STUDY OF IMPACT OF PERSONALITY TRAITS ON ACADEMIC PERFORMANCE OF MANAGEMENT STUDENTS

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Abstract *The purpose of this study is to understand how big five personality traits, namely extraversion, agreeableness, conscientiousness, emotional stability and openness to experience influence academic performance of MBA students. A primary study on a sample of 706 MBA students from different management institutes of Mumbai region is conducted. Two academic metrics; Percentage of marks secured in Graduation and Percentage of marks secured in MBA first year were considered for analysing academic performance. T-test and Mann Whitney U test were used to analyse the data. Conscientiousness strongly influenced academic success for both the measures of academic performance. Extraversion and Agreeableness also had considerable impact on academic performance considering graduation percentage. However, impact of Emotional stability and Openness to experience on academics was not observed in this research.*

Keywords: *Personality Traits, Academic Performance, MBA Students*

INTRODUCTION: The word personality comes from the Latin word persona which means mask. It was used in ancient Latin theatres to represent a particular character. Personality represents a stable set of characteristics responsible for a person's identity. Though the dimensions of personality are beyond one's control, they strongly influence one's attitudes, expectations and assumptions and behaviour (Kinicki, 2008). Personality captures what people are like and ability captures what people can do (Colquitt, 2009). Personality has to do with individual differences among people in behaviour patterns, cognition and emotion (Mischel, 2004). Personality factors are of extreme importance in today's competitive organizational world. Often an unsuitable kind of personality proves dreadful and causes undesirable tensions and worries in organization. Personality can be conceptualized using personality traits. Personality traits are recurring regularities and trends in a person (Colquitt, 2009). Personality traits are enduring personal characteristics that are revealed in a particular pattern of behaviour in a variety of situations. One popular and widely used personality trait model is *Five Factor Model* (FFM) (Goldberg, 1993; Costa & McCrae, 1992). Various Researchers have studied hundreds of American English adjectives used to describe personality traits. Research has identified five factors that account for nearly all of the variability of the complete word list. These five factors can be named *extraversion, agreeableness, conscientiousness, neuroticism* (or its opposite pole, emotional stability), and intellect or *openness to experience* (John et al., 2008). Many personality psychologists (Costa & McCrae, 1992; Goldberg, 1992) agree that said five

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domains capture the most basic individual differences in personality traits and different alternative trait models can be conceptualized in terms of the Big Five structure. The Big Five structure does not imply that personality differences can be summarised to only five traits. Rather, these five dimensions represent personality at a very broad level of generalisation and each dimension summarizes a large number of distinct, more specific personality characteristics. These overarching domains represent the basic structure behind all personality traits (O'Connor, 2002). Following is the description of each trait in detail;

Extraversion

Extraversion includes traits like being sociable, talkative, gregarious, assertive, active, ambitious and expressive (Barrick & Mount, 1991). They have a strong desire for praise, social recognition, status and power. Extraversion is associated with adjective traits such as talkative, sociable, passionate, bold, and dominant (Colquitt, 2009). Extraversion is marked by noticeable engagement with the external world. Extraverts enjoy being with people. They are full of energy and often experience positive emotions. They tend to be action-oriented, assertive and enthusiastic individuals who are likely to say yes to opportunities for excitement. When in a group, these individuals like to talk a lot, assert themselves, and draw attention to themselves (Friedman & Schustack, 2016).

Agreeableness

Agreeableness include personality traits such as being courteous, trusting, flexible, cooperative, soft hearted, forgiving, good natured, and tolerant (Barrick & Mount, 1991). Agreeableness has adjectives such as kind, cooperative, sympathetic, helpful, courteous, and warm (Colquitt, 2009). Agreeableness reflects individual differences in concern with cooperation, collaboration and social harmony. Individuals high on Agreeableness value getting along with others. Agreeable individuals are considerate, friendly, generous and helpful. They are willing to compromise their happiness for others benefit. Agreeable people also have an optimistic view of human nature. They believe people are basically honest, decent, and trustworthy (Barrick & Mount, 1991).

Conscientiousness

Conscientiousness includes traits such as being hardworking, thorough, organized, responsible, careful, and persevering (Barrick & Mount, 1991). Conscientiousness is associated with trait like being dependable, organized, reliable, ambitious, and hardworking (Colquitt, 2009). Conscientiousness concerns the way in which people control, regulate, and direct their impulses (Friedman & Schustack, 2016). The benefits of high conscientiousness are obvious. Individuals high on conscientiousness achieve high levels of success through purposeful planning, persistence and perseverance. Others regard them as intelligent and reliable (Colquitt, 2009).

Emotional Stability

Neuroticism (polar opposite of emotional stability) includes traits like being anxious, depressed, emotional, angry, embarrassed, worried, and insecure (Barrickand Mount, 1991). Neurotic individuals are limited in

social skills and avoid situations that demand for taking control. Neuroticism has to do with traits like bring nervous, moody, emotional, insecure, and unstable (Colquitt, 2009). Neuroticism (polar opposite of emotional stability) means the tendency to experience negative feelings. Individual with high on Neuroticism are less emotionally stable. These individuals may experience some negative feeling such as anxiety, anger, or depression, and they are likely to experience several of these emotions (Friedman & Schustack, 2016).

Openness to Experience

Openness to experience includes traits like being imaginative, curious, original, intelligent, broad minded and artistically sensitive (Barrick & Mount, 1991). Openness has to do with curious, imaginative, creative, complex, refined, sophisticated (Colquitt, 2009). Openness to Experience describes a personality trait that differentiates imaginative, creative people from down-to-earth, conventional people. Open individuals are intellectually curious, sensitive to beauty, and appreciative of art. They tend to be more aware of their feelings, compared to closed people. They tend to think and act in individualistic and non-traditional ways (Friedman & Schustack, 2016).

Popularity of Big Five Model

Curiosity in personality and personality traits' research gained momentum in late 1960s and psychologists began a decades-long debate about the importance of trait versus situational influences on behaviour. However, by the 1980s, several researchers had resumed lexical work. Capitalizing on advances in computing power, these researchers analysed personality ratings made using much larger sets of trait descriptive adjectives than had been previously possible. They recovered versions of the Big Five/FFM structure in American English, sparking initial consensus around this structure. Researchers failed to find additional broad trait dimensions beyond the Big Five (John et al., 2008). The Big Five approach has become immensely popular for many reasons. The first and foremost being, these personality traits are quite stable and they are not likely to experience ordinal changes particularly after early adulthood. Personality is stable over a period of four-year (Cobb-Clark & Schurer, 2011). The average personality changes seen are small and do not vary substantially across age groups. Personality change within individuals is generally unrelated to experiencing adverse life events. Like other non-cognitive traits, personality can be modelled as a stable input into many decisions (Caspi, 2005). Changes over time in entire levels are extreme over childhood, some changes are also likely to occur during adulthood. However, they seem to be very gradual and determined by biological maturation rather than life experience. Big Five is a robust measure both across cultures and samples. Also, Big Five personality traits are considered to be largely uncorrelated with cognitive skills which is defined as the ability to solve abstract problems (John et al., 2008) Hence, the Big Five personality traits constitute truly distinct factors in the analysis of labour market outcomes.

NEED FOR STUDY

The concept of personality has huge significance in organizational behaviour. Often the behaviour is directed and influenced by the personality. Individuals must be conscious of their personality traits and their consequent influence on behaviour. Understanding and acknowledging this will benefit the individual in behaving rationally. For example, if a person is aware that he has high agreeableness, he will be friendly and compassionate most of the times, but there might be a situation in which he should be analytical rather than sympathetic. Similarly, a person with high openness will never fit in a routine monotonous job, he would need a job which gives more opportunities for exploring new ideas. Making the right decision and right choice of behaviour will depend on the conscious understanding of these traits. Study of how Personality traits impact academic success can be very useful for students as well as academic institutes. Students will become more aware of the traits impacting their academic success. Students can make deliberate efforts to improve the behaviour and traits. For example, if Conscientiousness is strongly influencing their grades, students can start becoming more organized and systematic in their studies to make sure they reach the desired level of academic success.

LITERATURE REVIEW

Various national and international papers are studied to understand and comprehend the link between personality and academic success. Literature review on papers studying relationship between Personality Traits and Academic Performance revealed following findings. Research assessed the role of big five personality traits in predicting academic success. Only two traits yielded significant zero-order correlations with eventual undergraduate success, with both Openness to experience and Agreeableness being positively associated with Final Grades. Openness to experience had a direct impact on Final Grades. However, the impact of Agreeableness was wholly mediated by an application measure of not missing lectures and seminars (Farsidesa & Woodfield, 2002).

Noftle and Robins (2007) show that the Big Five, especially Conscientiousness, predict academic achievement, including grades and standardized test scores. Openness was proved to be the strongest predictor of verbal scores whereas Conscientiousness was the strongest predictor of both high school and college grades.

Poropat's research (2009) also show that Conscientiousness strongly predicts academic achievement. Academic performance was found to significantly correlate with Agree-ableness, Conscientiousness and Openness to Experience. When tested, correlations between Conscientiousness and academic performance were largely independent of intelligence. In a study done in 2011, a group of researchers validated that Personality and learning styles are both likely to play significant roles in influencing academic achievement. (Komarraju et al., 2011). A sample of 308 undergraduate students completed the Five Factor Inventory and the Inventory of Learning Processes and reported their grade point average. Two of the Big Five traits, conscientiousness and agreeableness, were positively related with all four learning styles (synthesis analysis, methodical study, fact retention, and elaborative processing), whereas neuroticism was negatively

related with all four learning styles. This suggests that both personality traits and learning styles contribute to academic performance. Another research also shows Conscientiousness to be the sole predictor of academic success. Extraversion is positively correlated with the academic performance (yet correlation is weak and insignificant). Agreeability and Neuroticism, have negative correlations with the academic performance (Buju, 2013). However, research proves that conscientiousness not important for academic success. Neuroticism, Introversion, Agreeableness and Openness to experience have observable ties to academic performance but conscientiousness is relatively unimportant for success (Nye et al., 2013). Personality plays significant roles in influencing students' academic achievement. A study explored the correlation between the `Big Five' personality traits and students' academic achievement measured by GPA. This study was conducted by reviewing the recent empirical literature on the correlation between the Big Five personality traits and GPA. This meta-analysis indicated that Conscientiousness highly correlates to GPA compared to others dimension (Ibrahim, 2014). A study was conducted to determine various personality traits and its correlation with their academic performance so that the teaching and learning methods can be modified to produce excellent academic achievements by the students after awareness of their pattern of personality. A sample 416 medical students were studied. The 'Conscientious Personality' trait showed highly significant association with high GPA. However, no significant association was observed between other personality traits (Openness, Extraversion, Agreeable, and Neuroticism) and GPA. Statistically no significant association was observed between personality traits and other characteristics of respondents i.e., Gender, Marital status and teaching methods (Al-Naim et al., 2016).

GAP ANALYSIS AND IDENTIFICATION OF VARIABLES

From the literature review it can be concluded that there is strong support on impact of Conscientiousness on academic success. However, there is ambiguity in determining relationship between other personality traits on academic performance. Different authors have different opinions regarding the same factors of personality. More importantly, there is paucity of research in area of linking personality traits and academic success for MBA students. Hence, keeping literature review as base, following variables are identified for study. As the research is about study of link between personality traits and academic performance, the given variables are identified for study. As the aim is to study the effect of personality traits on academic performance of business management students *(i) Academic Performance in terms of Graduation percentage and (ii) Academic Performance in terms of MBA first year percentage* are identified as dependent variables. The Independent variables are the big five personality traits namely (i) Emotional stability, (ii) Extroversion, (iii) Openness to experience, (iv) Agreeableness, and (v) Conscientiousness. *Emotional stability* means the degree to which a person can be depressed, anxious, angry and emotionally insecure. *Extroversion* means the degree to which a person can be talkative, active, sociable, and assertive. *Openness to experience* stands for the degree to which an individual can be open to new experiences and intellectually curious. *Agreeableness* is the extent to which a person can be flexible, good natured, trusting, and liked by others. *Conscientiousness* is the degree to which a person can be a planner, a dependable, responsible and organized person.

OBJECTIVE OF STUDY

Based on the literature review and gap analysis, the objectives of study are to understand the impact of big five personality traits on academic performance of management students.

HYPOTHESES: Based on literature review, following hypothesis is identified.

H: Big five Personality traits (Emotional stability, Extroversion, Openness to experience, Agreeableness and Conscientiousness impact academic performance.

RESEARCH METHODOLOGY

Secondary research in form of literature review is done. Also, primary research on post-graduate students of management studies is conducted through a survey questionnaire. Type of Research is Descriptive and Exploratory Research. Target population consists of post-graduate business management students of Mumbai region. Sample size drawn is 706 students**.** Sample size has been taken into consideration according to the Uma Sekaran book 'Research methods for business' (2015) using published tables of population and corresponding sample size. Populations above the size of 10000 are statistically infinite and hence the percentage of sample requires 4% when the population size is above 10000 and, in such cases, a sample size of 706 is considered to be sufficient. Type of sampling is Purposive sampling. Seven institutes from Mumbai region are selected. Questionnaires are given to all full-time MBA students of these seven institutes. The sample size of 706 management students consisted of 478 (around 68%) male and 228 (32%) female respondents. MBA institutes generally have a male dominated presence. The questionnaire was given to management students of seven different institutes of Mumbai region only.

The survey makes use of the big five factor structure of Goldberg, L.R. (1992) to measure personality traits. Likewise, each domain of personality is measured using close-ended questions revolving around each of the big five traits namely emotional stability, Extroversion, Openness to experience, Agreeableness and Conscientiousness. Academic Performance in terms of percentage of marks secured in graduation and MBA first year is asked. The Cronbach's alpha is 0.929 for items measuring personality traits, which means the questionnaire has high internal consistency, hence the questionnaire is reliable.

The data collected was analyzed through descriptive and inferential analysis. The responses collected are analyzed using the computer software Statistical Package for Service Solution (SPSS). Descriptive statistics are calculated to understand the personality traits and academic performance. Mann Whitney U test and t-test was done to see the impact of personality traits on academics.

RESULTS : The data analysis is carried out in two parts; descriptive and inferential. Descriptive analysis looked at normality of data, skewness and kurtosis. Inferential analysis is done for hypothesis testing to understand relationship between personality traits and academic performance. The results of these analyses are mentioned below. The first step in descriptive data analysis was to understand the central tendency of data for personality traits.

Table 1: Personality Traits

	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness To Experiences
N	706	706	706	706	706
Mean	3.693	3.788	3.688	3.312	3.591
Median	4.000	4.000	4.000	3.000	4.000
Mode	4.0	4.0	4.0	3.0	4.0
Skewness	-.376	-.825	-.566	-.228	-.566
Std. Error of Skewness	.092	.092	.092	.092	.092
Kurtosis	.298	1.107	.535	-.097	.827
Std. Error of Kurtosis	.184	.184	.184	.184	.184

Table 1 shows the mean ranking of each trait for all 706 students. It can be observed that students on an average were high (above 3 points on a scale of 1 to 5) in all 5 personality traits. The median and mode stands at 4. Mean is lowest for emotional stability. Thus, the students demonstrated on an average higher rating in personality traits. Next step is to understand the central tendency of the dependent variables. This is done to understand the normality of the data, to decide the use of parametric and non-parametric tests.

Table 2: Academic Performance

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Std. Error	Kurtosis	Std. Error
Graduation %	666	47.06	49.94	97.00	68.7476	8.72770	76.173	.520	.095	.116	.189
MBA First Year %	422	47.00	42.00	89.00	68.8816	6.83951	46.779	-.049	.119	.250	.237

Table 2 shows the descriptive statistics of the dependent variable's academics (Percentage of marks). From 706 respondents, 666 students disclosed their graduation percentage. The percentage ranged from a minimum of 49.94 percent to a maximum of 97 percent with mean of 68.74 percent. 422 students disclosed their MBA first year percentage. The percentage ranged from a minimum of 47 percent to a maximum of 89 percent with mean of 68.89 percent.

Table 3: Normality Test

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Graduation Percentage	.064	663	.000	.979	663	.000
MBA First Year Percentage	.053	183	.200	.992	183	.365

a. Lilliefors Significance Correction

From Table 3, it can be seen that significance level is less than 0.05 for graduation percentage, hence it can be concluded that data is not normally distributed at 5% level of significance. Non-parametric test (Mann Whitney U test) will be done to test the hypothesis considering Graduation Percentage. However, MBA first year percentage is normally distributed at 5% level of significance (p>0.05). Hence, parametric test (t-test) will be done to test the hypothesis considering MBA first year Percentage. Following hypothesis

considers the impact of personality traits on academic performance considering Percentage of marks secured in Graduation.

H1: Personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experiences) impact academic performance (considering Percentage of marks secured in Graduation).

Table 4: Relationship between Personality Traits and Academics (Graduation %)

Mann-Whitney (U)	Graduation percentage		
	U	p	N
Extraversion	46291.500	.023	666
Agreeableness	43052.000	.025	666
Conscientiousness	44990.000	.001	666
Emotional Stability	52839.000	.882	666
Openness to Experiences	51413.500	.133	666

Hypothesis H1 is partially accepted at 5% level of significance. From the Table IV data of Mann-Whitney statistics assessing relationship between personality traits and academics, it can be inferred that Conscientiousness predict academic performance (U=45288.000, p=0.002). Also, agreeableness (U=43052, p=0.025) and extraversion (U=46291.500, p=0.023) have a significant impact on academics considering percentage of marks secured in graduation.

It can be interpreted that business management students with high Conscientiousness, high extraversion and high agreeableness show better academic performance considering percentage of marks secured in by them in their graduation. Next analysis is the assessment of impact of personality traits on academic performance considering MBA first year percentage.

H2: Personality traits (Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experiences) impact academic performance (considering Percentage of marks secured in MBA first year).

Table 5: Relationship between Personality Traits and Academics (MBA First Year %)

t test	MBA first year percentage		
	T	p	df
Extraversion	0.923	0.357	422
Agreeableness	0.640	0.523	422
Conscientiousness	3.963	0.000	422
Emotional Stability	-0.599	0.550	422
Openness to Experiences	-0.278	0.781	422

Hypothesis H2 is partially accepted at 5% level of significance. From the Table 5 data of t-test statistics assessing relationship between personality traits and academics, it can be inferred that Conscientiousness strongly impacts academic performance (t=3.963, p<0.00001). However, no other trait has a significant impact on academics considering percentage of marks secured in MBA first year. It can be interpreted that business management students with high Conscientiousness show better academic performance considering percentage of marks secured in by them in their first year of MBA.

CONCLUSION

Based on data analysis and hypothesis testing, it can be concluded that only Conscientiousness strongly positively influence academic percentage. Agreeableness and extraversion also influenced academic percentage, but not for all measures of academic success. The primary research and hypothesis testing hence proves the strong influence of personality traits specially Conscientiousness on academic performance of business management students.

The study lays down its foundation on The Five Factor Model (Goldberg, 1993; Costa & McCrae, 1992). Hence the research limits itself to the big five personality traits only. Also, the primary research involves business management students from post-graduation level across Mumbai. Only fill-time business management courses are considered and the sample is restricted to Mumbai region.

REFERENCES

Al-Naim, A., Al-Rashed, A., Aleem, A., Khan, A., Ali, S. I., & Bogam, R. (2016). Personality traits and academic performance of medical students in Al-Ahsa, Saudi Arabia. *International Journal of Scientific Research*, *5*(4), 425–427.

Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*(1), 1–26.

Buju, S. (2013). Personality profile of students with technical academic performance. *Procedia Social and Behavioural Sciences*, *78*, 56–60. Doi: 10.1016/j.sbspro.2013.04.250

Caspi, A., Brent, W. R., & Rebecca, L. S. (2005). Personality development: Stability and change. *Annual Review of Psychology*, *56*(1), 453–484.

Colquitt, J., Le-Pine, J., & Wesson, M. (2009). *Organizational behaviour; improving performance and commitment in the workplace.* New York, NY: McGraw-Hill, Irwin.

Corr, P. J., & Matthews, G. (2009). *The Cambridge handbook of personality psychology*. Cambridge, UK: Cambridge University Press. ISBN 978-0-521-86218-9

Costa, P. T. Jr., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) manual*. Odessa, FL: Psychological Assessment Resources.

Dzulkifli, M. A., & Alias, I. A. (2012). Students of low academic achievement – Their personality, mental abilities and academic performance: How counsellor can help? *International Journal of Humanities and Social Science*, *2*(23), 220–225.

Eyong, E. I., David, B. E., & Umoh, A. J. (2014). The influence of personality trait on the academic performance of secondary school students in cross river state, Nigeria. *IOSR Journal of Humanities and Social Science*, *19*(3), 12–19.

Farsidesa, T., & Woodfield, R. (2002). Individual differences and undergraduate academic success: The roles of *Individual Differences*, *34*, 1225–1243.

Friedman, H. S., & Schustack, M. W. (2016). *Personality: Classic theories and modern research.* Boston, MA: Pearson/Allyn and Bacon.

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment*, *4*(1), 26–42.

Hakimi, S., Hejazi, E., & Masoud, G. L. (2011). The relationships between personality traits and students' academic achievement. *Procedia - Social and Behavioral Sciences*, *29*(1), 836–84. https://doi.org/10.1016/j.sbsproul.2011.11.312

Ibrahim, N. S., Yusof, N. S., Razak, N. F., & Norshahidi, N. D. (2014). A meta-analysis of the relationship between big five personality traits and students' academic achievement. *ICSSR E-Journal of Social Science Research*, *2*, 15–22.

Kinicki. (2008). *Organizational behaviour: Core concepts.* New York, NY: McGraw-Hill Irwin.

Komarraju, S. J., Karau, R. R., & Schmeck, A. A. (2011). The big five personality traits, learning styles, and academic achievement. *Personality and Individual Differences*, *51*, 472–477.

Mischel, W. (2004). Toward an integrative science of the person (Prefatory Chapter). *Annual Review of Psychology*, *55*, 1–22.

Neesha, T. K., Minal, M., Kirtana, D., & Varun, K. (2017). Personality, achievement motivation and academic performance among sojourn students. *Guru Journal of Behavioural and Social Sciences*, *5*(1), 631–638.

Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: Big five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology*, *93*(1), 116–130.

Nye, J., Orel, E., & Kochergina, E. (2013). *Big five personality traits and academic performance in Russian Universities*. Working Paper Series: Psychology WP BRP 10/PSY.

O'Connor, B. (2002). A quantitative review of the comprehensiveness of the five-factor model in relation to popular personality inventories. *Assessment*, *9*(2), 188–203. doi:10.1177/1073191102092010

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual Differences*, *43*, 971–990.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In *Handbook of personality: Theory and research* (3rd ed., pp. 114–158). New York, NY: Guilford.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin*, *135*(2), 322–338.

Rüppel, F., Liersch, S., & Walter, U. (2015). The influence of psychological well-being on academic success. *Journal of Public Health*, *23*, 15–24. doi:10.1007/s10389-015-0654-y

Uma, S., & Roger, B. (2015). *Research methods for business: A skill-building approach* (6th ed.). Hoboken, NJ: John Wiley and Sons.

Wigtil, C. J., & Henriques, G. R. (2015). The relationship between intelligence and psychological well-being in incoming college students. *Psych Well-Being*, *5*(4), 1–19. Retrieved from https://doi.org/10.1186/s13612-015-0029-8