demographic Differences

To further characterise the identified clusters, differences across key socio-demographic variables were examined using chi-square tests of independence. The results indicate statistically significant differences across clusters in terms of education, gender, and age.

As shown in Table 8, education is strongly associated with cluster membership ($\chi^2 = 46.594$; $p < .001$). Cluster 1 is predominantly composed of respondents with lower levels of education, with a particularly high share who completed secondary school (66.18%) and a relatively small proportion with higher education. In contrast, Cluster 2 includes a substantial proportion of respondents with graduate (24.75%) and postgraduate education (14.14%), indicating a higher concentration of more educated individuals. Cluster 3 shows a mixed structure, with a relatively higher representation of respondents with undergraduate degrees (21.64%) and secondary education (48.51%), but a notably lower share of respondents with postgraduate qualifications (2.24%).

Overall, the results suggest that higher levels of education are more prevalent among individuals with stronger innovation-related profiles, particularly in Cluster 2.

Table 8. Distribution of Respondents by Education Across Clusters (%)

Education Level	Cluster 1	Cluster 2	Cluster 3	Total
Primary education	11.77	3.54	11.19	7.50
Secondary school / Gymnasium	66.18	39.90	48.51	47.25
Undergraduate degree	7.35	17.68	21.64	17.25
Graduate degree	2.94	24.75	16.42	18.25
Post-graduate degree (Master's of Science / PhD)	11.77	14.14	2.24	9.75
Total	100.00	100.00	100.00	100.00

Note: Each cell displays column percentages.

$\chi^2 = 46.594$; $df = 8$; $p < .001$

Source: Author's work

Gender differences across clusters are also statistically significant, although less pronounced ($\chi^2 = 6.839$; $p = 0.033$), as presented in Table 9. While males dominate across all clusters, their representation is particularly high in Cluster 3 (73.88%) compared to Clusters 1 (63.24%) and 2 (60.10%). Conversely, female respondents are relatively more represented in Cluster 2 (39.90%). These findings indicate a modest association between gender and innovativeness profiles, with women somewhat more present in the most innovation-oriented cluster.

Table 9. Distribution of Respondents by Gender Across Clusters (%)

Gender	Cluster 1	Cluster 2	Cluster 3	Total
Male	63.24	60.10	73.88	65.25
Female	36.77	39.90	26.12	34.75
Total	100.00	100.00	100.00	100.00

Note: Each cell displays column percentages.

$\chi^2 = 6.839$; $df = 2$; $p = 0.033$

Source: Author's work

Age differences are statistically significant and more clearly structured ($\chi^2 = 17.043$; $p < .001$), as shown in Table 10. Cluster 1 is dominated by older respondents (73.53% aged 35 and above), while Cluster 3 has the highest proportion of younger individuals (55.97% under 35). Cluster 2 again occupies an intermediate position, with a more balanced age distribution. This pattern suggests that younger respondents are more represented in clusters characterised by higher proactive innovativeness, while older respondents are more prevalent in less innovation-oriented profiles.

Table 10. Distribution of Respondents by Age Across Clusters (%)

Age Group	Cluster 1	Cluster 2	Cluster 3	Total
Under 35	26.47	40.91	55.97	43.50
35 and above	73.53	59.09	44.03	56.50
Total	100.00	100.00	100.00	100.00

Note: Each cell displays column percentages.

$\chi^2 = 17.043$; $df = 2$; $p < .001$

Source: Author's work

Taken together, the results indicate that socio-demographic characteristics are meaningfully related to personal innovativeness profiles. Education and age show clear and consistent patterns, while gender differences are present but less pronounced. These findings provide additional support for the interpretation of clusters and highlight the importance of considering demographic heterogeneity when analysing innovation-related behaviour.

Conclusion

This study examined the structure and distribution of personal innovativeness in a Croatian sample using a multidimensional measurement approach and clustering techniques. The results show that personal innovativeness is best understood as a two-dimensional construct. The first dimension reflects proactive and behavioural aspects of innovativeness, including creativity, experimentation, and active engagement with new ideas. The second dimension captures attitudinal openness to innovation, as reflected in lower levels of scepticism and resistance. Based on these dimensions, three distinct profiles were identified: a group with low innovativeness and higher resistance, a dominant group characterised by high innovativeness and openness, and a third group combining strong proactive tendencies with more cautious attitudes toward innovation. In addition, statistically significant differences across clusters were observed for education, age, and gender.

From a theoretical perspective, the findings support and extend existing conceptualisations of personal innovativeness. While earlier work has often treated innovativeness as a single latent trait (Agarwal & Prasad, 1998), the present results are more consistent with approaches that distinguish between innovation adoption and resistance (Ram & Sheth, 1989) and with the broader diffusion of innovations framework (Rogers, 2003). The clear separation between proactive behaviour and attitudinal openness suggests that these dimensions should be considered jointly but not conflated. Furthermore, the observed socio-demographic differences are broadly aligned with prior research indicating that age and education are relevant correlates of innovation-related behaviour, while gender effects tend to be weaker and context-dependent (Arsenijević et al., 2012; Pilav-Velić et al., 2020; Jung & Ejeremo, 2014). In this sense, the study contributes by linking multidimensional measurement of innovativeness with segmentation-based analysis in a specific regional context.

In practical terms, the findings highlight the importance of recognising heterogeneity in innovation-related behaviour. The presence of a large group of highly innovative and open individuals suggests a substantial potential for innovation-driven activities. At the same time, identifying a segment characterised by caution and resistance underscores the need for targeted interventions to reduce perceived risks and increase trust in new ideas. The “cautious innovator” profile is particularly relevant, as it indicates that high creative potential does not necessarily translate into full acceptance of innovation. For policymakers, educators, and organisations, this implies that a one-size-fits-all approach to fostering innovativeness is unlikely to be effective. Instead, tailored strategies that address different behavioural profiles may yield better outcomes, especially in regional development.

Several limitations should be acknowledged. The study is based on a non-probabilistic sample, which limits the generalisability of the findings. The cross-sectional design does not allow for causal interpretation or analysis of changes over time. In addition, the measurement instrument, although grounded in established concepts, represents an adapted rather than standardised scale, which may affect comparability with other studies. The reliance on self-reported data also introduces the possibility of response bias.

Future research could build on these findings by applying confirmatory factor analysis to validate the identified structure of personal innovativeness and by testing the stability of the clusters across different samples and contexts. Longitudinal studies would be particularly valuable for examining how innovativeness evolves over time and in response to environmental or institutional changes. Further research could also explore the relationship between innovativeness profiles and concrete outcomes, such as technology adoption, entrepreneurial activity, or organisational performance. Expanding the analysis beyond Croatia to include cross-country comparisons would provide additional insight into the role of socio-cultural context in shaping personal innovativeness.

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